
URBAN WILDLIFE MANAGER'S NOTEBOOK



Produced by the

NATIONAL INSTITUTE FOR URBAN WILDLIFE

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Urban Wildlife Manager's Notebook Series

The Urban Wildlife Manager's Notebook is an informational leaflet published by the National Institute for Urban Wildlife on wildlife management techniques and approaches that can be applied to urban/suburban backyards, open spaces and parks. A single topic is explored in depth in each issue.

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URBAN WILDLIFE MANAGER'S NOTEBOOK -- 1

A Wildlife Plan for Small Properties

URBAN WILDLIFE NEWS is pleased to offer another regular feature for our readers who enjoy nature at home. The *Urban Wildlife Manager's Notebook* should interest those who want to attract and keep desirable wildlife species in their backyards and nearby open spaces. The results of our work and those of others in the exciting new field of urban wildlife research will be passed on to you. The *Notebook* will suggest simple and practical methods based on scientific fact that you can use. You will have the opportunity to become a good "urban wildlife manager", and to enjoy the benefits that come from wildlife conservation no matter where you live.

WHAT IS AN URBAN WILDLIFE MANAGER?

All wildlife requires *habitat* -- a place to live. A good manager should provide conditions to satisfy the four basic requirements for life of all animals:

FOOD WATER COVER LIVING SPACE
--

You may already be an urban wildlife manager! If you feed birds, keep a bird bath filled with water, and hang bird houses in your yard, you have provided three of the four requirements for some species. You may be attracting songbirds, and perhaps squirrels, to your yard.

What more can you do to attract a larger variety of birds as well as rabbits, chipmunks, turtles, salamanders, and butterflies? In nature, trees, shrubs, grasses, vines and flowers provide food, cover, and space to rear young. These also can be provided in urban areas. Most homeowners have an interest in landscaping their properties. When you decide to improve your yard with plantings, select plant varieties that are pleasing to you and that also *have a value for wildlife*.

YOUR WILDLIFE PLAN

(1) Draw a map of your property, and indicate plants already in place. Define areas you intend to landscape for privacy, climate control or aesthetic reasons. If you want a vegetable garden, select an unshaded area. If you are lucky enough to have a pond, or plan one, sketch it in. Indicate North on the map.

(2) Remember, your goal is to ensure that your amenity values and the requirements for wildlife are met. If you need a windbreak, evergreens planted on the north side of the house will simultaneously provide COVER AND LIVING SPACE for animals. If you like attractive flowering fruit trees, you will also fulfill the FOOD needs of some birds and mammals.

(3) The plan below is for a lot size of about 1/3 acre. The height, density, and distribution of plants have been varied to attract many different types of animals. An accepted ecological principle used in wildlife management states that "the greater the variety of plants in an area, the greater the variety of wildlife." In addition to different combinations of plants note the following features for wildlife in the plan:

- A gravel plot (some birds such as mourning doves require grit for digestion);
- Bird feeder and martin house;
- Pond as a water source, and to support fish, turtles, frogs, and water birds;
- A trellis with a flowering vine, and a flower bed for the nectar-eating butterflies, moths, and hummingbirds.

(4) The list below suggests some plants recommended for wildlife. Not every type may be available to you or suitable for your location. Visit local nurseries, your county agricultural agent, or use reputable mail-order catalogues, and make appropriate selections for your plan. Include some plants that bear and retain fruit through the winter. Look for plants with dense foliage, thorns, and that form clumps or hedgerows. Include evergreens for their year-round protective qualities, and plants that flower in different months.

PLANTS RECOMMENDED FOR ATTRACTING WILDLIFE

E = East; M = Midwest; W = West

LARGE TREES

Beech	EMW	Pine (E. white, Scotch)	EM
Fir (Douglas)	W	Pine (W. white, ponderosa, lodgepole)	W
E. Hemlock	E	Sassafras	EM
Maple (red)	EM	Sweetgum	EM
Oak (white, No. red, black)	EM	Amer. sycamore	EM
Oak (pin)	M	Tulip-poplar	EM
Oak (Calif. black, Oregon white)	W		

SMALL TREES

Cherry (black)	EMW	Mesquite	W
Crabapple	EMW	Mulberry (red, white)	EMW
Dogwood (flowering)	EMW	Redbud	EM
Hackberry	EMW	E. red cedar	EM
Wash. hawthorn	EMW	W. red cedar	W
Amer. holly	EM	Serviceberry	EMW

LARGE SHRUBS

High-bush blueberry	EMW	Bush honeysuckle (Amur, Tatarian)	EMW
Common buttonbush	EM	Oregon grape	W
Cascara	W	Manzanita	W
Black chokeberry	EMW	Multiflora rose	EMW
Coralberry (Common winterberry)	EMW	Autumn olive	EMW
Dogwood (silky, gray)	EMW	Russian olive	EMW
Elaeagnus cherry	EMW	Amur privet	EM
Elderberry	EMW	Sumac	EMW
Firethorn (pyracantha)	EMW		

SMALL SHRUBS

Japanese barberry	E	Bicolor lespedeza	EMW
Bayberry	E	Pokeberry	E
Amer. beauty-berry	EM	Common snowberry	EMW
Buffaloberry	W	Viburnum (arrowwood, nannyberry, Amer. cranberry)	EMW
Cotoneaster	EMW		
Japanese holly	EMW		

VINES, GROUND COVERS

Bearberry	Ground juniper
Bittersweet	Common trumpet creeper
Wild grape	Virginia creeper

FLOWERS

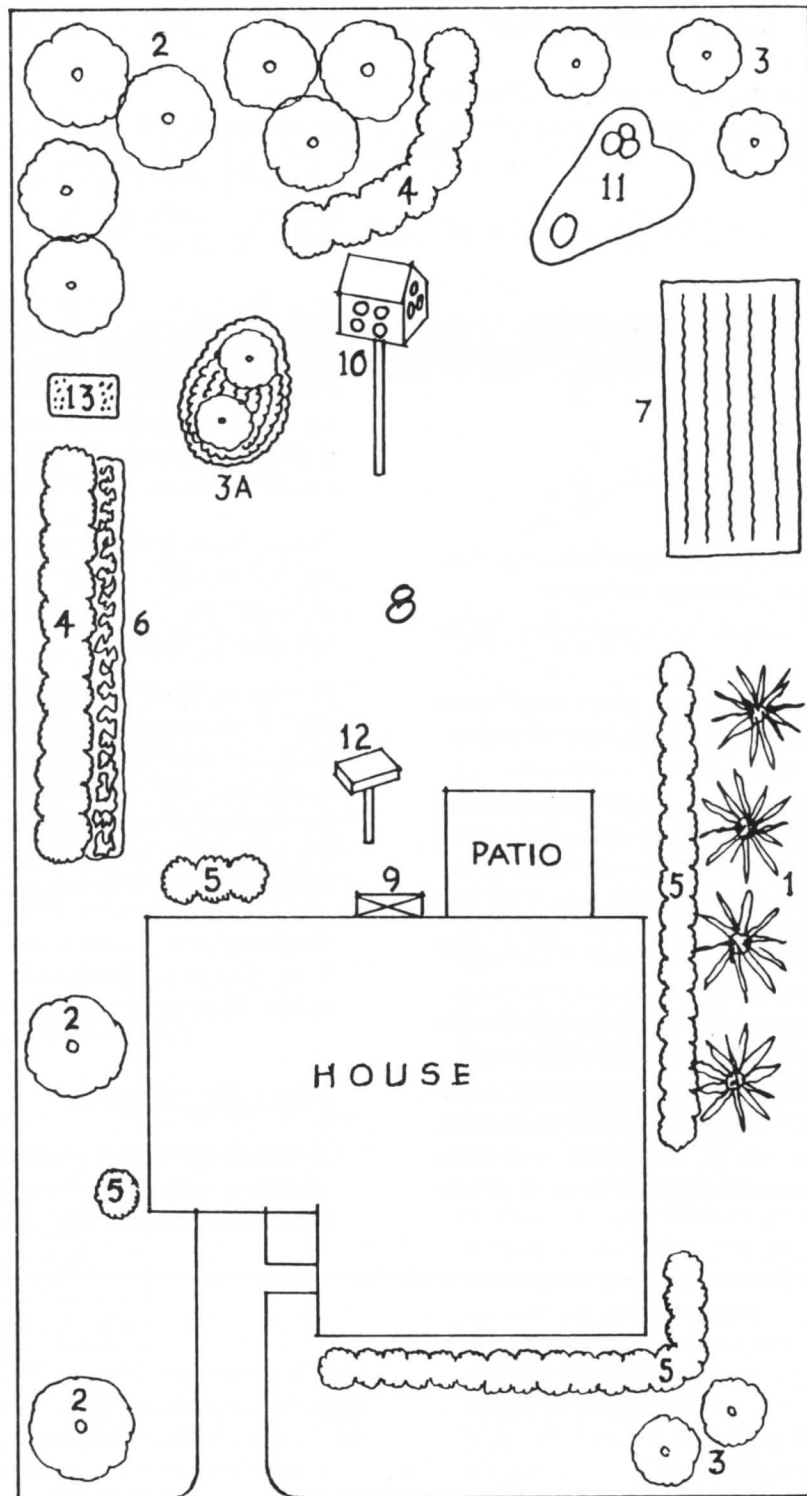
Aster	Forget-me-not	Marigold
Columbine	Hollyhock	Petunia
Coral root	Jewelweed	Sunflower
Cosmos	Lilies	Zinnia
Crysanthemum		

LIMITED IN SPACE?

• If you can only plant one tree, a good choice is the Washington hawthorn (*Crataegus phaenopyrum*.) The deciduous hawthorn provides browse, fall and winter fruit, and cover and nesting sites. It can be planted as a hedgerow and a screen. Choose a well-drained location in full sun.

• Plant a vine on a trellis, fence, or against a building. Consider the common trumpet creeper (*Campis radicans*) to attract hummingbirds, and the wild grape (*Vitis vulpina*) to provide fruit, cover, and nesting space. The grape does well in sun or shade, the trumpet creeper requires sun.

A SAMPLE BACKYARD WILDLIFE PLAN



- | | | | |
|-----------------------------------|---------------------|--------------------------------|----------------------|
| 1. Evergreen Screen | 4. Large Shrubs | 8. Open Lawn | 11. Turtle/Fish Pond |
| 2. Large Trees | 5. Small Shrubs | 9. Trellis with Flowering Vine | 12. Bird Feeder |
| 3. Small Trees | 6. Flower Beds | 10. Martin House | 13. Gravel Plot |
| 3A. Small Trees with Ground Cover | 7. Vegetable Garden | | |

ADDITIONAL HINTS:

- When planting small stock, leave enough room to avoid later pruning; flowers and fruits form on the outer parts of branches, and over-pruning removes wildlife food and nesting sites.
- To attract hummingbirds, plant tubular flowers (columbine, petunia, trumpet creeper) in reds, pinks, and oranges.



- Plant tall trees in rear of plot, or in middle of an "island", descending to lower plantings in the front.
- Rock piles attract chipmunks, but avoid if you dislike snakes.
- Brush piles attract cottontails and other small mammals; conceal with a vine overgrowth to improve appearance.
- Recycle Christmas trees by tying upright to a deciduous tree trunk during the winter for bird cover (or add to brush pile).
- Toads like damp areas covered with boards.
- Avoid plants with staining fruits, like mulberry, near patios and clotheslines.
- Do not plant red cedar and apple in the same yard -- the cedar is an alternate host for a rust that spots the fruit.
- Check local ordinances about utility easements, plantings near property lines, height of grasses permitted, and plant species banned (e.g., multiflora rose is an agricultural pest in some areas) before finalizing your plan.

NOTES:

FOR MORE INFORMATION:

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IN CONCLUSION:

A well-designed plan will provide year-round habitat for wildlife and give you, the urban wildlife manager, many hours of beauty and enjoyment.

URBAN WILDLIFE MANAGER'S NOTEBOOK--2

A Simple Backyard Pond

All wildlife has four requirements for life--food, water, cover and living space. Homeowners who wish to attract backyard wildlife probably neglect water most frequently. A simple birdbath will meet minimum requirements. However, a garden pond is inviting to both wildlife and people, and need not be expensive nor complicated.

The concrete-lined pond with filters, pumps and fountains is best left to the expert handyman or private contractor. Readers interested in such a pond will find guidance in the accompanying bibliography. In this note, we will discuss only simple options, including (1) a hole dug and filled with water (for areas with non-porous, clay soils); (2) a hole lined with a flexible liner; (3) a preformed pool sunk in a hole; and (4) a "tub pool" sunk to ground level.

Water Gardening

Managing a backyard pond is often called "water gardening." It brings together several subjects--light, water, plants, and a community of aquatic organisms. In this miniature ecosystem, plants utilize carbon dioxide and release oxygen, and pond-dwelling animals, including fish, take in oxygen and release carbon dioxide.

Light

Ideally the pond site should receive 5 hours or more of sunlight daily. Most aquatic plants, such as the ornamental water lilies, and the food-chain algae, need light to thrive. If the pond is too heavily shaded, aquatic plants will not grow well. In addition, if located beneath trees, leaves will collect in the pond, and if not removed, will decompose, lowering available oxygen in the water to fish and other organisms.

Water

Pumps and filters are unnecessary in the small pond. Static water that warms up quickly is ideal for aquatic plants. While many fish species prefer moving water, they need only well-oxygenated water that is non-polluted. Most "balanced" ponds have a slightly green cast from the algae. Excessive nutrients in the water cause algal "blooms."

Plants

Like food chains on land, the aquatic food chain begins with plants. No more than one-half of the pond's surface should be covered with plant leaves and flowers. This ensures that sunlight reaches submerged plants and algae, and permits a view of the water and the fish. *Algae* are microscopic simple plants without true roots, flowers and leaves. *Algae* occur where there is light and water, and are important photosynthesizers (oxygen-producers). *Aquatic plants* have true roots, flowers and leaves, and are of three types: a) *emergent*: rooted on the bottom with leaves and flowers on stems above the water surface (e.g., cattails); b) *floating*: leaves rest on the water surface (e.g., water lilies); and c) *submergent*: rooted on bottom, with leaves growing beneath surface, or just up to the surface, of the water (e.g., pondweeds).

Aquatic Organisms

Goldfish are inexpensive, colorful, and carefree additions to the pond. Small sunfish also will thrive. Fish will help control the larvae of mosquitoes, gnats and other insects usually associated with quiet water. The exotic Koi carp requires deeper water and filters.

Once the pond is in place, "colonizers" will arrive: a) *Insects* (water striders, dragonflies, damselflies, beetles, mayflies, caddisflies and others); b) *Mollusks* (snails); c) *Crustaceans* (daphnia or water fleas, crayfish and others); and d) *Vertebrates* (frogs, toads, salamanders, turtles, water birds, songbirds, mammalian visitors and others).

Installing Your Pond

Note: Review local ordinances and laws pertaining to ponds in your state. You may wish to consult an attorney and your insurance agent for the proper interpretation of your circumstances.

General Procedures

1. *Select a sunny location*, one that receives at least 5 hours of sun daily.
2. *Choose a shape and size*. For most situations, a circular or rectangular pool works well and these are easier to excavate than odd shapes. Preformed pools

come in various dimensions. Wooden barrels can vary in size. If undecided about what size pool to choose, one that is approximately 50 square feet is recommended. (Try an 8-foot x 6-foot rectangle, or an 8-foot diameter circle.)

3. *Choose a pond depth of 15-24 inches.* This will meet the needs of many fish and plants. If using a pre-formed pool or a tub, the container depth will be predetermined. Avoid excavating deeper than is necessary. Except in northern areas, fish and plants can usually survive the winter beneath the ice in a pond that is 15-24 inches deep.

4. *Site the pond within reach of the garden hose.*

5. *Excavate properly.* Use a rope or heavy string to lay out pond dimensions on the ground. Excavate hole to uniform depth, removing any sharp objects. Cover bottom with fine sand or tamped-down soil.

Specific Procedures

1. *The bare-earth pond.* This is the least expensive option but will not work in all locations. Consult your local Natural Resources Conservation Service (formerly Soil Conservation Service) officer for the soil profile of your area. There must be a good clay bed that holds water. The pond surface must be thoroughly compacted. A clay product, bentonite, is available which can be applied to the excavated surface to seal it.

2. *The flexible-liner pond.* Quick and inexpensive, these liners will last for several years if not punctured. The liner may be made of stretchable polyethylene, plastic or rubber. To calculate the size of liner required:

$$\text{Width} = \text{width of pool} + (2 \times \text{depth}) + 2 \text{ feet (1 foot overlap, each side)}$$

$$\text{Length} = \text{length of pool} + (2 \times \text{depth}) + 2 \text{ feet (overlap)}.$$

Spread liner taut across top of hole, held in place with stones. With hose, fill liner slowly with water. Weight of water causes material to sag and mold to the shape of the depression. Smooth out folds and fill to within several inches of top. Let pond stand 1 week while chlorine escapes. Conceal liner overlap around edges with large rocks or decorative blocks. (Some liners come with metal edging.)

3. *The one-piece molded pond.* Moderately priced, these pools come in plastic and fiberglass, in aqua or black colors. Black fiberglass gives a natural-appearing and long-lasting pond.

Excavate to depth of pool. Level several inches of sand in bottom of hole. Rim of pool should be 1-2 inches above ground level when in place. Add 1 gallon of water to determine if pool is level. If not, remove and redistribute sand base. While water is running in, fill in spaces along sides of pool with soil to equalize pressure. Allow to stand 1 week to dechlorinate.

4. *The tub pond.* The smaller garden might best accommodate one or several tub ponds made of old half-barrels. Never use redwood nor newly-made wooden barrels. Older metal tubs, except those of copper, are acceptable if scrubbed first with a vinegar solution and rinsed well.

Sink the barrel in excavated hole, with several inches left above ground. Add soil mixture to a depth of 8-10 inches in bottom of container. Saturate soil with water. Fill container slowly with water and let stand 1 week.

Adding the Plants

This can be done a week or more after water has stood in the pond. You can cover the entire pond floor with 6-8 inches of soil for rooting plants, or you can confine plant roots to containers placed on the pond bottom. We recommend the latter. Growth will be less aggressive, the containers are easily removed for soil renewal, the depths of the containers can be adjusted, and fish are more visible.

Choose plants from each of the three groups: emergent, floating, and submergent. (See Table 1 for a regional listing of aquatic plants valuable for fish and wildlife.) Every water gardener will probably want to include one or more water lilies, the quintessential pond plant. The *hardy* lilies need no winter protection except in the north. *Tropical* lilies must be treated as annuals except in southern states. Pygmy hardies are available for the smallest tub ponds. A typical hardy lily covers 12 square feet of water surface when mature. Thus, in a 48-ft² pond, one plant covers a quarter of the surface area. With the aim of covering one-half of the total surface area of the pond with plants, a maximum of two water lilies should be used in a 48-ft² pond, only one if other surface plants are used.

Planting Water Lilies

Use a plastic tub, older metal container (not copper), or aged wooden box (not redwood) for each lily. Allow 10 quarts of soil for each hardy lily root, 14 quarts for each tropical root. (In tub ponds, plant the root directly in the soil at the pond bottom.) Fill container with

Table 1. Regional listings of aquatic plants valuable for fish and wildlife.

Emergents	
Smartweed (<i>Polygonum</i>)	NE, SE, PR, M/D, PA
Bulrush (<i>Scirpus</i>)	NE, PR, M/D, PA
Spike rush (<i>Eleocharis</i>)	NE, SE, PR, M/D, PA
Bur-reed (<i>Sparganium</i>)	NE, PR, M/D, PA
Arrowhead (<i>Sagittaria</i>)	NE, SE, PR
Cattail (Typhaceae)	SE, PR
Horsetail (Equisetaceae)	PR, PA
Floating	
Duckweed (<i>Lemna</i>)	NE, SE
Waterlily (Nymphaeaceae)	SE (Other regions, with precautions noted in text)
Algae (colonizer)	
Submergent	
Pondweed (<i>Potamogeton</i>)	NE, SE, PR, M/D, PA
Naiad (<i>Najas</i>)	NE, SE
Water milfoil (<i>Myriophyllum</i>)	PR, M/D, PA
Eelgrass (<i>Zostera</i>)	NE, PA
Wild celery (<i>Vallisneria</i>)	NE, SE
Horned pondweed (<i>Zannichellia</i>)	PR, M/D, PA
Other plants useful for bog garden or in pond	
Blue flag (<i>Iris versicolor</i>)	
Buttonbush (<i>Cephalanthus occidentalis</i>)	
Swamp rose (<i>Rosa palustris</i>)	
Joe-pye weed (<i>Eupatorium dubium</i>)	
Water spurge (<i>Euphorbia palustris</i>)	
Yellow skunk cabbage (<i>Lysichitum Americanum</i>)	
White-striped sweet flag (<i>Acorus calamus variegatus</i>)	

NE = Northeast, SE = Southeast, PR = Prairie, M/D = Mountain/Desert, PA = Pacific.

garden soil of one-quarter clay. Do not add sand, peat, leaf mold, or manure. Enrich soil with water-lily fertilizer (one-half pound per bucket or one pound per tub pond). Saturate soil with water. Lay plant root (rhizome) under 1-2 inches of soil, almost horizontally, with growing tip (crown) above surface. Place a flat stone over the buried root to keep it in place. Cover rest of soil with gravel. Saturate thoroughly and then gently lower container into pond. When plant leaves float comfortably on water surface, adjust depth of container with bricks.

Planting Other Stock

The submergents and floating plants, along with the algae, are the "oxygenators" in the pond. Plant one

bunch for each 3 square feet of water surface area.

The emergents do not contribute to the pond's natural balance, except to provide some fish and wildlife cover. Place two or three plants of one type per container (e.g., 5 inches deep, 9 inches across), and sink in pond. These plants would also thrive as a "bog garden" in damp soil next to pond.

Adding Fish

The motion and color of goldfish add variety to the backyard pond. Fish help control mosquito and certain other insect larvae.

Add fish after chlorine has been dispersed from the pond (1 week after filling), and plants have become established (2-4 weeks after planting).

General Procedures

1. *Do not overstock.* Buy one fish for every 2 square feet of pond surface area (Koi carp require 25 square feet per fish).
2. *Avoid shocks to fish.* Fish contract fungus infections readily if exposed to sudden temperature changes. Float the plastic carrying bag in pond for an hour to equalize temperatures before releasing fish. When changing pond water, retain fish in some of old water in a temporary container. Some experts treat the water with disinfectant when adding new stock or changing the water.
3. *Feed fish at first.* In a balanced pond, plants and insects, their eggs and larvae, are food to fish. In a new pond, feed fish with a commercial fish food. Once daily, sprinkle on the water surface the amount that is consumed in 5 minutes.
4. *Prepare for winter.* If ice seals the pond surface all winter, the oxygen in the pond may be depleted, suffocating the fish. It is possible to keep a hole open in the ice with an immersion heater. To form the hole, do not bang the ice (the sound shocks the fish). Rather, put a metal can on the ice and pour in boiling water. If there is no outdoor power supply for use of the heater, cover one corner of the frozen pond with insulation such as straw to keep unfrozen. If convenient, you could also keep fish indoors in an aquarium through the winter.

Adding Other Aquatic Animals

The tadpoles of frogs and toads are welcome scavengers in the pond, eating algae, decomposing plants, surplus fish food, and other matter. They are food to

some of the carnivores in the pond--dragonfly nymphs, diving beetles, water birds and mammals.

Snails should probably be avoided since they may destroy good plants. The consensus is also against adding mussels.

It is likely that many types of aquatic fauna will colonize your pond without any help or expense.

Cleaning the Pond

Clean infrequently! Unless the water is chemically polluted, a balanced pond seldom needs to be completely emptied for cleaning.

If you must empty pool, relocate the fish and plants. Create a make-shift pond above ground with a plastic tub or plastic sheeting, using dechlorinated water to hold fish. Examine plants for overgrowth and repot in clean soil. Cover the potted soil with wet newspapers to hold. Empty pool with a siphon or bucket and scrub with solution of potassium permanganate (1/4 tsp/200 gallons water), and hose out several times. Use a dechlorinator in the new water and return fish and plants to the pond.

An ordinary "Spring cleaning" can be a partial change of water, which allows the fish to remain in the pond. Leaves and other debris are removed and plants divided, repotted, and fertilized as needed. A trickling hose is allowed to run into the pond for several hours. As the diluted water overflows the pond, the old water is gradually replaced. Another method is to siphon or dip out about one-half of the water. Replacement water is slowly added to refill the pond. For both methods, a dechlorinator is added to protect the fish and plants.

In early fall, emergent and submergent plants should be cut back, and the spent lilies removed. The fish should be fed regularly to prepare for hibernation. In a severe climate, lilies and fish can be stored inside for the winter.

Conclusion

A backyard pond provides a significant water source for many kinds of wildlife. It also invites human resi-

dents to enjoy its aesthetic beauty. Once established, the small pond can become the center of your urban wildlife habitat.

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URBAN WILDLIFE MANAGER'S NOTEBOOK -- 3

Feeding Birds In Winter

Louise E. Dove, Wildlife Biologist

The end of summer marks the end of the breeding season for backyard songbirds. Homeowners and other would-be "urban wildlife managers" will notice a decline in the sightings and activity of birds. Some species may have already migrated out of the area, an instinctive form of behavior in some animals associated with their need to feed year-round. Some species may be migrating in from more northern breeding grounds to spend the winter. Not all species migrate, but even year-round residents may move around locally a great deal in search of food, water, and cover, as cool weather arrives. Occasional individual members of a migrating species will also remain behind if berry-producing plants or backyard feeders can support their winter food needs. Wintering birds are seen in almost all parts of the U.S. The opportunity to attract and feed birds in winter is available to those with the interest and resources!

Those who feed wintering birds may do so out of a sense of charity, to ensure their survival. It is unlikely this feeding will have much impact on total bird populations. Regular feeding probably makes the difference to a number of individual birds, however, especially in years of heavy snow cover when natural seeds and berries are inaccessible. In the process, those who feed have the fascination and joy of observing, photographing, and studying birds close-at-hand.

FOOD REQUIREMENTS OF BIRDS

Birds have a high metabolic rate (the speed with which they produce energy), and must eat large amounts of high-energy food often, and rapidly. This is true year-round, but is especially critical in winter. Winter nights last about 15 hours in the northern U.S. Studies on house sparrows showed these small birds could survive about 67 hours without food in summer (at 85° F.), but only 15 hours -- the length of the night -- in winter (at 5° F.). Thus, small birds must feed every day during the wintertime daylight hours.

Feeding birds year-round is a satisfying pastime, but in winter will ensure a ready source of energy to birds under stress from the weather. There is some disagreement among wildlife professionals on the need to maintain an uninterrupted feeding program during the winter months. It is likely that most birds have more than one site to visit for food and foraging, and if your feeder is empty now and then, they will move on to the next location. Ideally, it should be replenished morning and

evening. Studies show that wintering birds begin to feed at dawn and stop about mid-afternoon.

WHERE TO FEED

The quickest way to begin feeding birds is to buy a bird seed mixture from the supermarket, and throw some handfuls on the ground. This will attract some birds, particularly those that are by preference ground-feeders. However, severe weather conditions and cat predation are two reasons to consider an assortment of feeding sites, most of them elevated. Food at various levels will also attract a larger variety of birds.

Birds seem to prefer feeding at one of four levels: (1) Mourning doves, sparrows, towhees and juncos are *ground feeders*; (2) Cardinals, finches, jays, and sparrows will come to a *raised or table-level feeder*; (3) chickadees, titmice, and goldfinches will cling to a *hanging feeder*; and (4) suet-eaters like woodpeckers, nuthatches, and wrens prefer to use *tree trunks* while feeding. Some birds feed at more than one level. These are not hard and fast rules, and in a particularly severe winter, birds will seek food wherever it is available. Normally, however, birds will fill an eating "niche", and it is ideal to have food at the various levels to attract all kinds of desirable birds.

CHOOSING FEEDERS

One can purchase feeders or build adequate models at home. A good assortment can be found for sale in garden centers, hardware stores, variety stores, and conservation organization catalogues. One can also make a variety of styles with outdoor plywood or pine scrap lumber, and simple tools. Substances in wood preservatives may be harmful to birds. If you must finish the feeder, use an exterior house paint or enamel and allow several days of good drying weather before filling with seeds.

Below are some practical ideas for your consideration. With several feeders and a source of water (discussed below) you are ready to attract wintering birds to your yard.

Raised Feeders

Platform feeder - Made with a simple wooden platform base, 12 x 18 inches, of ¾-inch stock. Add edge strips to prevent loss of seed. Mount on a wood or metal post, place on a patio railing or outdoor picnic table, or add

legs and set into ground as a "bird table." Drill holes in the bottom to drain water.

Window shelf feeder - Similar to the wooden platform in construction, but mounted on a window sill with screw eyes and chains. Size can be adjusted to fit window. If feeder is subject to strong winds, run chains through lengths of aluminum conduit before attaching. Drill drainage holes in bottom. Those who are handy with tools could add a roof for weatherproofing seeds. Desirable because serviced from inside during cold weather.

Hopper-type feeder - Most are designed with an overhanging roof and glass sides to protect the seed. Clear glass also alerts the owner to an empty hopper. (See Schutz reference for method of construction, or purchase directly). Can be mounted on a post or hung from a tree limb or clothes line.

Hanging Feeders

Coconut shell feeder - A coconut shell, cut in half, is easily made at home. Remove the meat, drill drainage holes at the bottom, and 3 small holes around the edge to attach chains or wire. Hang from a tree limb or on a porch or balcony (under a protective overhang if possible).

Cylindrical tube-feeder - This clear, plastic feeder is available for sale everywhere. It can also be constructed from a plastic mailing tube (glue on a plastic coffee-can lid for the tray at the base). Accommodates small birds at perches located next to outlet holes. This one (with small holes) holds niger seed, a favorite of the American goldfinch.

Hopper-type feeder (see above) - Can also serve as a hanging feeder.

Tree Trunk Feeders

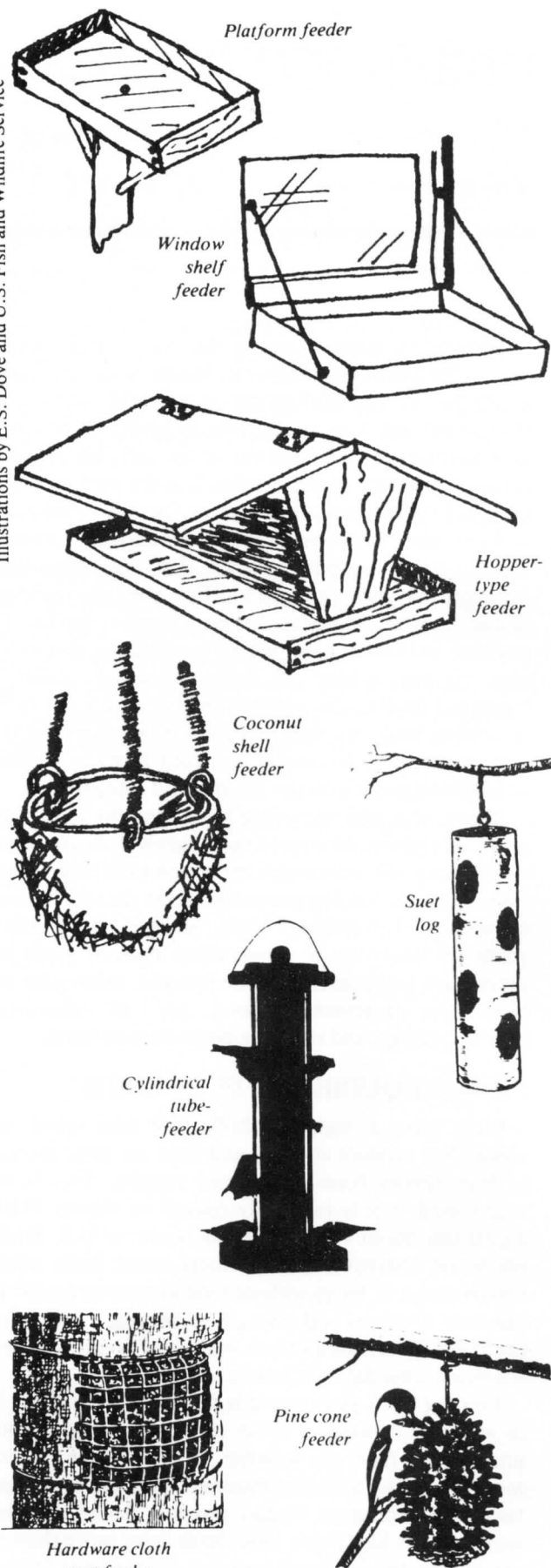
Suet log - A log 12-18 inches long, 3 inches in diameter, and with 6-8 holes drilled with a 1-inch bit, is attractive to small woodpeckers, chickadees, brown creepers, tufted titmice, and nuthatches. If bark adheres to log, birds can cling to surface. If not, "score" wood surface for them. Bits of suet are pressed into the holes.

Hardware cloth suet feeder - Bend a piece of hardware cloth into a square and nail to a board, which is attached to the tree, or nail directly onto tree trunk. Rub suet onto exposed metal surfaces to reduce possibility of bird feet and tongues freezing to metal in severe weather.

Mesh suet bag - A string or plastic mesh bag, recycled from a supermarket onion bag, can be stuffed with suet, tied closed, and hung from a branch. Woodpeckers and other woodland species will hang from the mesh to feed.

Pine cone feeder - Large pine cones, to which melted suet or a suet pudding (see below) is applied, can be hung as a simple feeder. Children can participate in creating and filling this type of feeder.

Illustrations by E.S. Dove and U.S. Fish and Wildlife Service



WHAT TO FEED

One can purchase commercial bird seed mixtures, such as those available in supermarkets and garden centers; or one can make one's own mixture.

Studies carried out by the National Institute for Urban Wildlife (formerly the Urban Wildlife Research Center, Inc.) for the U.S. Fish and Wildlife Service have shown that two common seeds -- the *black, oil sunflower*, and the *white millet* (or *white proso*) -- are most attractive to a variety of seed-eating birds. The most economical method of feeding backyard birds is therefore to purchase (1) black, oil-type sunflower seeds, and (2) white proso millet seeds, in bulk quantities, in separate lots, from seed supply or animal feed dealers. The two types of seed can be presented separately or together, depending on the type of feeder used and types of birds you wish to attract.

Niger seed (incorrectly called thistle) is extremely popular with finches, but is relatively expensive to buy.

FILLING THE FEEDERS

(1) *Ground feeders* - Mourning doves, sparrows, juncos and towhees, and game species like pheasants and quail, are attracted to food scattered on the ground. These species prefer white millet. After heavy snowstorms, seeds can be scattered on the snow, or placed on flat boards, logs, or trays on the ground.

(2) *Platform feeders and raised hopper feeders* - Cardinals, chickadees, titmice, nuthatches, blue jays, grosbeaks, wrens, and many others will seek sunflower seeds from raised feeders. To also attract sparrows, juncos, and doves to raised platform feeders, feed a sunflower-millet mixture.

(3) *Hanging feeders* - Species that do not mind "swinging in the wind" include goldfinches, pine siskins, nuthatches, cardinals, house and purple finches, chickadees, and titmice. On the other hand, pesky house sparrows do not like swinging feeders and can be discouraged by their use. Feed oil sunflower seeds to attract all of these species, and in addition, niger for the finches and siskins. Millet will bring sparrows to a hanging feeder. The size of the outlet holes must be considered before filling the cylindrical feeders. Coconut shells can be filled with a sunflower-millet mixture, as can hopper feeders.

(4) *Tree feeders* - Pure suet can be stuffed into the hardware cloth feeder, the log feeder, and the mesh bag for birds like the downy and hairy woodpeckers, wrens, brown creepers, and nuthatches. *Suet pudding* can be offered in the log feeder or in the hanging pine cone.

A typical *suet pudding* recipe:

- 1 part peanut butter
- 1 part precooked cereal (oatmeal, cream of wheat, or cornmeal mush)
- 1 part suet

Heat until suet and peanut butter melt and mixture can be stirred together. Harden in

refrigerator in a clean coffee can. Use tongue depressor or disposable plastic knife to fill feeders.

Softened suet can also be spread over pine cones directly (catch excess on newspapers), hardened, and the cone hung outside.

DISCOURAGING UNWANTED ANIMALS

Anyone who feeds birds in winter will sooner or later have starlings, house sparrows, blackbirds, and/or squirrels monopolizing a feeder. The best defense is to provide several feeders so that desirable birds have a fighting chance to feed peacefully.

Never place table scraps or peanuts in your feeders. The former will attract mammals such as rats, and the latter is a favorite of squirrels and starlings. If suet or suet pudding proves too attractive to starlings, discontinue its use temporarily.

By eliminating perches from log feeders, starlings and blackbirds will not be able to land and feed continuously. If an aggressive mockingbird tries to drive away small birds from a suet feeder, place suet in at least 2 locations. Mockingbirds also enjoy fruit and may be enticed to an orange half or pieces of apple placed on a platform feeder.

A metal feeder can be purchased which is "squirrel-proof." The weight of the squirrel on the treadle portion of the feeder, on which the birds sit to feed, closes a slot so the squirrel cannot reach the seed. Squirrel "baffles", mounted under a post feeder, sometimes prevent squirrels from climbing up a post. In desperation, many homeowners capture squirrels live in a Havahart trap and transport them at least 10 miles before releasing them.

ADDITIONAL FEEDING SUGGESTIONS

- Feeding areas should be located near cover -- trees and shrubs to which birds can escape to avoid predators and adverse weather conditions. Bell the neighborhood cats!

- Since the homeowner hopes to attract birds for personal observation and enjoyment, locate the feeders within view of windows. Keep binoculars and a bird guide handy if you are just learning the birds.

- Take precautions to prevent aspergillosis, a potentially-fatal bird infection caused by a fungus that grows in wet bird seed. Use weatherproof feeders where possible; buy only clean bird seed; discard seed that becomes moldy; in wet weather put out only enough seeds that can be consumed in several hours; scrub feeders periodically with disinfectant; discontinue feeding sickly birds till population dies out.

- Begin to feed by late October and discontinue in late spring unless you wish to maintain a feeding program through the summer.

WATER IN WINTER

Some moisture is derived by birds from the seeds they eat. However, water for drinking (and sometimes bathing) is important on cold winter days, too. A small weatherproof water heater can be purchased for use in a bird bath, small pool, or other receptacle, to keep water free of ice. This assumes one has an electric outlet out-of-doors or readily available under a garage door, etc.

An alternative method of providing ice-free water for birds is to pour warm water periodically throughout the day in an upside-down garbage can lid or the bird bath. NEVER add antifreeze or other chemicals to the water. (See also *Urban Wildlife Manager's Notebook -2, A Simple Backyard Pond*. National Institute for Urban Wildlife, 1983).

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IN CONCLUSION

A winter bird feeding program is an enjoyable pastime for homeowners who wish to see wintering birds close-at-hand, and who have the time and resources to properly maintain a series of feeders.

Black (oil-type) sunflower seeds and white millet seeds are the most economical seeds to feed, since they are sought by more birds than other seed types.

NOTES:

URBAN WILDLIFE MANAGER'S NOTEBOOK -- 4

Housing For Nesting Birds

Louise E. Dove, Wildlife Biologist

BIRD NESTS -- WHY AND WHERE?

In the Northern Hemisphere, bird activity associated with the instinct to rear young is compressed into a short period of time during late spring and early summer. A number of seasonal changes probably trigger this annual cycle, of which the increase in day length is believed most important.

Among the activities associated with bird reproduction is that of nest building. Nests are primarily used by birds during the breeding season. They serve to protect the eggs, brooding parent and the young birds from predators and from the weather.

In natural situations, trees and shrubs provide nesting places for many birds. One group of birds builds its nest within the crotch of limbs or attached to limbs and branches. This group includes the robin, with its grassy cup cemented with mud, and the Northern Oriole that weaves a hanging bag. A second group of birds builds within cavities of dead and dying trees. This latter group includes the woodpeckers which often further excavate a tree hollow, and the wrens.

Almost 50 species of "cavity nesters" have been reported nesting in bird houses, and more than two dozen occur in the Eastern U.S. The bluebird, chickadee, house finch, nuthatch, certain swallows, all owls and woodpeckers, certain wrens, and other birds which normally choose tree cavities, will accept bird houses. In addition, four common non-cavity nesters will accept a nesting shelf -- a house with one or more sides open. These are the robin, barn swallow, song sparrow, and phoebe.



Natural cavities have declined because of loss of forest habitat, and use of dead trees for firewood.

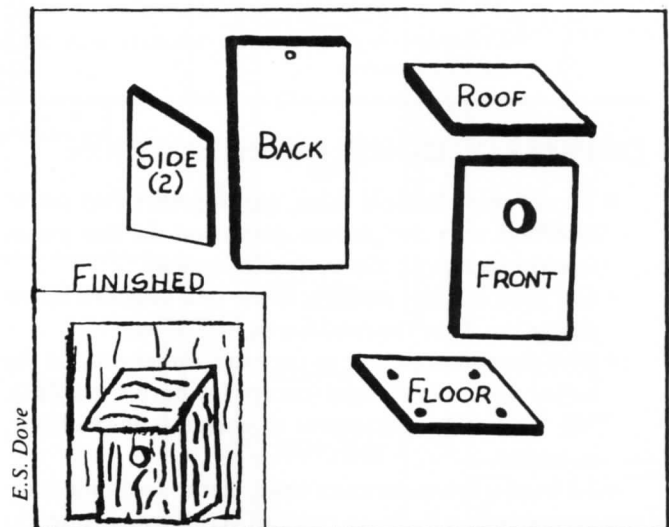
Because of the paucity of natural cavities in urban and suburban areas, the urban wildlife manager who wishes to attract a nesting species to his backyard with man-made bird houses has the opportunity to do so. However, it is necessary to build the house to certain specifications according to the species sought. Otherwise, undesired types of birds may move in.

BIRDHOUSES: BASIC DESIGN

The first step towards designing a bird house is to decide what bird species you wish to attract. Obviously, the species must commonly occur in your area during spring and summer.

A single-room bird house is constructed easily with inexpensive materials. Rather than trying to follow elaborate working drawings, refer to the sketch of a simple bird house (below), which illustrates the six pieces needed, and to Table 1, which gives the proper dimensions for attracting various species. *The most important dimension is the diameter of the entrance hole.* The entrance determines what kinds of birds can get into the house. If you wish to attract a small bird but the hole will admit a larger starling, the more aggressive starling may usurp the box.

Because of the serious decline in the bluebird population, and the opportunity for people to provide bluebird nesting boxes, detailed plans for a bluebird house are presented later in this Notebook.



Parts of a simple bird house

MATERIALS FOR HOUSE CONSTRUCTION

Good bird houses can be purchased commercially. However, it is less expensive to build your own and may be fun to do. Construct houses out of 1/2 to 3/4-inch rough-cut softwoods like white pine and cedar, or 1/2-inch exterior plywood. If you can purchase wood that is covered with bark (sawmill waste), so much the better -- it resembles the natural cavity the bird prefers.

Materials without cost that can be used to construct bird houses include hollow logs picked up in the woods, large hollow gourds, and gallon-sized plastic milk containers. Materials used must be durable, waterproof and cool in summer. (Tin cans conduct heat too readily and are not appropriate.)

splitting first.

- Drill a few small holes in floor for drainage.
- Bore small holes or cut narrow slits just under roof, on the sides, for summer ventilation.
- Inside of front should be rough-surfaced to aid young birds in climbing to leave entrance.
- Use galvanized or aluminum (rust-proof) nails, 1-1/2 to 1-3/4 in. long (12-1/2 or 14 gauge).
- Glue permanent joints with waterproof glue.
- The top or one side should open for cleaning; use a hinged roof or fasten one side with wood screws and no glue.
- Do not add a perch below entrance -- it invites predators.
- Never paint interior of house; if exterior is painted

TABLE 1: BIRDHOUSE DIMENSIONS¹

Species	Entrance hole (Diam., in.)	Entrance above floor (in.)	Depth inside (in.)	Floor size (in.)	Placement height (ft.) (above ground/water)	Preferred habitat
Bluebird	1 1/2	6	8	5 x 5	3-10	Rural, open field, golf course (sunny)
Carolina wren	1 1/2	1-6	6-8	4 x 4	5-10	Woodland edge; backyard near building
Chickadee	1 1/8	6-8	8-10	4 x 4	4-15	Woodland edge
Downy woodpecker	1 1/4	6-8	8-10	4 x 4	6-20 ^c	Woodland edge
Flicker	2 1/2	14-16	16-18	7 x 7	6-20 ^c	Open area; woodland clearing
Hairy woodpecker	1 1/2	9-12	12-15	6 x 6	12-20 ^c	Woodland clearing
House finch	2	4	6	6 x 6	8-12	Woodland edge; backyard near building
House wren, Bewick's wren	1 1/4	1-6	6-8	4 x 4	5-10	Same as Carolina wren
Nuthatch	1 1/4	6-8	8-10	4 x 4	12-20	Woodland edge
Purple martin	2 1/2	1	6	a	15-20	Open areas; no tall trees; near water
Screech owl	3	9-12	12-15	8 x 8	10-30 ^c	Woodland clearing; woodland edge
Titmouse	1 1/4	6-8	8-10	4 x 4	12-20	Woodland edge
Tree swallow, Violet-green swallow	1 1/2	1-5	6	5 x 5	4-15	Open areas; near water
Wood duck	4 ^b	12-20	10-24	10 x 18	10-30/2-6 ^c	Above water; facing wetlands
Barn swallow			6	6 x 6	8-12	Under building eaves; near water
Phoebe	Will use nesting shelf with one of more sides open		6	6 x 6	8-12	Same as barn swallow
Robin			8	6 x 8	6-15	Under building eaves; needs mud
Song sparrow			6	6 x 6	1-3	On building, close to ground

Compiled from multiple sources, especially D.D. Boone, G.H. Harrison and J.K. Terres (see bibliography)

^b Cut an oval shape, side to side

^a 6 x 6 inches per pair; customary to build multiple-unit apartments for purple martins

^c Add 1-2 in. of wood chips to floor of house

DETAILS OF HOUSE CONSTRUCTION

- To cut two identical sides, nail together two pieces of wood with the pattern drawn on the top piece; saw through both pieces simultaneously.
- Cut tops of sides at slight angle (see bluebird house design) to slope the roof for runoff of water.
- Drill the entrance hole to the exact dimension, in the upper third of the front (except for purple martins). See Table 1 for placement of entrance above floor, in inches.
- To bore a sharp entrance hole, clamp front piece together with a back-up piece of scrap wood in workbench vise; drill will enter second piece without

(not necessary), use exterior latex or lead-free oil-based paint and let house age outside over the winter.

- House wrens (the easiest species to attract to bird houses) carry in assorted sticks for their nests. Cut a horizontal slot rather than a round hole to facilitate this activity.

NESTING SHELVES

A nesting shelf is a small wooden platform, roofed or unroofed, and open on one, two, three or four sides. It is usually mounted on the side of a building, under the

(Continued on top right column)

A SPECIAL CASE: THE BLUEBIRD

The bluebird is a cavity-nester in trouble. Natural cavities in decayed trees are in short supply and old wooden fence posts that rot to form acceptable bluebird cavities are being replaced by metal posts. The use of pesticides in orchards, loss of farm habitat and competition for cavities from the house sparrow and starling are other reasons for a 90% decline in the population of Eastern bluebirds in the last half century. The other two bluebird species -- Mountain and Western -- have declined less dramatically.

A concerted effort is underway to help increase bluebird populations. Found only in North America and Bermuda, the bluebird will accept man-made bird-houses placed in rural or appropriate suburban habitat. Below is one of two designs recommended by the North American Bluebird Society for all three species of bluebirds. According to Lawrence Zeleny, founder of the Society (personal communication), there is some evidence that in a few areas of the far west a slightly larger race of Mountain bluebird may occur which

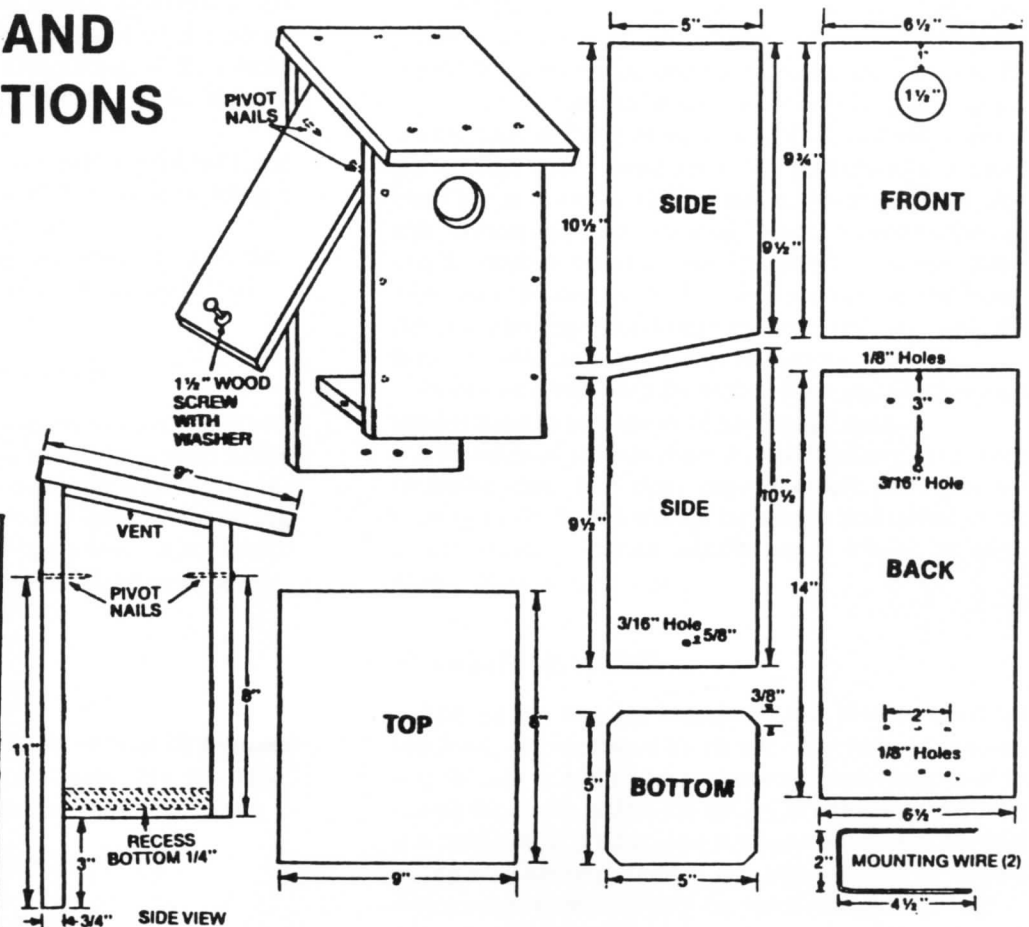
requires a larger entrance hole -- i.e., 1-9/16-inch diameter. For most areas, the 1-1/2-inch hole is *critical*, in order to keep out the starling, which can enter if the hole is 1/8 inch larger.

A bluebird box, or a trail of boxes spaced 100 to 200 yards apart, is ideally placed on a post or tree, 3 to 6 feet above the ground in an open rural or suburban area, with short undergrowth and scattered trees. There should be sites nearby for perching -- a fence, hedgerow or wire -- from which bluebirds hunt ground-dwelling insects. A pasture, golf course, rural cemetery, fenced farm lane or abandoned orchard is excellent bluebird habitat.

Monitor bluebird houses weekly, removing house sparrow nests and used bluebird nests. Most bluebird pairs nest twice a season, but not in the same nest.

Ready-made houses and other information on bluebirds may be obtained from the North American Bluebird Society (see bibliography for address).

BLUEBIRD NESTING BOX PLANS AND INSTRUCTIONS



Dimensions shown are for boards 3/4\" thick.

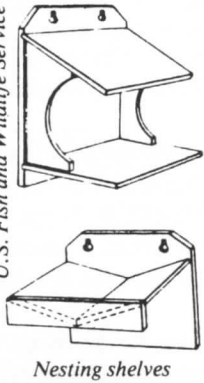
Use 1-3/4\" galvanized siding nails or aluminum nails.

Pivot nails must be located exactly opposite each other as shown for proper opening of side board.

Cut top edges of front and back boards at slight angle to fit flush with top board.

Cut 3/8\" off each corner of bottom board as shown.

Insert bottom board so that the grain of the wood runs from front to rear of box.



Nesting shelves

eaves of the roof.

Suggestions for constructing a shelf are similar to those for a house. However, since one side is always open, the size of the entrance hole is not a factor. Dimensions suitable for the 4 species that use shelves are in Table 1. Note that the song sparrow shelf should be placed close to the ground, whereas the other species accept a shelf at greater heights.

HANGING UP BIRD HOUSES

The best time to hang a new house is in the fall, which allows the wood (and any paint) to age over the winter. Table 1 suggests heights at which to place the house for various species. If hanging several houses, space them at least 30 feet apart (bluebird houses, 100 yards apart). Some songbird species defend their "territory" from intruders of the same species during the nesting season.

There are 3 ways to mount houses:

- (1) Suspend from a tree branch with wire threaded through an eyebolt inserted into the roof.
- (2) Set on top or on the side of a post or metal pipe set in the ground in cement. Where a metal pipe is used, screw a pipe flange the size of the pipe to the bottom of the house.
- (3) Nail the back onto a main branch of a tree. If the back extends above and below the front of the house (see sketch) this is simple. Otherwise, drill a hole through the back opposite the entrance hole, insert a long screw, and attach to tree.

Where cats, dogs or raccoons are a problem, use method 1 or 2. If you use method 2, consider adding a metal conical guard around the post.

Do not hang any house beyond reach of a ladder. Otherwise, it cannot be maintained properly (see below).

MAINTAINING BIRD HOUSES

If you follow the foregoing suggestions for constructing and hanging bird houses, maintenance is easy. In the fall, after nesting season is over, climb a ladder to inspect the boxes. Remove and dispose of nesting materials and other debris. At times fleas, lice, wasps, ants, bees or mice may infest houses. *Remove carefully*, and disinfect the house.

IF HOUSE GOES UNUSED

There is no certainty that any or all of your bird houses will be occupied, especially the first year they are hung. Consider the following before you become discouraged:

- Was the house hung too late in the spring?
- Is the hole too small?
- Is the desired species in the area?

- Did house wrens try to interfere with the nesting of the species desired?
- Is the house located in appropriate habitat?
- Has it weathered at least one season, especially the paint?
- Is it near an area of human traffic?

IF PEST SPECIES TAKE OVER

In the U.S., birds and their nests are protected by Federal law with the exception of the European starling (*Sturnus vulgaris*) and house (English) sparrow (*Passer domesticus*). Both species will compete with native cavity nesters for nest sites. It is recommended strongly that you discourage nesting by these pests, including removal of their nests and eggs from bird houses and the destruction of nests if you find them elsewhere. Starlings seldom nest within 5 feet of the ground so houses can be placed below this height where starlings become a problem.

ATTRACTING TREE DWELLERS

The non-cavity nesters, those birds that will not accept any kind of man-made house, also can be attracted to good backyard habitat. If the needs of all wildlife are provided -- food, water, cover and space for rearing young, the tree-dwellers (e.g. orioles) will be more likely to nest in your yard.

Trees and shrubs can be pruned to provide limbs and crotches where nests can be built. Nesting materials are available naturally or can be provided by humans. By allowing your yard to be somewhat untidy, grass, straw, sticks, moss and bits of bark should be available early in the spring. The homeowner can additionally provide short strips of cloth, yarn or string, wood shavings, dog hair, cotton and other material. Schutz suggests constructing a "nesting materials box" to present the materials. The box is 3-sided, with ¼-inch dowels across the front. An overhanging roof keeps the materials dry and the house doubles as a suet feeder in winter.

In dry weather, keep an area of bare soil damp with a garden hose to provide mud for robins' nests.

The nests of tree-dwellers are particularly vulnerable to house cats, and dogs may interfere with ground-nesting birds. Strays should be caught and taken to the animal shelter. Human disturbance also must be minimized in the nesting area.

MARTIN HOUSES

The purple martin, largest of the North American swallows, is gregarious by nature. A colony of martins may accept a multi-compartmented man-made martin house. However, unless the colony is already established, it is difficult to predict whether your house will become occupied. One requirement is a nearby pond or stream which is a source of insects on which martins can feed.

Try a six-room house the first year. If it is used by martins, add on to the house the next year. Designs are available which allow stories to be added to the first floor.

Excellent aluminum houses are available commercially which are easy to handle and maintain.

If you decide to build a house, Table 1 gives dimensions for one compartment, designed to hold one nesting pair of martins. You should probably consult a library book with specific martin house designs.

Consider also the following suggestions:

- Place the entrance hole (2-½ in. in diameter) one inch above the bottom of the floor. Martins like to sit in the doorway.
- Extend the floor to form a porch about 3 inches wide all around the house, with a dowel rail to protect unfledged young.
- Paint house white to reflect heat.
- Place house 50 feet from nearest human dwelling or tree, on a telescoping pole 15 feet high.
- Remove pest species like the house sparrow frequently.
- Try an inexpensive martin "condominium" -- a row of hollow gourds or plastic milk bottles, with proper entrance holes, suspended from a horizontal arm attached to a 15-foot post sunk in ground.

IN CONCLUSION

Those who provide bird houses and other amenities for wildlife expect to derive pleasure in observing, and perhaps studying and photographing, wildlife close-at-hand. Despite your efforts to minimize the hazards in your backyard, not all birds will have a successful nesting season. Loss of some eggs, young and even adults is often inevitable. It is estimated that 50% of newly-hatched birds will not reach maturity, and the average life span of an adult songbird is only one year.

It is important for the human observer to remain objective and to realize these natural losses do not threaten most bird populations.

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NOTES:

URBAN WILDLIFE MANAGER'S NOTEBOOK -- 5

Natural Landscaping -- Meadows

Louise E. Dove, Wildlife Biologist

INTRODUCTION

- "A man-made monoculture..."
- "...an unstable plant community susceptible to complete devastation by insect or disease..."
- "...economically and ecologically unsound..."
- "A botanical absurdity..."
- "...biological deserts"
- "A luxury we may no longer be able to afford..."

The lawn, as cared for by the average homeowner, has been defined by all of these terms in the last decade! The traditional plot of carefully-manicured green grass associated with the urban/suburban home is being reconsidered and is under attack. Growing numbers of homeowners, landscape architects, botanists and environmentalists are convinced that *alternative* methods of maintaining the home grounds are more appropriate in this era of energy and resource conservation.

It is estimated that Americans spend \$20 billion annually on yard maintenance to purchase fertilizers, lawn mowers, gasoline, pesticides and water. Because lawn grasses are not well-adapted to much of North America (the convention of growing lawns began in the wet, cool climate of England), extraordinary measures must be taken to maintain them. According to Diekelmann and Schuster, one-sixth of the commercial fertilizers manufactured in the U.S. are used to grow lawns, and two-fifths of the pesticides produced are applied to home lawns and gardens. Forty million power mowers consume 200 million gallons of gas annually to keep the grass cropped. Noise pollution from mowers, "algal blooms" in urban streams and lakes created by fertilizer run-off, the health risk from pesticides, lawn-watering restrictions, the reluctance of homeowners to expend the cost and effort necessary for lawn maintenance and the desire to enhance wildlife habitat are other reasons that alternative methods are becoming popular.

ALTERNATIVE METHODS TO THE LAWN

In *natural landscaping*, natural processes are allowed to go on in designing a landscape as an alternative to the traditional lawn. One approach is the extreme one of letting the place "go wild" -- grasses, vines, shrubs and trees

are permitted to grow without human intervention, creating a "wilderness". Another approach is a planned, gradual reduction of lawn area, and a setting aside of small areas where native plant materials are deliberately introduced, and/or desirable volunteers are allowed to mature.

Those interested in attracting more wildlife will want to consider alternative methods to the lawn, for it is known that plant diversity encourages wildlife diversity. By reducing the lawn area to that necessary only for family recreation, or to satisfy the homeowner's desire for a plot of clipped grass for aesthetics, a more diverse and interesting landscape can be created. Native wildflowers and grasses can be grown in unmowed areas, which will attract seed-eating birds like finches, small native mammals and pollinating invertebrates like butterflies. Establishing a meadow area is a logical first step to creating a natural landscape around one's home.

THE MEADOW VS. THE LAW

Most cities and towns have ordinances against unmowed areas. "Weed ordinances" specify the maximum height for grass, and prohibit the growing of certain "noxious" plants. As more property owners have given up traditional lawns, these ordinances have been challenged, and landmark cases have been won in court. In many of the cases won by property owners, the law specified that certain "noxious weeds" could not be present, and the owners demonstrated the absence of these "weeds", in their yards. Lorrie Otto, an outspoken advocate of the natural lawn in the Milwaukee area, sued the city when mowers came in to cut her meadow without her permission. She collected damages because the local ordinance prohibited only 3 plants -- leafy spurge, field bindweed and Canada thistle, and none was present in her yard. In a celebrated case in Virginia, an expert Smithsonian botanist testified on behalf of the natural yard, convincing the judge that not even botanists can answer, "what is a weed?" Donald Hagar, a Wisconsin wildlife biologist, refused to cut grasses on his 2.6-acre property, and was accused of creating a fire hazard, health hazard and "rat haven". Expert testimony refuted all of these claims and the judge declared the town's grass-cutting section of the weed ordinance to be unconstitutional because it did not

apply equally to developed and undeveloped land. These decisions and others have prompted some communities to allow for "natural landscaping."

Before you begin your meadow, consult the "codified ordinances" of your town or city, and understand the restrictions on meadow habitats. Try to educate your neighbors and the weed-ordinance enforcers ahead of time, explaining your landscape plan. If the ordinance forbids certain "weeds", be prepared to remove them if they appear in your yard. If you are unable to convince others of the benefits of natural landscaping, and are unwilling to "fight city hall", consider planting a low-growing ground cover of benefit to wildlife in place of the lawn.



Courtesy: Peggy Fleming, National Park Service

Butterfly weed blooms in mid-summer in an urban meadow. The nectar-producing flowers occur in orange and yellow, and are particularly attractive to butterflies.

CONTROLLING ECOLOGICAL SUCCESSION

When a lawn mower is permanently retired, and the land remains undisturbed, *ecological succession* will occur. Through this process, native plant species invade the area and, in naturally forested regions, a mowed lawn may be transformed to a mature "climax" forest in about 150 years. (See figure 1). However, most of us want to derive pleasure from our surroundings in our lifetime. The home gardener can speed up the process by planting appropriate native vegetation, and maintaining the vegetation at the successional stage desired. Thus,

grasslands or an intermediate stage of shrubs and small trees can be achieved on an urban/suburban lot within a few years. To insure low maintenance, it is important to use native plants. Since they occur naturally in the area, native plants are suited to the climate and soil conditions. Non-native plants usually require more water, fertilizer and disease control and may not thrive despite the care given. Native plants that are locally successful will also provide food and cover for many native wildlife species.

In figure 1, note that an early stage in succession is that of *forb-grassland*. (A *forb* is a broadleaved, non-woody plant other than grass). Grasslands that occur in areas of high rainfall, such as the Northeast and Pacific Northwest of the U.S., are *meadows*. By keeping an area in grasses and forbs, a meadow is created. In areas of low rainfall, such as the Midwest, natural grasslands are called *prairies*. Native meadows and prairies may contain up to 200 different species of forbs and grasses. Seasonal changes in the predominant species are typical. In a man-made meadow, this diversity can be controlled by the initial planting of species, and by subsequent control of introduced and volunteer species. One can decide "what kind and how much meadow" or prairie one is comfortable with.

THE MEADOW: A THING OF BEAUTY

W.G. Kenfield (*The Wild Gardener in the Wild Landscape*, 1966), has written:

"The Grassland is a thing of beauty. As the season advances from early spring to late fall, one grass after another becomes prominent, in green, yellow, pink, and bronze... From the earliest spring bulbs to the last chrysanthemums they come and go in endless profusion. Sometimes there will be a low-lying carpet of yellow, extending continuously. Then there will be the isolated orange of lilies and the purple spikes of blazing star, or patches of asters and goldenrods. As one vanishes (literally vanishes, without benefit of gardening) another bursts into view. Finally, all turns to magnificent hues of brown in the autumn frosts. It is submerged beneath a sea of snow. It emerges with spring thaws as smooth as if flattened by some conscientious roller."

Coupled with the natural landscapes's improved habitat for wildlife, the meadow will be an attractive alternative to the monotony of the home lawn.

ESTABLISHING AN URBAN MEADOW

Meadows are suitable on any scale and can be tailored to fit into the surroundings. In an urban/suburban situation, the first aim should be reduction in lawn size. Some lawn will probably be retained for picnics and lawn games. Meadows can be established in any area of full sun and well-drained soil. They are effective when bordered by shrubs or a woodland. Borders also help screen the meadow from outside view. Having chosen an area of

(Cont'd)

TABLE 1. PLANT SPECIES FOR URBAN MEADOWS AND PRAIRIES

<i>Meadow</i>	
<i>Andropogon scoparius</i>	Little bluestem
<i>Asclepias spp.</i>	Milkweed
<i>Asclepias tuberosa</i>	Butterfly weed
<i>Aletris farinosa</i>	Colicroot
<i>Aster Novae-angliae</i>	New England aster
<i>Cichorium intybus</i>	Chicory
<i>Chrysanthemum leucanthemum</i>	Oxeye daisy
<i>Coreopsis lanceolata</i>	Coreopsis (Tickseed)
<i>Eupatorium purpureum</i>	Joe-Pye-Weed
<i>Fragaria virginiana</i>	Wild strawberry
<i>Gentiana spp.</i>	Gentian
<i>Helianthus spp.</i>	Sunflower
<i>Hemerocallis fulva</i>	Day Lily
<i>Hypoxis hirsuta</i>	Yellow stargrass
<i>Liatris spicata</i>	Blazing star
<i>Oenothera fruticosa</i>	Sundrops
<i>Phlox paniculata</i>	Perennial phlox
<i>Rudbeckia hirta</i>	Black-eyed Susan (Coneflower)
<i>Sisyrinchium angustifolium</i>	Blue-eyed grass
<i>Solidago spp.</i>	Goldenrod
<i>Spiraea tomentosa</i>	Hardhack (Steeplebush)
<i>Tradescantia virginiana</i>	Spiderwort
<i>Tussilago farfara</i>	Coltsfoot
<i>Yucca filamentosa</i>	Yucca

Prairie

<i>Amsonia tabernaemontana</i>	Bluestar (Blue dogbane)
<i>Andropogon gerardi</i>	Big bluestem
<i>Andropogon scoparius</i>	Little bluestem
<i>Anemone caroliniana</i>	Prairie windflower
<i>Aster ericoides</i>	Heath aster
<i>Coreopsis palmata</i>	Prairie coreopsis
<i>Echinacea angustifolia</i>	Purple coneflower
<i>Euphorbia corollata</i>	Flowering spurge
<i>Eustoma grandiflorum</i>	Prairie gentian
<i>Helianthus salicifolius</i>	Prairie sunflower
<i>Liatris punctata</i>	Blazing Star (Button snakeroot)
<i>Lupinus texensis</i>	Texas bluebonnet
<i>Panicum virgatum</i>	Switchgrass
<i>Penstemon cobaea</i>	Beard-tongue
<i>Petalostemon purpureum</i>	Purple prairie clover
<i>Phlox pilosa</i>	Hairy phlox
<i>Ratibida pinnata</i>	Prairie coneflower
<i>Rosa spp.</i>	Rose
<i>Solidago spp.</i>	Goldenrod
<i>Stipa spartea</i>	Needlegrass
<i>Tradescantia ohioensis</i>	Spiderwort
<i>Veronia Baldwinii</i>	Western ironweed
<i>Yucca glauca</i>	Soapweed

TABLE 2. SOURCES OF NATIVE SEEDS*

Herbst Brothers Seedsmen 1000 N. Main Street Brewster, NY 10509 (East)	Larner Seeds P.O. Box 11143 Palo Alto, CA 94306 (New England and West)
Little Valley Farm R.R. 1, Box 287 Richland Center, WI 53581 (Midwest)	Natural Habitat Nursery 4818 Terminal Road McFarland, WI 53558 (Midwest)
Wildlife Systems Ltd. P.O. Box 1031 Blackfoot, ID 83221 (Western intermountain area)	

See also: Soil Conservation Society of America, 1982. Sources of native seeds and plants. (7515 N.E. Ankeny Road, Ankeny, IA 50021, \$3.00 postpaid).

*Listing here does not imply an endorsement by the Institute



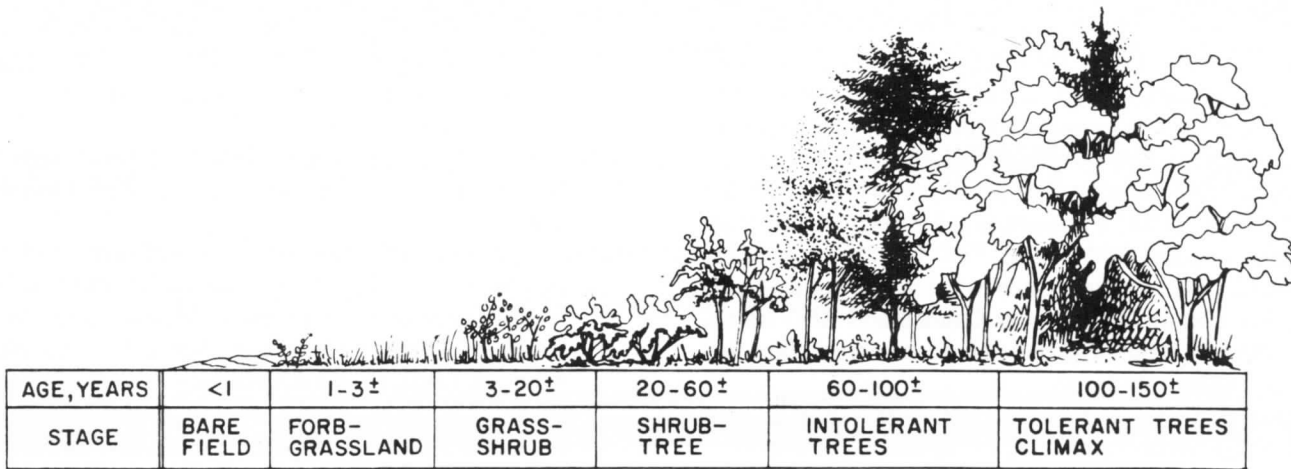


Fig. 1
SUCCESSIONAL STAGES

Source: T.D.Rader, Coop. Extension Service, The Penna State University

lawn that meets meadow requirements for sun and good drainage, one can sit back and stop mowing and in a minimum of 4 years, wildflowers will become established (along with exotic weeds and woody seedlings). Otherwise, in early Fall, before frost, one can remove the existing sod, till, and broadcast a grass-forb seed mixture (mixed with sand) over the entire area. A third approach is, in early Fall, to open up "soil pockets" in the lawn, and plant seed mixtures in the pockets, OR transplant clumps of like seedlings, grown in pots, into the soil pockets. Use a bulb planter to remove turf in pockets 12-18 inches apart.

Diekelmann and Schuster suggest that to achieve a natural landscape, a grid of 50% grasses and 50% forbs should be laid out, alternating types horizontally and vertically every square foot. Aggressive species like switch grass (*Panicum virgatum*), prairie coreopsis (*Coreopsis palmata*), wild strawberry (*Fragaria virginiana*), milkweed (*Asclepias* spp.), and sunflowers (*Helianthus* spp.) should be excluded at first to allow slow-spreading grasses and forbs to increase their coverage.

Table 1 lists species that can be used in urban meadows and prairies. This is a sampling of the species available. Check a regional guide to find those native to the area and appropriate to the soil conditions where planting will be carried out. By alternating plantings of grasses and forbs, grasses eventually fill in spaces between forbs to produce a natural design. Grasses dominate numerically, although forbs will dominate visually at some seasons of the year because many forbs produce brightly colored flowers.

Planted areas should be kept well-watered till frost, and mulched for protection over the winter. Fall seed planting is preferred to spring because some species need frost treatment to germinate. A number of seed companies offer native wildflower seed mixtures adapted to geographical regions, or packets of seeds of individual species, for producing pot-grown seedlings (see table 2).

It will take 3 growing seasons to establish a meadow (or prairie). Weeds and woody seedlings should be hand-pulled or dug out during this time. As the plants become established over the first few years, they spread by reseeding, and clumps can be divided to expand the meadow area. Certain plants spread by growth of under-

ground rhizomes or corms, also. Fertilization is not recommended since this encourages invading exotic weeds. Mossman, however, recommends mulching blooming plants with partly rotted compost every few weeks, which would tend to improve the soil over time. Baines states that (in Britain) the most colorful wildflower meadows flourish in poor soil, and recommends removal of top soil if present, before sowing a meadow.

It is important to water young plants as they become established, and to soak the ground around adult plants (with a hose) in particularly dry growing seasons.

MAINTAINING A MEADOW

Once established, meadows and prairies are relatively self-sufficient. A meadow needs an annual mowing to control weedy species, or, if too tough for a mower, cut down with a scythe. A prairie responds to an annual mowing or burning, although the latter may be restricted in urban areas. Never undertake burning without assistance. (Note: In the Midwest, the prairie is considered the climax situation in natural succession, so long as periodic burning occurs and dry conditions exist).

Some gardeners mow in late fall after the plants have gone to seed. Early spring mowing allows wildlife to forage on seeds and to obtain cover during the winter months, and is recommended for those who wish to attract wildlife through the winter.

CONCLUSION

Landscaping has been described as "the arrangement of plant material using its form, texture and color to create special effects." Natural landscaping emphasizes the choice of native plants to create a habitat that, once established, requires little human intervention. The diversity and success of native flora in an urban meadow will attract native wildlife including many species of birds and butterflies. The urban gardener will be rewarded with more aesthetic surroundings and lower maintenance efforts and costs, preservation of native plant and animal species and improvement of the ecology of the home grounds.

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NOTES:

URBAN WILDLIFE MANAGER'S NOTEBOOK -- 6

Reptiles And Amphibians

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INTRODUCTION

Lizards, snakes, turtles, salamanders, frogs, toads and crocodilians -- who among us has not felt a twinge of fear and disgust at the sight of one of these slithering, wiggling or leaping creatures? Ignorance is largely responsible for our reaction to the reptiles and amphibians. The more we understand about their role in the natural environment, the less will be our apprehension. If there is an appreciation for their importance in the food chain, we can accept them as part of the total environment of our cities, towns and backyards. We can also enjoy learning to recognize their color patterns, and more about their interesting behavior.

Perhaps no other classes of animals have been so maligned through folk-lore and superstition. Frightening tales about the effects of certain reptiles and amphibians on humans - all false - continue to be perpetuated in modern culture.

The true basis for concern, of course, is the small number of poisonous species that exist and that pose a dangerous threat if encountered; and the crocodilians. The crocodilians -- crocodiles and alligators -- will be discussed only briefly in this Notebook because of their narrow, mostly non-urban range in the U.S. However, crocodilians can be savage when aroused and should never be approached in the wild, or elsewhere.

There are four types of poisonous snakes and one poisonous lizard in the U.S. However, there are 112 species of *nonpoisonous* snakes, 88 species of *nonpoisonous* lizards, and no poisonous amphibians. By learning to recognize the few venomous species, people can become less fearful of the nonpoisonous ones. This is not to minimize the ability of the venomous snakes to inflict a fatal bite on humans. *It is strongly recommended that one becomes familiar with the color patterns, habits and ranges of those animals one is likely to encounter.* Table 1 lists the poisonous snakes in this country, the states in which they are found, and suggested field study guides.

The Gila monster, the only poisonous U.S. lizard, is found only in the Southwestern deserts.

In fact, few of the poisonous OR nonpoisonous species of reptiles and amphibians are ever encountered by the urban dweller. In part, this is due to the secretive nature of these animals. More significantly, studies confirm that

their numbers have dwindled as urbanization has proceeded. The loss of aquatic habitat, and other changes in land use, have caused reptiles and amphibians to become scarce in many cities.

This leaflet was prepared to (1) provide factual information on reptiles and amphibians, (2) provide suggestions for locating the common species in and near cities, and (3) to discuss some of the techniques being used to manage reptiles and amphibians in and near populated areas. It is hoped this will encourage urban conservationists to work for the protection of these animals and their habitat.

TERMINOLOGY

The word *herptile* is a collective term for reptiles and amphibians, and will be used frequently in this leaflet. "Herptiles" can refer to either or both type of animals. "Herps" is a slang term sometimes used in the same sense in the literature on these animals.

GENERAL CHARACTERISTICS OF HERPTILES

The general characteristics of the reptiles and amphibians (excluding the crocodilians) are outlined in Figure 1, next page.

Southern Leopard Frog

(Source: U.S. Fish and Wildlife Service, S.E. Region)

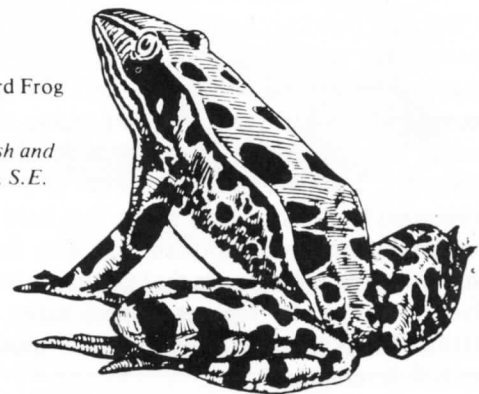


Fig. 1. Characteristics of Amphibians and Reptiles (Excluding the Crocodilians)

<u>Amphibian</u>		<u>Reptile</u>		
Cold-blooded		Cold-blooded		
All require moist habitats		Some adapted to dry habitats		
Reproduction usually aquatic		Terrestrial reproduction		
No scales: moist, glandular skin		Scales, horny plates		
Gills present at some stage		No gills		
<hr/>		<hr/>		
<u>Frogs, toads</u>	<u>Newts, salamanders</u>	<u>Turtles</u>	<u>Lizards</u>	<u>Snakes</u>
Adults tailless	Adults have tails	No teeth	Teeth	Teeth
Eggs fertilized externally	Eggs fertilized internally	4 legs	Usually 4 legs	Legless
Gilled larval stage: tail but no limbs (tadpole)	Gilled "larva" with tail & limbs	Eyelids	Usually eyelids	No eyelids
Hind limbs adapted for jumping, hopping	Small limbs	Egg layers	Some lay eggs, some bear live young	Some lay eggs, some bear live young

UNDERSTANDING THE HERPTILES

Amphibians Require Moisture

Amphibians - frogs, toads and salamanders - lead double lives. Most species spend part of their life cycles in water, and part on land. The land-dwellers are seldom far from water, and their eggs, unprotected by shells or membranes, must develop in the waters of streams, lakes, ponds or "puddles". Depending on the species, adult amphibians deposit eggs as floating jelly-like masses, in long strings or as single eggs on submerged vegetation, where they quickly develop into aquatic swimming larvae with gills. The frog tadpole is a familiar example. In most regions, the larvae metamorphose into air-breathing adults that climb onto land but will return, like their parents, to breed in bodies of water. On land, amphibians must find moist habitat to protect themselves against loss of body fluids. Their skin is thin, moist and permeable, and liquid is absorbed or lost easily. Oxygen can be exchanged through the skin to supplement intake by their lungs. (Many salamanders are lungless and this is their means of respiration.) This mechanism also permits amphibians to hibernate in winter at the bottom of ponds and lakes, or underground in moist soil. Many will also estivate in summer.

Reptiles Require Heat

The first true land animals were reptiles, ancestors of present-day turtles, snakes, lizards and crocodilians. Reptiles were able to remain on land permanently because adults had scales or bony plates covering their bodies that protected them from moisture loss and predators. Further, their eggs were protected, having developed leathery or limy shells that held fluid for the developing embryo. Reptilian eggs also first developed amniotic sacs, membranes that further protect embryos. Even in the desert regions, where many reptiles live, fertilized eggs contain the watery environment necessary for full development.

Both reptiles and amphibians are cold-blooded: their bodies cannot generate internal heat. Their body temperatures, and thus their levels of activity, depend on the temperature of their environment. Turtles bask on a log to absorb the sun's heat. Snakes lie on dark - paved highways at night to obtain radiated heat. Reptiles move in and out of the sun in a daily routine to keep their body temperature at an efficient level. Their skin, covered with scales or bony plates, does not lose much moisture in direct sun. However, if the sun's heat is too intense, reptiles will move to a cooler area.

Amphibians require suitable ambient temperatures to remain active, also. However, frogs, toads and salamanders cannot be exposed to the direct sun for long or they will lose moisture through their permeable skin and quickly die by desiccation. Toads are seldom seen hunting for insects except after dark. Amphibians remain relatively cold and sluggish to satisfy their primary need to stay in moist surroundings, whereas reptiles have a more primary need to stay warm.

Warm-blooded animals (birds and mammals) consume food at regular intervals. Eighty percent (80%) of their intake of calories is used to maintain a constant internal temperature. A reptile needs only 10% of the calories required by a mammal of the same size because its body temperature is maintained by the heat of the sun.

It is not surprising that reptiles and amphibians are seldom seen! Amphibians must remain hidden in damp places like leaf litter, meadows and near streams and ponds; reptiles move in and out of the sun around rock piles, logs and undergrowth. Herptiles remain inactive, surviving on small amounts of food, if weather conditions do not meet their needs. They hibernate during winter in colder climates.

There are guidelines later in this paper for those who wish to find and observe the common herptiles.

Table 1. State List of Venomous Snakes in the U.S. and Suggested Study Guides

<u>Type of Snake</u>	<u>States where one or more species found</u>
Copperhead ^a	AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MD, MA, MS, MO, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VA, WV
Cottonmouth ^a	AL, AR, FL, GA, IL, KY, LA, MS, MO, NC, OK, SC, TN, TX, VA
Rattlesnake ^a	Found in all states <u>EXCEPT</u> AK, DE, HI, ME
Coral	AL, AZ, AR, FL, GA, LA, MS, NM, SC, TX

^a A "pit viper", that is, having a pit located on each side of the head about midway between the eye and nostril. The pit is a sensory organ detecting heat and helps the snake locate small mammal prey in the dark. NOTE: One must approach a snake closely to detect the pit; do not use this method as the definitive field mark of a poisonous snake!

Some Suggested Study Guides:

Conant, R., 1975. *A Field Guide to Reptiles and Amphibians of Eastern and Central North America*. 2nd ed. Houghton Mifflin Co., Boston. 429 pp.

Simon, H. 1979. *Easy Identification Guide to North American Snakes*. Dodd, Mead & Co., New York. 128 pp.

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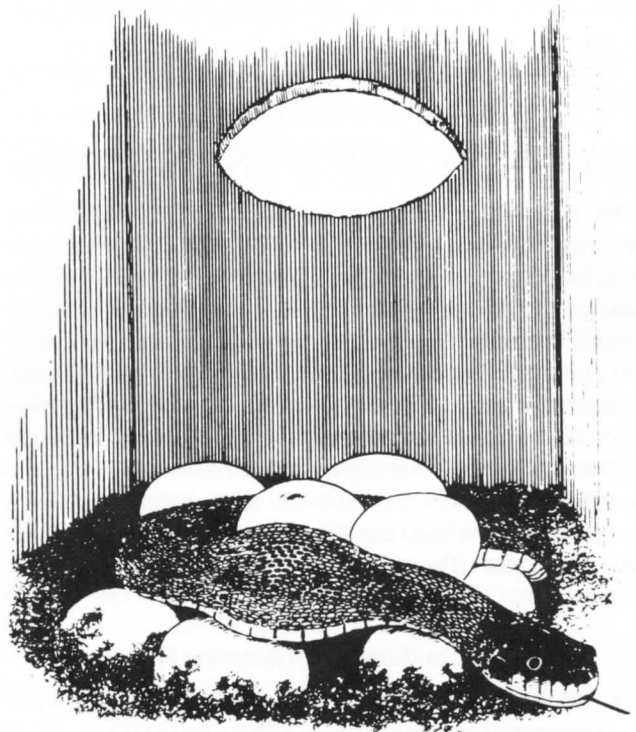
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FOR SERIOUS STUDENTS

There are 3 major American professional societies for herpetologists, each publishing a recognized scientific journal:

- American Society of Ichthyologists & Herpetologists
 Publisher of *Copeia*
 c/o Carter Gilbert
 Florida State Museum
 University of Florida
 Gainesville, FL 32611
- Society for the Study of Amphibians and Reptiles
 Publisher of *Journal of Herpetology*
 c/o Rudolfo Ruibal
 Ohio University
 Department of Zoology
 Athens, OH 45701
- Society of Systematic Zoology, Herpetologists' League
 Publisher of *Herpetologica*
 c/o Robert G. Jaeger
 Department of Biology
 University of Southwestern
 Louisiana
 Lafayette, LA 70504



Snake in Wood duck box

(Source: U.S. Fish and Wildlife Service, S.E. Region)

HERPTILES AND URBANIZATION

Reptiles and amphibians are seldom seen by urban dwellers. Probably few of us can recognize the most common local species. Except for basking turtles, one cannot transfer the techniques of bird-watching to "watching herptiles." Unlike birds, herptiles are not part of the everyday experience of those who enjoy urban wildlife.

In urban areas, herptile populations are particularly vulnerable to loss of habitat. They are not far-ranging and require summer breeding sites as well as winter hibernating quarters within the confines of the city. City amphibians, like their country cousins, require open water to lay their eggs. Terrestrial forms, which include most of the reptiles, are threatened when ground cover, underbrush and woodland are removed. The removal of woodlots, landfilling, and loss of wetlands are examples of habitat reduction for urban herptiles.

Some species with simple habitat requirements and small home ranges will tolerate urbanization and actually increase locally. This is true for the Fowler's toad (*Bufo Woodhousei fowleri*) which can use almost any temporary water hole to breed, and the Northern brown snake (*Storeria dekayi dekayi*) which persists under debris on vacant lots (Schlauch '76). The majority of native species decline, however, with urbanization, for the reasons already discussed, and others. The numbers of road kills of snakes, salamanders and other herptiles are surprisingly high. Collectors may adversely affect populations of land turtles, snakes and frogs. Gill and Bonnet ('73) believe that habitat reduction causes a great increase in competition between species of herptiles. (Egg-eating might occur, for instance). This further explains their scarcity in cities and suburbs.

How, then, can the interested urban dweller observe herptiles?

WHEN-HOW-WHERE TO FIND HERPTILES

Herptile species may be fairly common in a local area, but they must be searched for to be seen. These animals tend to be secretive, and often, inactive, because of the weather. Leedy and Adams ('82) list at least 7 environmental factors that influence herptile activity - temperature, precipitation, soil moisture, humidity, light intensity, wind and season. Furthermore, each species has its own daily and seasonal activity pattern. Toads tend to actively hunt insects on summer nights; salamanders are not in the open on sunny days, during a dry spell. Some species are easily seen if one searches the proper habitat at the right time of the year. The rare forms are seldom found even by scientists.

Favorable Conditions for Observing Herptiles

- Amphibians are active 24 hours after a rain starts, at temperatures above 24°C. (75°F.)
- Snakes are more active when temperatures are 21°-32°C. (70-90°F.), after dark.
- Aquatic turtles may be seen on land on overcast, humid days at temperatures above 15°C. (59°F.)
- Crocodylians are relatively helpless in water tem-

peratures of 7°C. (45°F.)

- Lizards and turtles bask on sunny days, in approximately the same temperature ranges that snakes prefer (see above).

Equipment

A hooked crowbar, hoe, or stevedore's hook may be useful to lift logs, rocks and boards under which herptiles sometimes hide. By lifting the far side, allowing the near side to stay in contact with the ground, one need not risk a snake bite. This, however, is a remote possibility -- there are only 30 fatal bites a year in the U.S.

Boots are practical since amphibians are seen in moist habitats, and boots will protect against many snake bites.

Since many species are nocturnal, use a flashlight or headlamp to detect the eyeshine of toads and frogs. (Hold the flashlight next to but directed away from the eyes). In spring, amphibians are easily located in breeding ponds, with flashlights. Approach breeding areas slowly and quietly.

Stebbins ('60) recommends keeping a notebook to record observations made of reptiles and amphibians. Use a loose-leaf book with a separate piece of paper for each entry. Describe the habitat, weather conditions and actions of the species, as well as place, date, and time of day. Repeated observations of the same species are interesting since they allow comparisons.

Where to Look

The moisture-seeking amphibians are often out after rain, and at night. Look under rocks, small brush piles, bark slabs, leaf litter, and logs, particularly in areas facing north, for salamanders. Sheltered areas in damp meadows and gardens and near ponds will likely attract toads and frogs. Areas that support insects will be obvious feeding areas. The woodland species will seek ponds, and undergrowth, that are located near the edge of woods.

Look for salamanders trapped in window wells of houses. Remove carefully and release where there is cover and moisture.

The heat-loving reptiles are more likely to be in areas facing south. Look near logs, rocks, bark slabs, dead standing trees, brush piles and man-made litter in cleared areas where the sun can reach. In summer, some snake species bask and forage in abandoned railroad beds. The box turtle is often found in areas with young trees and undergrowth. Lizards bask along fence rows, on tree trunks or on rock piles. Since ground litter attracts and provides cover for small rodents, as well as insects and other invertebrates, tortoises (land turtles), lizards and snakes will likely be around litter searching for prey.

Shallow ponds and other water bodies will attract a variety of wildlife, including toads, frogs, salamanders, turtles and harmless water snakes. Even if the ponds are dry by late summer, they will be useful in spring and early summer for many breeding amphibians. Tadpoles of different species may be seen using the aquatic plants --

arrowhead, pickerel weed, and others -- for food and shelter. Snakes and turtles may lie in the sun on logs partially submerged in water.

Snakes, toads and salamanders often move onto warm highways at night and can be observed by driving slowly after dark along dark-surfaced roads where there is little traffic.

Do not become a collector of the herptiles you are fortunate enough to observe. They are difficult to keep alive in captivity and are better conserved by allowing them to remain in the wild.

IMPROVING URBAN HABITAT FOR HERPTILES

All forms of wildlife require food, water, cover and space to reproduce. A diverse backyard or open space area with these features will attract herptiles, and other urban wildlife species. Open water, such as a pond, will attract amphibians and aquatic turtles. A rock pile may be home to lizards and snakes, and a tortoise will seek shrubbery with some open canopy.

New Jersey's Endangered and Nongame Species Program has introduced some innovative management programs to benefit reptiles and amphibians. Artificial hibernacula (winter hibernating areas) were created to protect snakes from predators and human collectors. Heavy logs and stumps were placed below the frost line, intermixed with sand, and covered with more timber and a 0.3-m (1 foot) thick cover of sand on top. Clearings were created nearby to increase small mammal populations as prey for the snakes. If these snake "mounds" are located away from developed areas, they encourage snakes to remain a distance from human activity, probably a desirable management technique in urban areas.

Many people have an unreasonable fear of all snakes, although there should be little concern about nonpoisonous snakes found in the backyard. All snakes will bite if threatened, but if not approached, are harmless. Rarely, a snake will lay eggs in or under foundations, or enter a dwelling through loose screens or open windows. If a snake is in the house, lay wet cloths on the floor area where it is thought to be. Cover the wet cloths with dry cloths or burlap. Snakes like moist, dark areas and will crawl under or between cloths. They can be captured, placed in a pillow case, and removed to the out-of-doors.

To discourage backyard snakes, remove all debris and vegetation around buildings, make sure basement doors and windows fit tightly, and that there are no spaces through outside walls to the inside, as around chimneys, foundations and pipes.

New Jersey biologists also designed a salamander breeding pond to increase numbers of the Eastern tiger salamander (*Ambystoma t. tigrinum*). The pond was structured to hold water in a midline ditch even during a drought, to protect developing salamander eggs. To introduce salamanders, eggs were transplanted from private ponds, taking care to eliminate predator fish, and 400 subadults left the pond the first year. Mature salamanders should return to breed in two years.

Bog turtles are also being managed in suitable bog habitat, by cutting back invading tree saplings to provide open canopy. This allows the sun to reach areas where eggs are incubating, and adult turtles are basking. A scheme to relocate adult turtles to new habitat was unsuccessful since turtles become imprinted on the home bog and try to return.

BENEFITS OF HERPTILES IN URBAN AREAS

Reptiles and amphibians are predators that help control rodents and insects. A single toad emerging at night from shelter to feed in a garden may consume 300 insects - including beetles, moths, flies, crickets and grasshoppers. Herptiles are known to prey on the destructive gypsy moth (*Lymantria dispar*). Snakes consume rats, mice and other rodents, as well as insects, amphibians, smaller snakes and birds. Turtles eat dead or diseased fish, enhancing the healthy fish population of a lake. They are also beneficial scavengers of other dead animals, and of water plants, snails, insects and crayfish. Bullfrogs may consume insects, tadpoles -- even small fish, birds and mice. Salamanders search for worms, slugs and insects in sheltered, damp places.

As part of the food chain, herptiles are in turn preyed upon by ground birds (e.g., thrushes), raptors (hawks, owls), skunks, shrews, raccoons, dogs and cats, rats, foxes, badgers, coyotes and other herptiles. Studies in New Hampshire (Burton and Likens '75) show that salamanders are potentially a source of higher-protein food for predators than are birds or mammals, and thus are significant prey in the food chain.

Aesthetically, herptiles "enliven the city with sounds and sights" (Campbell '74). Many residents enjoy the choruses of frogs and toads from breeding ponds in spring. The calling usually begins after rain or at night. The colors and patterns in snake and lizard scales are strikingly beautiful in many species. The motion of a snake as its body curves side to side with forward motion seems effortless, and is fascinating to watch. The wonder of frog and toad coloration is how well it blends with the surroundings. Until the animal leaps explosively to escape a potential threat, one is seldom aware of its presence. The form of a turtle's shell tells its preferred habitat -- in a land turtle, the shell is high-domed, permitting the head and appendages to be drawn in completely. Aquatic turtle shells are low, flat and may be soft, offering less protection. Both types of shell may have attractive color patterns.

Persons skilled in nature photography are needed to photograph herptiles. The visual literature is sparse in this field.

MYTHS ABOUT REPTILES AND AMPHIBIANS

It is astounding that many false beliefs about herptiles have survived for centuries. Some that you may have heard, and the true facts, follow.

Myth: Toads give persons who touch them warts.

Reality: False. The “warty” skin on toads is actually a collection of glands that secrete a milky fluid, harmless to man, but irritating to predators.

Myth: Frogs and toads “rain” from the sky.

Reality: These animals are often seen after rains because they require moist conditions. Ordinarily, toads hide by day in burrows and become active at night, consuming insects.

Myth: Female snakes swallow their young to protect them from predators.

Reality: About half of the snake species incubate their eggs internally and give birth to completely developed young. An adult female expelling young from her body may have been misunderstood to have “swallowed” them previously.

Myth: The glass snake (*Ophisaurus*) breaks into one or several pieces when caught, and later reassembles itself.

Reality: A limbless lizard (and some of the lizards with legs) has tail vertebrae that break cleanly, allowing the tail to remain behind. The tail may still wiggle and attract a predator, while the lizard escapes. The animal later regenerates a new tail.

Myth: The flickering tongue of snakes and lizards is a harmful stinging organ.

Reality: The tongue is a sense organ that “tastes” the environment and helps the animal find prey.

Myth: Some persons are “immune” to snake venom and show no reaction when bitten by a poisonous snake.

Reality: It is estimated that 40% of the venomous snakes biting humans do not release venom at the time. Ordinarily, venom is injected through the 2 hollow fangs with which snakes strike prey. The venom is actually stored in sacs in the snake’s skull, not in the fangs. The fangs act as hypodermic needles.

Did You Also Know?

- Many lizards have a third eye, located on top of the head. The “parietal eye” has a lens and a retina, but no iris, and is sensitive to sunlight. It is believed to control the lizard’s activity in daylight.
- Horned lizards of the genus *Phrynosoma* can eject a fine spray of blood from the eye up to several feet, when aroused. A rapid rise in blood pressure causes tissues of the third eyelid to rupture, and blood to spurt out, probably as a defense mechanism.
- Most amphibians can change colors. The Pacific tree frog (*Hyla regilla*) can turn from black to bright green in about 10 minutes.
- Newt, eft and asker are old names for salamanders, some still in usage. A common salamander of the Atlantic region, *Triturus viridescens*, demonstrates the confusion of terms. The “red eft” of the woods is the same species as the “spotted newt” of ponds, at different phases of its life cycle.
- A few species of amphibians do not lay eggs in water. The ensatina salamander (*Ensatina eschscholtzi*) of California lays eggs underground or inside rotting logs. The female stays with the eggs until the young hatch, fully formed.

- Salamander larvae of some species grow to a large size, retain their gills, and remain aquatic. Such species are said to be “neotonic”, and are called axolotls. In this country, the mud puppy (*Necturus*) is a very large, gilled salamander that might be seen in urban rivers.

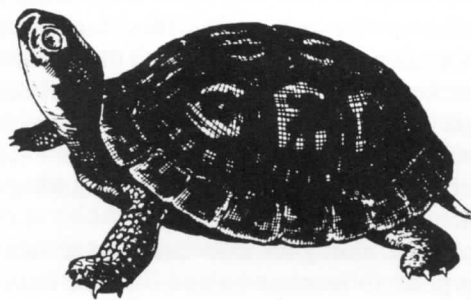
A NOTE ON THE CROCODILIANS

Information on the crocodylians - crocodiles and alligators - is not included in this leaflet because of their narrow, largely non-urban range. In the U.S., the crocodile is found chiefly in Florida (Everglades National Park, Biscayne Bay and the Florida Keys). The alligator resides in Florida water bodies, and the Gulf and lower Atlantic Coast.

Occasional nuisance complaints result from the movement of alligators into newly-constructed canals, ponds and ditches in new residential developments in Florida and elsewhere. Loss of habitat, hunting and poaching, caused alligators to be placed on the Federal Endangered Species List in 1967. Active enforcement and management activities led to a dramatic recovery of American alligator populations in Louisiana and Texas. It continues to be classified as endangered or threatened in 8 other Southern states.

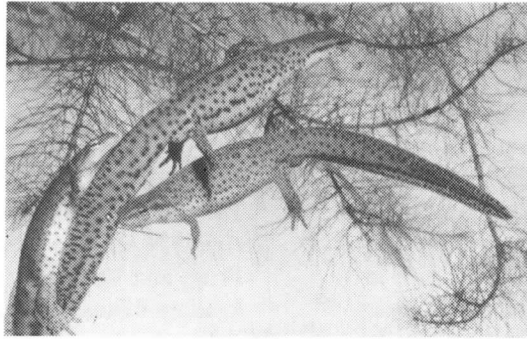
CONCLUSIONS

Urbanization and loss of suitable habitat are in conflict with native populations of reptiles and amphibians in most cases. The herptiles occupy an important place in the food chain, helping to control rodent and insect populations, and serving as prey for larger consumers. With education and understanding, people can overcome a fear or dislike of herptiles, and help insure their conservation. The presence of these interesting though seldom-seen animals indicates a healthy environment, and adds to the pleasure of living in an urban area.



Eastern Box Turtle

(Source: U.S. Fish and Wildlife Service, S.E. Region)



Red Spotted Newt
(Source: E.P. Haddon, U.S. Fish
and Wildlife Service,
Washington, D.C.)

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NOTES:

URBAN WILDLIFE MANAGER'S NOTEBOOK -- 7

Birds That Attack Houses

Louise E. Dove, Wildlife Biologist

WOODPECKERS: WHY THEY MAKE NOISE

The woodpecker that awakes you at dawn in spring drumming loudly on a metal flashing on your roof is making good use of habitat you are providing. The drumming, tapping, and hammering of a woodpecker are part of its breeding behavior. Woodpeckers do not have true songs, only sharp calls, and cannot proclaim their breeding territories by singing from treetops and fence posts in the familiar manner of the songbirds. Instead, they rap with their bills on dead tree limbs, metal downspouts, television antennae, and other objects that resonate, in order to attract a mate and announce a territory. Both male and female woodpeckers drum. Human residents that share their habitat will lose a little sleep, but otherwise can enjoy the presence of these colorful and interesting birds.

WOODPECKERS: WHY THEY DAMAGE WOOD SIDING

Unfortunately, other activities of woodpeckers can become costly to the homeowner. In spring, having established a territory and found a mate, woodpeckers must excavate a nest site in which to deposit their eggs, and later contain the young, until fledged. In late summer or early fall, non-migratory woodpeckers also excavate roosting cavities. In natural situations, woodpeckers excavate nesting and roosting cavities in trees. However, in developed areas, it is not uncommon to find a woodpecker drilling a large hole in the wall of a house. Buildings shingled with cedar and redwood, both fairly soft woods and easily drilled, seem particularly vulnerable to woodpecker attacks. One house may be attacked many times. A large round or cone-shaped hole, the beginning of a cavity, may be abandoned in favor of similar new holes nearby. This may be fairly typical behavior of woodpeckers. In non-residential areas, a pair of woodpeckers also may start and abandon a number of nest holes before completing one. Observations by Dennis (1964) and others on woodpecker holes drilled in utility poles, determined that only 5% of the holes had a function. Bent (1939) reported observations of numerous unfinished nesting holes of the white-headed woodpecker in trees



Figure 1. Woodpecker drilling a nest cavity in a telephone pole.
Source: National Institute for Urban Wildlife, Undated. *Wildlife conflicts? Wildlife Habitat Conservation Teacher's Pac Series.*

in the Yosemite region (California), seen in 1924. In developed areas, if a nesting hole is completed in house siding, the birds usually pull out some of the insulation from between the walls and lay their eggs in this space (San Julian *et al*, undated).

Besides drumming and drilling holes, a third activity of woodpeckers, that of feeding, may also cause damage to human dwellings. Woodpeckers habitually live an arboreal existence, searching vertical surfaces of tree trunks and branches for wood-boring beetles and other insects picked off the trees.^a

The beneficial activities of woodpeckers will not be covered in this report. However, it is important to note that woodpeckers consume large numbers of harmful insects, and thus are an important part of the ecosystem in managing insect populations. If house siding is infested with insects, woodpeckers can locate and take advantage of this food source. Thus, woodpeckers can be an *asset* by locating potentially house-damaging insects, allowing the homeowner to take corrective action. Rustic plywood siding of the reverse "board-and-batten" design often has small exposed gaps left during factory construction. Adult leaf cutter bees of the family *Megachilidae*, cluster flies, carpenter ants, and other insects lay eggs which develop into larvae and adults within the plywood (see Wilson *et al*, 1976; Patterson, 1985). Extensive drilling back and forth in horizontal rows on the side of a house probably is the result of a woodpecker removing such insects. In a shingled house, this damage often occurs through the thin end of a shingle just below the butt end of the overlapping shingle above (Department of the Interior, undated). (See Figure 4).

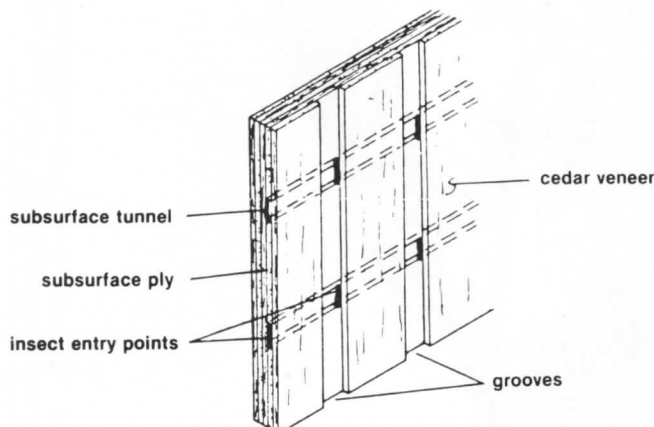


Figure 2. Plywood siding vulnerable to insect infestation. (*Lit. cit.*)

The acorn woodpecker of the Western U.S. excavates a series of small holes in trees and telephone poles in which to store individual acorns. These woodpeckers may also attack houses for storage repositories, returning weeks or months later to retrieve the stored acorns (Bent, 1939; Craven, 1981). Red-headed and red-bellied woodpeckers are also known to hoard food in times of plenty, and may deposit nuts and even insects in crevices of trees and man-made structures. This may lead to further excavation by the woodpecker when it returns later to retrieve its stores. (See Bent, 1939; Terres, 1979; Dennis, 1981).

There may be rough longitudinal gashes one to several inches long in the board or shingle siding, particularly around window frames where a bird probably defended its territory against the bird reflected in the window (Evans *et al*, 1984).

The brown-headed nuthatch (*Sitta pusilla*), not a woodpecker but an arboreal bird of Southeastern pine forests, has been reported to make holes in wood siding (Jackson, 1982).

Some ornithologists believe that disruption of native habitat increases competition among woodpeckers for territory. This leads to indiscriminate attacks on houses by individual birds. Man's construction activities in wooded areas crowd woodpecker populations into more and more confined areas. With fewer dead trees for nesting, roosting, and feeding, a wooden house would appear attractive to a displaced woodpecker.

On the other hand, Dennis (1964) reports that woodpeckers attack utility poles even where the habitat contains plenty of dead and dying trees. Woodpeckers seem to develop a fondness for a site. If your home has displaced the former territory of a woodpecker, the bird's behavior may be territorial. It will begin to drill what is (unfortunately) now in its previously-selected site -- your house. Dennis states that this strong "site tenacity" is inherent in all woodpeckers.

Dennis suggests further that woodpecker populations might increase where food and nesting conditions improve due to larger numbers of dead and dying trees in the habitat. Theoretically this could occur during construction activities in urbanized areas (if snags are left standing), and lead to increased attacks on houses because of the increase in the numbers of woodpeckers in the area.

^a Woodpeckers possess certain features that make them at home on tree surfaces, including (1) a strong "chisel-like" bill to hack into the bark and wood; (2) a thick skull which can withstand the pounding; (3) long, strong toes with curved nails that grab the bark; (4) stiff tail feathers which prop the birds while climbing or pounding; and (5) a very long, extensible tongue with a barbed tip for spearing insects. (Note: Some woodpeckers also eat nuts, seeds, berries, or sap, or feed on the ground or in the air.) (Terres, 1979).

CONTROL MEASURES FOR WOODPECKERS

According to Evans *et al* (1984), "At present, there is no known, practical, consistently effective technique for preventing woodpecker damage." Their survey of 68 houses damaged by woodpeckers in East Tennessee identified a number of characteristics of such damage, including:

- The majority of the houses were contemporary or ranch style, and were located in subdivisions.
- Ninety-four percent of all woodpecker problems occurred from February to May.
- The houses commonly had woods located within 0.50 miles of the house, with large, hardwood trees.
- Unpainted surfaces received more damage than painted surfaces.
- Surfaces that were brown or natural in color were most frequently damaged.
- Cedar was the wood species most often attacked.

Evans *et al* (1984) tested a mirror-type trap for woodpeckers in locations where territorial damage was occurring, but it did not work; tests of a magnifying mirror were inconclusive and need to be repeated. The use of artificial snakes and/or owls to repel woodpeckers did not stop their damaging activities, nor did hardware cloth nailed over the damaged site.

Other authors advocate using prompt action and a combination of methods to control woodpecker excavation and/or drumming activities. You may want to try some of the following suggestions if your house is under attack:

- Persistently shout at, chase away, bang pans at, and/or squirt with a garden hose, a woodpecker as soon as it starts to drill.
- Nail plywood over the excavation site(s).
- Cover the affected area with a sheet of plastic or with netting, and leave it in place through the fall.
- Hang aluminum foil or cloth streamers (3 feet long by several inches wide) at damage sites(s).
- Eliminate any ledges or cracks on which the woodpecker has a foothold while drilling.
- Discourage noisy drumming by removing object being drummed upon (if easy); or cover or wrap drumming site with padding.
- Provide an alternative drumming site nearby - e.g., two overlapping boards, the back one firmly secured and the front one fastened to it at one end, will resonate.
- Treat siding with pentachlorophenol (toxic wood preservative).
- Consider a non-wood siding if building a home in or near woods.
- On existing siding, in early summer fill every hole or gap with caulking.
- Do not offer suet or other attractants to woodpeckers in your yard.
- Unplug electrical appliances on the side of the house under attack; one hypothesis suggests woodpeckers mistake the buzzing noise for insects.
- As a last resort, obtain a permit from the regional office of the U.S. Fish and Wildlife Service to trap or

shoot an individual bird causing extreme damage. *Woodpeckers are protected by federal and state laws and cannot be killed without such a permit.* (Craven, 1981; Dennis, 1981; Department of the Interior, undated; Marsh, 1983; Massachusetts Audubon Society, 1979; Patterson, 1985).

If you succeed in ridding your house of a problem woodpecker, be sure to repair the damaged areas, or they may attract other woodpeckers, as well as insects and moisture.

A NEW CHEMICAL REPELLENT FOR WOODPECKERS

A review of the literature by Evans *et al* (1984) failed to find information on chemical materials repellent to woodpeckers. However, the Southwest Research Institute of San Antonio, Texas, has recently patented a chemical, "ST-138", which has been shown to repel woodpeckers and other birds from wood surfaces. When brush-painted or sprayed on wood surfaces, a solution of "ST-138" is apparently distasteful to woodpeckers, causing them to avoid treated areas. The repellent appears to be harmless to the birds. "ST-138" is not yet available to the public, pending a review by the U.S. Environmental Protection Agency. [On release for sale, "ST-138" will be marketed by the WPR Company, P.O. Box 31, El Campo, TX 77437, (409) 543-6271.]



Figure 3. The entrance hole to a pileated woodpecker roosting or nesting cavity is typically 4-5 inches (10-12.5 cm) in diameter, and tapers to a point. (Photo courtesy of Luther C. Goldman)

BIRDS THAT ATTACK WINDOWS

A bird may actively attack a window when it sees its reflection and believes a rival bird has entered its territory. The case of woodpeckers stripping wood from the framing of windows has already been mentioned. Cardinals (*Cardinalis cardinalis*) and mockingbirds (*Mimus polyglottus*) are also strongly territorial and may continue to fight their reflections day after day. Male cardinals have been seen to repeatedly fly against other reflective surfaces, such as an aluminum sliding board on a playground.

Songbirds may passively strike a window pane while flying, and be temporarily stunned, injured, or killed. This unfortunate event seems to occur because the bird has seen the reflection of trees or sky in the pane and has the illusion of space beyond the window. It may also occur when a hawk or some other predator appears suddenly and causes a bird or flock of birds to rush to escape. Collisions of migrating birds with glass windows of tall office buildings is a common occurrence and take a toll of bird populations each year.

To help prevent birds from flying into windows accidentally, the U.S. Fish and Wildlife Service has issued a hawk silhouette for use on large plate glass windows of homes and office buildings. Birds have a natural fear of raptors, and a "hawk silhouette" will frighten them away from areas where they may cause damage to themselves or property. A copy of the silhouette is included with this notebook. To use, cut out the silhouette and tape it to the inside of the window. Additional copies are available from the Publications Unit, Department of the Interior, U.S. Fish and Wildlife Service, Washington, D.C. 20240.

Windows where birds repeatedly attack their reflections can be temporarily darkened with pieces of cardboard or sprayed on the inside with an opaque window cleaner (Davis and Miller, 1983; Dennis, 1981; Department of the Interior, undated).

BIRDS THAT NEST IN OUR HOUSES

Homes built with unboxed eaves, widely louvered air vents, unshielded circuit boxes and other "nooks and crannies" may be attractive to pest birds like starlings (*Sturnus vulgaris*) and house sparrows (*Passer domesticus*) for nest building. Starlings in particular compete with more desirable cavity-nesting birds for nest sites. They can be partially controlled in urban areas by denying them access to breeding spaces within your house. The house sparrow, while not a cavity-nester, will build under rooves and inside air vents and ducts. To prevent this, woven hardware cloth or poultry wire can be placed over openings. A 3/4-inch (1.9 cm) or smaller mesh will keep out starlings and house sparrows. Eaves should be boxed in. Starlings and house sparrows are *not* protected by law in the U.S., and nests and eggs may be destroyed whenever they are located.

Chimney swifts (*Chaetura pelagica*) traditionally nested in hollow trees, but the chimneys of human dwellings provide ideal sites for nesting and roosting purposes. If

you have an unused chimney with no access to the house, you might welcome these visitors. Otherwise, the top of a chimney should be screened to keep out these and other birds. (Screening will also prohibit the entry of squirrels, bats, and raccoons). Be sure to wait until young birds are fledged to screen, but act by the start of the next nesting season (February). (Seater, 1975; Geis, 1976; Davis and Miller, 1983; Dennis, 1981).

BIRDS THAT ATTACK PEOPLE

It is unnerving to be dive-bombed by a territorial bird in one's own backyard, or while on a jogging trail. This uncommon event during the spring/summer breeding season is a temporary problem. It is unlikely the bird can hurt you, and the behavior will stop once the nesting season is over.

CONCLUSIONS

When humans and birds share the same habitat, conflicts may arise. Noisy woodpeckers proclaiming territory are tolerable. Woodpeckers excavating holes in human dwellings are not. A variety of methods should be tried in a persistent manner to discourage a destructive bird.

Birds that actively or passively attack windows are more easily managed, as are those that might gain access to air vents, chimneys, and other spaces available in your house. Tolerance may be necessary in some instances.

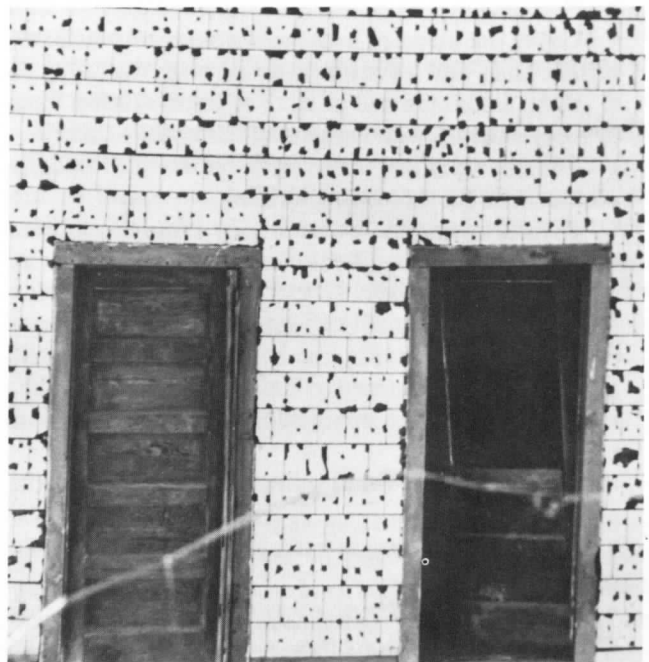


Figure 4. This abandoned house shows the cumulative effects of woodpeckers drilling for insect prey beneath the (asphalt) shingles. Note that the overlap of the shingles concentrates the food at a particular level. (Photo courtesy of Larry W. VanDruff).

TABLE 1. LIST OF WOODPECKER SPECIES OF THE U.S.

[Common and scientific names from the 6th edition of American Ornithologists' Union's *Check-list of North American Birds* (1983)]

Lewis' Woodpecker	<i>Melanerpes lewis</i>
*Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>
*Acorn woodpecker	<i>Melanerpes formicivorus</i>
Gila woodpecker	<i>Melanerpes uropygialis</i>
*Golden-fronted woodpecker	<i>Melanerpes aurifrons</i>
*Red-bellied woodpecker	<i>Melanerpes carolinus</i>
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>
Red-breasted sapsucker	<i>Sphyrapicus ruber</i>
Williamson's sapsucker	<i>Sphyrapicus thryoides</i>
*Ladder-backed woodpecker	<i>Picoides scalaris</i>
Nuttall's woodpecker	<i>Picoides nuttallii</i>
*Downy woodpecker	<i>Picoides pubescens</i>
*Hairy woodpecker	<i>Picoides villosus</i>
Strickland's woodpecker	<i>Picoides stricklandi</i>
Red-cockaded woodpecker	<i>Picoides borealis</i>
White-headed woodpecker	<i>Picoides albolarvatus</i>
Three-toed woodpecker	<i>Picoides tridactylus</i>
Black-backed woodpecker	<i>Picoides arcticus</i>
*Northern flicker	<i>Colaptes auratus</i>
*Pileated woodpecker	<i>Dryocopus pileatus</i>
**Ivory-billed woodpecker	<i>Campephilus principalis</i>

*Known to attack man-made structures

**May be extinct

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NOTES:

URBAN WILDLIFE MANAGER'S NOTEBOOK -- 8

A Guide To Developing An Urban Wildlife Library

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ISSN 0882-584X

INTRODUCTION

Recently, a university student in wildlife management asked the Institute for guidance in starting a personal library on urban wildlife. It was a challenge to respond to his request. Despite the rapid growth of interest in recent years in urban wildlife among students and the general population, there are no textbooks that deal exclusively with urban wildlife. Research reports in the scientific literature are few and scattered. (There is only one journal devoted exclusively to urban ecology). In responding to the student, we steered him to various sources to start his collection of urban wildlife materials. Information is located in reference and semi-technical books, in popular books, in the publications of this Institute, in the serial literature, in government reports, in newsletters and informational leaflets of state fish and game agencies, in publications of international, national and local conservation organizations, and in newspapers that report on conservation issues.

We hope that in publishing the basic "Urban Wildlife Library" suggested to our correspondent, somewhat expanded below, we will help other students and interested conservationists who wish to begin a small library of their own. With a few exceptions, we have limited our recommendations to books that are still in print (as determined by checking the current edition of *Books in Print* - see Reference 1). Criteria for listing reports, newsletters, leaflets and other softbound items were that they be readily available to the public, usually at little or no cost. In addition, we have listed a number of indexing/abstracting references that can be consulted in a good public or university library, to help locate new publications on urban wildlife as they appear.

We would like to hear from readers who wish to recommend publications that have been omitted here. In the near future, perhaps the field of urban wildlife will have grown so rapidly that, in updating this list, we would be obliged to choose from an excess of available titles. For those of us who place a high value on learning about urban wildlife, this would not be a hardship.

I. REFERENCE BOOKS

"The Top Three"

There is a place in most home libraries for both reference books and books of general interest. It has been suggested that any basic home library should have 3 reference books -- a dictionary, an atlas, and a one-volume encyclopedia (2). We suggest that a basic *urban wildlife home library* should include 3 types of references also -- a book on wildlife management, such as The Wildlife Society's *Wildlife Conservation: Principles and Practices* (3), or *Wildlife Management Techniques Manual* (4); several field guides, such as a *A Field Guide to the Birds: A Completely New Guide to All the Birds of Eastern and Central North America* (5); *A Field Guide to Reptiles and Amphibians of Eastern and Central North America* (6); *A Field Guide to the Mammals* (7); *Butterflies and Moths: A Guide to the more Common American Species* (8), (see also references 9-13); and the accumulated references to urban wildlife through 1979, available in *An Annotated Bibliography on Planning and Management for Urban-Suburban Wildlife* (14).



Photo: W.F. Dove

References on Ecology

The application of ecological principles in the planning and management of urban areas needs to be expanded. There are a number of references on ecology from which to choose one or more titles for your library:

- Fundamentals of Ecology* (15)
- Nature in the Urban Landscape: A Study of City Ecosystems* (16)
- A Reference Book of Urban Ecology* (17)
- Urban Ecology* (18)
- Urban Ecology: The Second European Ecological Symposium* (19)
- Urban Ecology: A Teachers' Resource Book* (20)
- Wildlife Ecology and Management* (21)

References on Birds

Since birds are the most readily observed form of urban wildlife, you may quickly find your library weighted in their favor. Nonetheless, there are several excellent references on birds that would enhance any collection:

- AOU's Check-list of North American Birds, 6th ed.* (22)
- The Audubon Society Encyclopedia of North American Birds* (23)
- Bent's Life Histories of North American Birds* (in 17 volumes) (24)
- The Life of Birds* (25)
- Nest Building and Bird Behavior* (26)
- Ornithology in Laboratory and Field* (27)

References on Mammals

General References:

- Mammalogy* (28)
- Mammals of the Eastern United States* (29)
- Wild Mammals of North America: Biology, Management and Economics* (30)

References on specific mammals:

- Eastern Chipmunks: Secrets of Their Solitary Lives* (31)
- Just Bats* (32)
- White-Tailed Deer: Ecology and Management* (33)

References on Herpetiles

- Amphibians and Reptiles of California* (34)
- Amphibians and Reptiles of New England: Habitats and Natural History* (35)
- Introduction to Herpetology* (36)

References on Insects

- Insect Life: A Field Entomology Manual for the Amateur Naturalist* (37)
- Perspectives in Urban Entomology* (38)
- Urban Entomology, Interdisciplinary Perspectives* (39)

References on Wildlife Habitat

We include the following references on plants because an urban wildlife biologist must be concerned with plants and other habitat components:

- American Wildlife and Plants: A Guide to Wildlife Food Habits* (40)

Checklist of North American Plants for Wildlife Biologists (41)

Landscaping with Native Plants in the Middle-Atlantic Region (42)

Natural Landscaping: Designing with Native Plant Communities (43)

Suburban Wildflowers: An Introduction to the Common Wildflowers of Your Back Yard and Local Park (44)

Trees, Shrubs and Vines for Attracting Birds: A Manual for the Northeast (45)

References on Urban Design

Granite Gardens: Urban Nature and Human Design (46)

Nature in Cities: The Natural Environment in the Design and Development of Urban Green Space (47)

NIUW PUBLICATIONS

The following publications of the National Institute for Urban Wildlife are recommended for an urban wildlife library. A complete list of publications of the Institute is available upon request.

An Annotated Bibliography on Planning and Management for Urban-Suburban Wildlife (14) has already been listed as one of the "top three" references for the library. The Bibliography provides annotations for almost 500 references that discuss the effects of urbanization on urban wildlife resources. It also provides background information for planning and managing those resources.

A Guide to Urban Wildlife Management (48) was written as a primer for managing wildlife in urban and suburban areas, of use to interested citizens, youths and community leaders. It provides an understanding and appreciation of urban fish and wildlife values, and offers suggestions to enhance habitats for urban species.

Planning for Wildlife in Cities and Suburbs (49) is a manual written for both wildlife managers and community planners. Several chapters are devoted to a discussion of the nature of urban wildlife management. The remainder of the manual provides practical guidelines for incorporating ecological considerations into the planning process.

Planning for Urban Fishing and Waterfront Recreation (50) is a companion manual to *Planning for Wildlife in Cities and Suburbs*. Following a discussion of the nature of aquatic organisms and habitats, the guide presents ways in which fish and other aquatic resources can be promoted in plans for urban and urbanizing areas.

Urban Wetlands for Stormwater Control and Wildlife Enhancement (51) is based on field research conducted by NIUW on urban stormwater control impoundments. The text covers the new concept of designing and constructing man-made wetlands for at least 3 purposes -- those of stormwater control, water quality improvement, and wildlife habitat enhancement.

The *Urban Wildlife News* (52) is a quarterly newsletter that has been published since 1976, and is currently distributed nationally and internationally to the members of NIUW and others interested in urban wildlife planning and management. The *News* serves as a clearing-

house for current urban wildlife research activities, coordinates recent information on nongame and urban wildlife management, and lists publications and meetings of interest to conservationists.

The *Urban Wildlife Manager's Notebook* (53) is a series of informational leaflets published quarterly since 1983 as a supplement to *Urban Wildlife News*. A single topic is explored in depth in each issue. To date, the titles in the Notebook series include: *A wildlife plan for small properties*, *A simple backyard pond*, *Feeding birds in winter*, *Housing for nesting birds*, *Natural landscaping--meadows*, *Reptiles and amphibians*, *Birds that attack houses*, and the current notebook on *How to start an urban wildlife library*.

Wildlife Habitat Conservation Teacher's Pac Series (An Environmental Education Teaching Aid). Ten titles are currently available in a series for educators targeted at the 4th through 7th grade level student. Each "Pac" contains a two-sided colored poster, lesson plans, student activity pages, a teacher overview, and a sturdy folder. A summary of those Pacs particularly concerned with urban areas, follows. A complete list and description of the ten Pacs in this series can be obtained from the Institute.

Urban Areas - People are part of nature and need nature around them, even in modern cities. A surprising variety of wildlife is supported by urban habitats. Students observe wildlife in the city, examine the effects of pollution on wildlife and human environments, and develop a management plan to encourage urban wildlife. (54)

Wildlife Conflicts? - A variety of conflicts can occur between wildlife and people. Proper management can reduce or avoid some conflicts in both urban and non-urban settings. Students learn to collect facts and develop a management plan for a wildlife conflict. Associations between specific conflicts and habitats are emphasized. (55)

SEMI-TECHNICAL AND POPULAR BOOKS

The following are generally attractive, illustrated books with a good deal of practical "how-to" information for nature conservationists. They are written in a semi-technical or popular style with few or no references.

- Alligators, Raccoons, and Other Survivors - The Wildlife of the Future* (56)
- After Man: A Zoology of the Future* (57)
- America's Favorite Backyard Birds* (58)
- America's Favorite Backyard Wildlife* (59)
- The Animals Among Us: Wildlife in the City* (60)
- The Backyard Bestiary* (61)
- The Backyard Bird Watcher* (62)
- Backyard Birddom* (63)
- Beyond the Bird Feeder* (64)
- The Bluebird - How You Can Help Its Fight for Survival* (65)
- City and Suburb: Exploring an Ecosystem* (66)

- Complete Guide to Bird Feeding* (67)
- A Concrete Look at Nature: Central Park (and Other Glimpses)* (68)
- The Endless Village* (69)
- Familiar Garden Birds of America* (70)
- Field Guide to Your Own Back Yard* (71)
- Habitat Guide to Birding* (72)
- How to Make a Wildlife Garden* (73)
- Natural History of New York City* (74)
- Song and Garden Birds of North America* (75)
- Suburban Wildlife* (76)
- Wildlife Begins at Home* (77)
- Wildlife in the City: A Study of Practical Conservation Projects* (78)
- Wildlife in Towns: A Teachers' Guide* (79)
- Wildness is All Around Us: Notes of an Urban Naturalist* (80)
- Zoobooks 2: City Animals* (81)

SYMPOSIA PROCEEDINGS

Wildlife conferences that give attention to the topic of urban wildlife are infrequent. However, the following proceedings, transactions or minutes have reported the results of the major urban wildlife conferences in N.A. and are therefore valuable to an urban wildlife library. Unfortunately, four of the proceedings are out of print. Facsimiles of out-of-print books may be obtained from University Microfilms International (82), although they may be quite costly. Out-of-print books may also be searched for in the listings in *AB Bookman's Weekly* (83).

If the proceedings can be located in a university or other library, the information can be abstracted onto index cards (5" X 8" is a good size), and the cards filed as part of your library collection. Be sure to get a complete citation of the author, date, title, title of proceedings, and page numbers, for any article abstracted.

Information on obtaining the proceedings still in-print is given in the bibliography, and a complete citation for all of the proceedings also appears in the bibliography.

(Note: The National Institute for Urban Wildlife will present a "National Symposium on Urban Wildlife", November 4-7, 1986, and expects to publish the proceedings from the symposium.)

- **Man and Nature in the City, Proceedings of a Symposium* (84)
- North American Wildlife and Natural Resources Conferences, Transactions of* (85)
- Urban Fishing Symposium Proceedings* (86)
- Urban Wildlife Open Exchange Meeting, Minutes of* (87)
- **Wildlife and People, Proceedings* (88)
- **Wildlife in an Urbanizing Environment, a Symposium on* (89)
- **Wildlife in Urban Canada, Proceedings of a Symposium* (90)
- See also: *Urban Ecology: The Second European Ecological Symposium* (19)
- *Out-of-print

DISSERTATIONS

Much of the current research on urban wildlife is being conducted by graduate students at major universities. The following indices list many of the doctoral dissertations accepted by universities in the U.S., and one of them should be available in the reference section of a public library.

- American Doctoral Dissertations* (91)
- Comprehensive Dissertation Index* (92)
- Dissertation Abstracts International* (93)

In addition, some doctoral dissertations in wildlife studies are listed in the quarterly indexing service, *Wildlife Review* (94). *Dissertation Abstracts International* (93) has a limited list of foreign dissertations. Microfilm copies of Canadian dissertations (since 1960) can be obtained from the National Library of Canada (95), where copies of all Canadian dissertations are deposited. For other suggestions for locating foreign dissertation titles, see the discussion on "Wildlife Management Literature" in *Wildlife Management Techniques Manual* (4).

It is more difficult to identify urban wildlife-related Masters' theses, since the indexing service, *Masters Abstracts* (96) lists few theses in wildlife studies. Except for those that are listed in *Wildlife Review* (94), there are no published lists of wildlife-related Masters' theses.

To examine a dissertation or thesis, ask your librarian to submit an Interlibrary Loan Request to the library of the university where the degree was earned. Not all libraries will allow dissertations to circulate. University Microfilms International (82) will print by microfilm/xerography authorized facsimiles of dissertations; write for more information if you wish to purchase a copy of a dissertation.

BUILDING A REPRINT FILE

The Serial (Periodical) Literature

In order to satisfy the need to remain current, much of the literature in all scientific disciplines is *serial* in format. Serials are defined as publications listed in successive parts and intended to continue indefinitely (97). To aid the biologist in quickly screening the periodical literature, single-reference serials are available that index and abstract a large number of wildlife-related publications. Among these single references are the following:

- Biological Abstracts* - Twice Monthly.
(References, abstracts and indexes to the world's life sciences research literature.) (98)
- Chemical Abstracts* - Fortnightly. (One of largest abstracting services in the world.) (See Biochemical sections). (99)
- Current Contents/Life Sciences* - Weekly.
(Reproduces the contents pages of over 1100 journals and 900 books). (100)
- Environmental Periodicals Bibliography* - Bi-monthly.
(A current awareness bibliography featuring serial publications in the area of environmental studies). (101)

- Forestry Abstracts* - Monthly.
(Compiled from world literature). (102)
- Wildlife Review* - Quarterly.

(An indexing and abstracting publication of wildlife literature; cumulative index contained in *Wildlife Abstracts*, generally published every 5 years). (94)

By searching one or more of these indexing/abstracting references regularly, in a university or other research library, one can stay abreast of much of the literature on urban wildlife. There are thousands of biological serials worldwide. No library can contain them all, nor can any single index. Consult an indexing/abstracting reference that lists the contents of these leading wildlife journals: *Journal of Wildlife Management* (103), *Urban Ecology* (104), and *Journal of Environmental Management* (105), among others. Dorney (106) has reviewed these three journals for the ten-year period, 1975-1985, and found that about 3% of the articles referred to urban wildlife. As more research is carried out in this area, the literature on urban wildlife should become more abundant.

Once you have located relevant published articles, a reprint of the report may be requested from the author, if his/her address is known; from the organization with which the author is associated; or from the journal which published the material. A request on a post card often brings a complimentary copy of the material within a short time.

If you can locate the periodical in a library, and the journal lists no restrictions against photocopying material, you can obtain a copy directly. If photocopying is restricted, you can abstract information from the report onto 5" X 8" cards and file the cards in your library. (Be sure to get a complete citation of the author, title, journal, volume, number, and page numbers, for any article copied or abstracted.)

The following reference index lists over 60,000 periodicals of all kinds published throughout the world. Entries are arranged by subject. Consult "biology"; "environmental studies"; "forests and forestry"; and "water resources" to locate current periodicals that are concerned with wildlife.

- Ulrich's International Periodicals Directory* (107)

U.S. GOVERNMENT PUBLICATIONS

The results of research sponsored by the U.S. Government are often published as reports by the U.S. Government Printing Office. These reports may be available directly from the sponsoring agency. Otherwise, the National Technical Information Service (NTIS), within the U.S. Department of Commerce, sells government reports in paper copy or microfiche to individuals. To obtain information about NTIS sales, call 703-487-4600, or write NTIS, 5285 Port Royal Road, Springfield, VA 22161.

To keep informed about new U.S. Government publications that you may wish to add to your library, consult the following indices in a reference library:

Government Reference Books: A Biennial Guide (108)
Monthly Catalog of United States Government Publications (109)

NTIS Abstract Newsletters: Natural Resources and Earth Sciences (110)

NTIS Government Reports: Announcements and Index (111)

The following U.S. Government publications are currently in print and may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20401 (see complete citation for stock number and cost):

Fifty Birds of Town and City (112)

Homes for birds (113)

House Bat Management (114)

Invite birds into your home (115)

STATE AGENCY PUBLICATIONS

Surveys in both the U.S. and Canada have shown high public interest in nonconsumptive wildlife activities, like bird watching and bird feeding. More than 30 states now have nongame wildlife programs in place funded by public donations, most commonly through state income tax "check-offs", and a few states have urban wildlife programs. A number of public wildlife agencies have responded to this interest by using the new revenue to publish booklets, informational leaflets, and newsletters that provide information on the nongame and urban wildlife species seen by the public.

To obtain those publications available through your state agency, contact your state nongame or urban biologist. A complete list of addresses of all state fish and wildlife agencies appears in the National Wildlife Federation's annual *Conservation Directory* (116).

See also the index, *Monthly Checklist of State Publications* (117) in a reference library.

AREA AND REGIONAL GUIDES

In addition to field guides (see 5-13), there are many regional and local guides that may be of interest. Check bookstores in your area for titles. Bird clubs and other conservation groups sometimes sell regional guides. You may also find such material displayed at nature centers, zoos, university bookstores, and historical sites. Your state fish and wildlife agency may also publish regional brochures. The following is only a sampling of what is available:

Attracting birds in the Maryland Piedmont (118)

Enjoying Birds around New York City (119)

Finding Birds in the National Capital Area (120)

Mammals of the San Francisco Bay Region (121)

The New York City Wildlife Guide (122)

See also: (34), (35), (74)

PUBLICATIONS OF PRIVATE CONSERVATION ORGANIZATIONS

The following publications are pertinent to an urban wildlife library. Contact the appropriate organization for more information.

The American Forestry Association. *National Urban and Community Forestry Forum*. 1319 18th Street, N.W., Washington, D.C. 20036. (Bi-monthly).

The Audubon Society of Portland. *The Urban Naturalist*. 5151 N.W. Cornell Road, Portland, OR 97210. (Quarterly for members).

Human Dimensions in Wildlife Study Group. *Human Dimensions in Wildlife Newsletter*. c/o Dr. Perry Brown, Resources Recreation Management, Oregon State University, Corvallis, OR 97331. (Quarterly).

Laboratory of Ornithology, Cornell University. *The Living Bird Quarterly*. P.O. Box 223, Ithaca, NY 14850. (For members).

National Institute for Urban Wildlife. *Urban Wildlife News* and *Urban Wildlife Manager's Notebook*. 10921 Trotting Ridge Way, Columbia, MD 21044. (Quarterly for members, \$15.00 annually).

National Wildlife Federation, 1412 16th Street, N.W., Washington, D.C. 20036, has the following publications available:

Backyard Wildlife Habitat Program Kit.

Thomas, J.W., R.O. Brush and R.M. DeGraaf. 1973. Rev. 1983. by C. Tufts. *Invite wildlife to your backyard*. (No cost for single copies).

Short Takes. Wildlife and nature facts and fillers. (Monthly).

Nature Conservancy Council of Great Britain. *Urban Wildlife News*. Northminster House, Peterborough PE1 1UA, England. (Quarterly).

Nongame Wildlife Association of North America. *Nongame Newsletter*. c/o C.N. Becker, Natural Heritage Section, Department of Conservation, 600 N. Grand Avenue West, Springfield, IL 62706. (Quarterly).

The Peregrine Fund, Inc. *Peregrine Fund Newsletter*. c/o 159 Sapsucker Woods Road, Ithaca, NY 14850.

The Urban Wildlife Group. *Urban Wildlife Group Newsletter*. 11 Albert Street, Birmingham B4 7UA, England. (Bi-monthly).

Wildlife Management Institute. *Outdoor News Bulletin*. Suite 725, 1101-14th Street, N.W., Washington, D.C. 20005. (Biweekly newsletter for members).

The Wildlife Society. *The Wildlifer* (bi-monthly newsletter), and the *Wildlife Society Bulletin* (quarterly journal). Available with membership. 5410 Grosvenor Lane, Bethesda, MD 20814. See also (103), *Journal of Wildlife Management*.

The Xerces Society. *ATALA* (journal) and *Wings* (newsletter). (Publications concerning butterflies and other invertebrates). 10 SW Ash Street, Portland, OR 97204.

SEMI-POPULAR MAGAZINES

The following science-oriented magazines have, from time to time, printed articles with an urban wildlife theme. While not generally available on newsstands, they may be found in the periodical section of a library, or subscribed to directly.

Audubon - Bi-monthly.

(National Audubon Society, 950 Third Avenue, New York, NY 10022).

National Wildlife and International Wildlife - Both, bi-monthly.

(National Wildlife Federation; 1412 16th Street, N.W., Washington, D.C. 20036).

Natural History - 10 issues per year.

(American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024).

Smithsonian - Monthly.

(Smithsonian Institution, Membership Data Center, P.O. Box 2953, Boulder, CO 80321).

Science News - Weekly.

(Science Service, Inc., Subscription Department, 231 West Center Street, Marion OH 43305).

VERTICAL FILE: NEWS CLIPPINGS, PAMPHLETS, BULLETINS, ETC.

A large city newspaper may have a conservation editor to report on environmental topics, and many newspapers carry syndicated science articles. Clip material about urban wildlife situations for your library, filing them in manila folders in a "vertical file." This file is also convenient to place the various paperbound leaflets, booklets, brochures, pamphlets, tearsheets, bulletins, reprints, and similar items, in folders under appropriate subject headings. To begin, choose broad subject headings for your files, such as "Urban Wildlife Management", and "Backyard Habitat." As your collection grows, major subjects can be subdivided into more specific sub-headings. If you need help with subject headings, the Library of Congress has prepared a subject heading list (123). Also, study the subject index in a wildlife indexing/abstracting journal, such as *Wildlife Review* (94), and consult the article by Yeager (1940), "Subjects for filing wildlife literature" (124).

The *New York Times Index* (125) is available on microfilm in many libraries. News articles can sometimes be copied off the microfilm reader. The following major urban wildlife news story appeared in the *Times* several years ago:

Wildlife returning to parts of urban America (126)

The following index lists selected materials such as pamphlets and leaflets that are appropriate for a "vertical file", and may be in the reference section of a public library:

Vertical File Index (127)

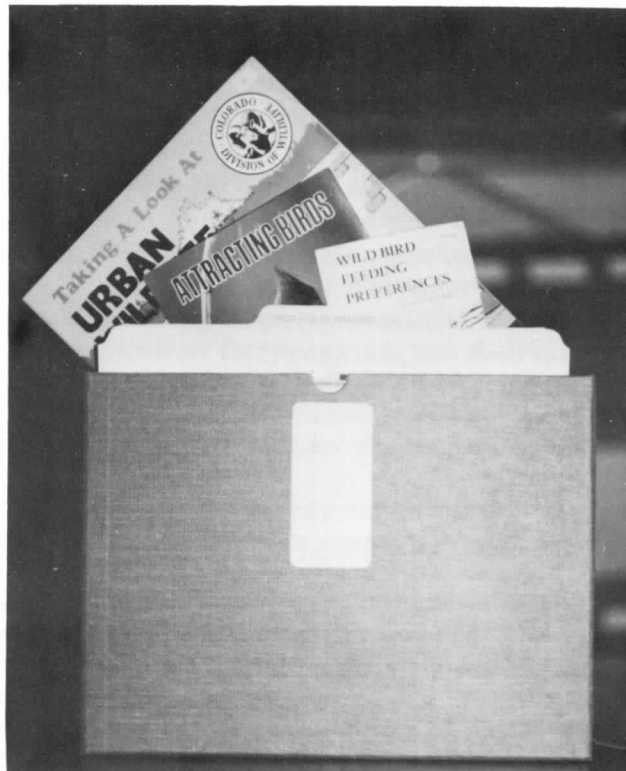


Photo: G.E. Jones

ORGANIZING YOUR LIBRARY

A well-organized collection can help you find information quickly and thoroughly. For more information on organizing and cataloguing your library materials, consult the book, "How to Organize and Operate a Small Library" (128), and the U.S. Fish and Wildlife Service publication, "The small office library: some easy ways to organize one." (129)

For a further discussion of the library source materials available to the wildlife management profession, see Chapter Two, "Wildlife Management Literature", and Chapter Three, "Developing and Maintaining a Small Personal Reprint Library", in the *Wildlife Management Techniques Manual* (4).

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NOTES:

URBAN WILDLIFE MANAGER'S NOTEBOOK -- 9

Brushpiles and Rockpiles: Small Habitats for Backyard Wildlife

Louise E. Dove, Wildlife Biologist

ISSN 0882-584X

One of the most effective ways of attracting more wildlife to your backyard is to increase the number of man-made shelters in the area. Cover and a place to raise young are two of the four requirements of wildlife (the other two being food and water). Many natural shelters are ideally provided by trees, shrubs and vines -- the vegetation that grows on your property. However, vegetation may be sparse or not yet established or you may wish to augment the plantings, hoping to attract ground-nesting birds, reptiles and amphibians, and small mammals. Two additional types of habitat can be added with very little effort. Brushpiles and rockpiles can be created largely from material collected during yard clean-ups, and when trees and shrubs are pruned, to create cover beneficial to many backyard wildlife species. Spaces in and under the piles of branches and rocks create small habitats where animals can escape the weather and predators, and can rest and raise their young.

BRUSHPILES

Wildlife managers have traditionally recommended brushpiles to increase the numbers of upland game species,

such as cottontail rabbits and bobwhite quail. Because many species of nongame animals also use brushpiles, their use in urban and suburban yards where space permits is an effective management tool.

In winter, a brushpile may provide cover for sparrows, cottontail rabbits and shrews, and, if the base underneath contains substantial limbs or logs, cover for hibernating salamanders and wood-boring insects. In summer, the same brushpile will be a cool retreat and a nesting site for a similar variety of animals. If the brushpile can be located near or adjacent to other cover, "travel lanes" from place to place will benefit the more secretive animals like reptiles, amphibians, and mammals. Fence corners, woodland borders, meadow edges, or other sites, if available, are ideal locations for brushpiles.

The brushpile can be constructed in one of several ways, depending on the space and materials available. (1) Form a base of two to five layers, each layer at right angles to the next. Use several logs or sturdy limbs in each layer and space the logs 6 inches (15.2 cm) apart within a layer. Small limbs and branches are then added over the base, with the butt end (the thickest end, usually the cut end) in the center of the brushpile, and the branch tip

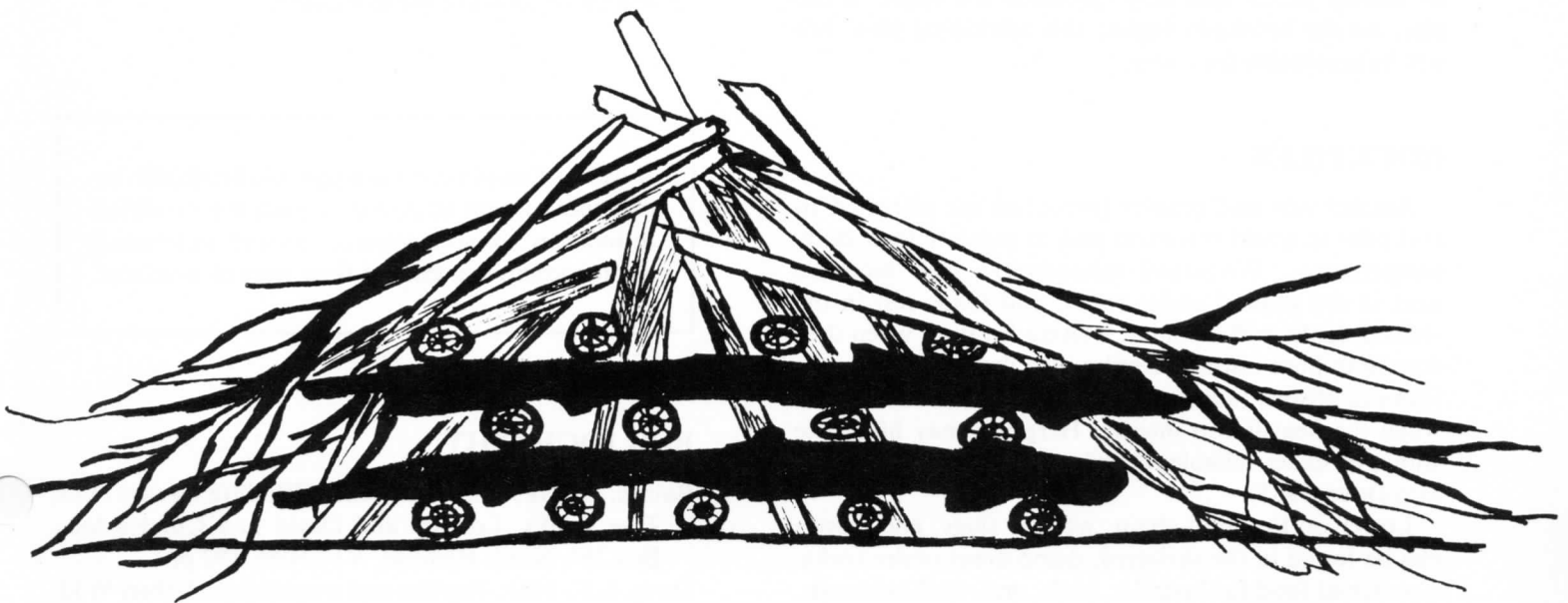


Figure 1. Cross-section of a well-constructed brushpile, showing a base of 5 layers, and limbs added over the base, tips pointing down. (Sketch: E.S. Dove)

pointing down and/or touching the ground. Continue adding branches completely around the base. This provides a mound or teepee-shaped pile that is dense in the middle, but has some access openings at the edges for wildlife (see Figure 1). As the logs on the ground decay, the next layer moves down to take their place. More branches can be added from time to time, making the brushpile part of your permanent backyard wildlife habitat. (2) Another plan for a base is to bring the butt ends of four trees together, 90° to each other, allowing the tree canopies to form an outer circle. Discarded Christmas trees might be collected from neighbors to form this base. Limbs and branches are then added over the base, as already described. (3) A "living" brushpile can be created by cutting the trunk of a live tree *part-way through*, about 2 feet (61 cm) above the ground, and then pushing the tree over. A "hinge" of living trunk remains attached to the stump, and keeps the tree alive enough to produce some leaves each year. Maple trees (*Acer* spp.) work well to provide a long-lasting live base. Cut branches are added, as above, butt against the base tree, and branch tips pointing downward. (4) Temporary brush shelters can be created each winter by "recycling" Christmas trees for a few months. Tie the discarded evergreen upright to the trunk of a living tree, or to a clothesline pole, to provide cover for birds well into the spring.

Studies show that a brushpile 3 to 5 feet (90 to 150 cm) high is optimal for wildlife, although the shape does not have to be circular. A smaller brushpile is probably more reasonable for urban/suburban gardens. To attract wildlife, be sure the pile is dense but not tightly packed, with interior spaces and some access holes at the base.

Vines can be planted to trail over the brushpile, making it more aesthetic and adding density to the pile. Virginia creeper (*Parthenocissus quinquefolia*), bittersweet (*Celastrus scandens*) and wild grape (*Vitis* spp.) all have fruits with food value to wildlife. In time, grasses and other herbaceous vegetation, including wildflowers, will volunteer in and around brushpiles, and birds will drop seeds of woody plants that may sprout at the edges of the pile. As the brushpile settles, this additional plant life will be invaluable for cover.

ROCKPILES

Amphibians and reptiles (herptiles) are attracted to rockpiles to avoid predators and to regulate their body temperatures. Woodland salamanders seek moisture next to the ground under rocks, and toads rest in the shaded nooks and crannies, waiting for dark when they emerge to hunt insects. Reptiles, like lizards, bask on the rocks to absorb radiated heat, but move out of the sun when the heat is too intense. Herptiles may hibernate within or under suitable rockpiles in colder climates. (See also Dove, 1985).

Lower on the food chain, worms, slugs, and insects can be found in the sheltered, damp areas under rocks, a source of food for herptiles, birds, and small mammals.

Chipmunks typically occur around rockpiles and stone walls, and under tree stumps, although these areas may

or may not be the location of their underground burrows where they spend much of their time. To attract chipmunks, stones of various sizes should be fitted together so the pile does not collapse, but does provide some interior spaces for these small mammals. Baines (1985) describes the construction of a dry-stone and earth bank that will provide a variety of small habitats for plants and insects and, presumably, for small vertebrate animals as well. Stones are stacked randomly into a two-sided wall that has a space between the sides. Layers of soil are added in and around the wall, with small gaps left between the stones, and larger spaces left in the center. Wildflowers and native ferns (if the site is shady) can be sown in the wall.

Rockpiles placed near underbrush or openings in wooded areas tend to attract chipmunks, if there are also nut-, seed-, and berry-producing plants in the area. Chipmunks are inveterate year-round hoarders of seeds and mast in their burrows.

In natural settings, rockpiles surrounded by shrubs are used by cottontail rabbits for protective cover. Wildlife managers who wish to create rabbit habitat are urged to choose rocks 5 inches (13 cm) and larger in diameter. This size rock will create spaces that accommodate rabbits.

Small insectivorous mammals like shrews are often numerous around moist rocky areas and in leaf litter, where insects like centipedes thrive. Shrews help to control insects, slugs, snails, and small herptiles. Shrews are prey for snakes, raptors, and larger mammals.

Kress (1986) recommends combining a rockpile and a brushpile to create a backyard wildlife shelter. For the base, three piles of rocks are laid out in a "V" formation, and covered first with large branches (stems toward the ground), followed by smaller branches. This design creates a mound or teepee similar to those already discussed. Ceramic drainage tiles also provide a good foundation for this combination-type shelter.

Activities of wildlife around brushpiles and rockpiles change with the seasons. This is part of the fascination of helping to conserve urban wildlife.

A word of caution: Before you add brushpiles or rockpiles to your backyard, consult the "codified ordinances" of your town or city and understand any restrictions that exist on these types of structures.

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NOTES:

URBAN WILDLIFE MANAGER'S NOTEBOOK - 10

Urban Insects I: Dragonflies and Damselflies in Your Backyard Pond

Louise E. Dove, Wildlife Biologist

ISSN 0882-584X

Butterflies and moths are perhaps the most aesthetically appealing insects encountered in urban situations, and they accomplish the pollination of many plants as they make the rounds of flower blossoms, gathering nectar.

The runners-up for most attractive insects would have to be dragonflies and damselflies. These predatory insects with bright metallic bodies and large gauzy wings may often be seen darting over ponds, lakes and streams in pursuit of prey. Their efficiency in preying upon mosquitoes makes them particularly desirable near our households. Homeowners with the space to install a backyard pond will probably be able to attract dragonflies, because they regularly fly long distances in search of desirable habitats. Damselflies are less powerful fliers, but if there are any closeby, they, too, may appear on such waters. If you do not have a pond or stream on your property, these insects can be seen and enjoyed in city parks and wild areas where year-round water provides habitat for their several life stages.

CHARACTERISTICS OF ADULTS

Dragonflies and damselflies are members of the Order Odonata, a term probably derived from the Greek word,

odon, (tooth), referring to the tooth- or tusk-like shape of their long, slender abdomens. Two suborders occur in the U.S. The Anisoptera, or dragonflies, are generally larger, thicker-bodied and more active flyers than the Zygoptera, or damselflies, which have very slender bodies and less flight agility. About 450 different species of Odonata occur in North America.

Flight

In flight, the wings of all Odonata are rigidly outstretched and when on the wing it may be difficult to distinguish damselflies from dragonflies. When at rest, however, dragonflies continue to hold their four wings in horizontal extension, whereas damselflies hold their four wings vertically over the abdomen, or partly spread over the body parallel to the abdomen. The wings in both groups are tapered and membranous and supported by a crisscrossing of veins made of chitin, a hard substance that also covers the body surface of insects. During flight the two pairs of wings work independently, the forewings moving upward while the hind wings are moving downward. These motions are timed so that the hind wings are not disturbed by turbulence from the forewings, and the flight is smooth and efficient. Besides moving up



Figure 1. Good urban habitat for dragonflies and damselflies. (Photo: L. W. Adams).

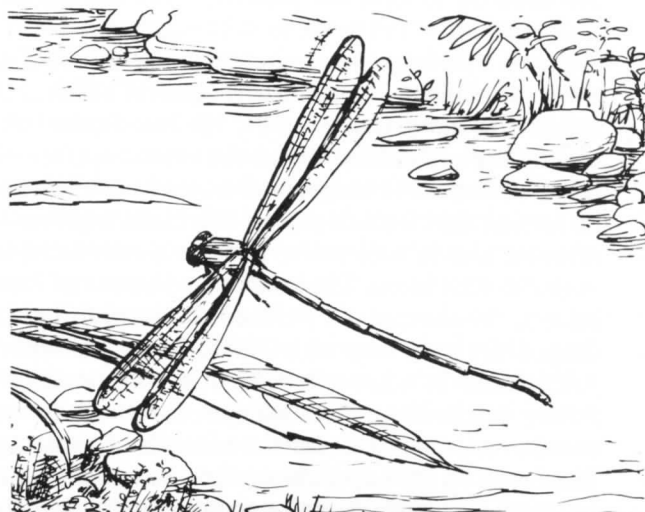


Figure 2. Damselfly over a pond. (From National Institute for Urban Wildlife's Wildlife Habitat Conservation Teacher's Pac Series: Rivers and Streams.)

and down, the wings also twist and bend and, taken together, these characteristics permit an infinite number of flight patterns as well as the ability to hover.

Flight muscles of Odonata contract and relax in response to nerve signals (as do vertebrate skeletal muscles), and are called synchronous. The wings of dragonflies have been measured to beat at frequencies of 35 cycles per second, slow compared to the honeybee which has asynchronous flight muscles (which contract and relax at a higher rate than the nerve signals received), and wings that beat at frequencies of more than 200 cycles per second (Smith, 1965).

Headstrom describes the feeding activities of dragonflies:

"...some of them -- the larger and stronger ones -- keep to the higher regions above the water, courting back and forth, passing and re-passing the same point at intervals of a few minutes, while the smaller species are less constantly on the wing, usually flying in short sallies from one resting place to another or hovering above the water before they alight...some of them appear to patrol a regular beat, stopping at the same places...darting here and there, now alighting on a water plant to rest a moment, now streaking off in pursuit of some other flying insect..."

Suburban Wildlife, 1984, p. 113

It is fairly easy to learn to distinguish the members of different families of dragonflies by their flight patterns. The darners (Family Aeschnidae) are large powerful flyers, and fly the highest. The gomphids (club-tails) of the Family Gomphidae make short looping flights between rests, and often stop on the ground. The most common, the skimmers (Family Libellulidae) engage in soaring flight, and hover over ponds, pools and lakes. Damselflies are such gentle fliers, their flight may be likened to that of butterflies in some cases. Most North American damselflies belong to the Family Coenagrionidae, or narrow-winged damselflies.

Vision

In keeping with their aerial skills, members of Odonata are believed to have the keenest vision among insects. This superiority lies in the greater number of facets that make up their large compound eyes. The six-sided facets are really miniature visual systems, each of which contains a lens and light-sensitive cells. No two facets point in exactly the same direction on the curved surface of the compound eye. The images received are from all directions, of varying light intensities, and they come together -- like separate tiles in a mosaic -- to form a complete picture in the insect's brain. The greater the number of facets in an eye, the sharper the picture is believed to be. Large dragonflies have eyes with 28,000 facets (compared to 4,000 facets in a housefly eye). It is of interest to note further details about Odonata eyes, for they help explain peculiarities about these insects' methods of hunting prey. The facets on the upper eye surface are larger than those on the lower surface, and are most useful for distant vision. Thus, dragonflies tend to approach insects, that are flying, from below -- presumably using the larger

facets on the upper eye surface to keep the prey in view. The smaller facets on the lower eye surface are probably more useful for near objects. Prey that is at rest and nearby by a passing dragonfly is likely to be captured by the dragonfly dropping down on it from above.

With excellent vision, dragonflies and damselflies have less need for antennae, and these sensory organs are reduced in size. Adult dragonflies have hearing organs on their antennae, and adults probably emit sounds by rubbing small projections behind the head against rough patches behind the eyes. The use of these sounds (if they exist) is not known. There are also sensory organs located on the head which keep the insects balanced in flight.

Feeding

Dragonflies and damselflies are daytime hunters and, being cold-blooded, prefer warm, sunny days. They fly with their six legs bent in front of them to form a "catching basket" for small flying insects. Their long spiny legs are also adapted for grasping a plant to rest. Prey is consumed in flight or while the insect is perched, using powerful biting and chewing mouth appendages. A dragonfly's preferred meal is a mosquito or a midge, while a damselfly prefers aphids. Wings and legs of the prey may be discarded as the food is cut and consumed in small pieces. Although most easily located around ponds and streams, dragonflies are known to hunt prey over land areas, swooping in close to grass and vegetation and beating their wings to flush out other insects (Breisch, personal communication, 1986).

Reproduction

Males of Odonata can be observed competing for territories at ponds and other spawning sites, returning day after day to the same areas, and actively driving off intruding males. Recent findings indicate that territoriality in dragonflies and damselflies is concerned with "mate guarding," a form of competition among males for the privilege of being the last male to mate with a female before she lays her eggs. Female dragonflies and damselflies may store sperm internally from a number of matings until the eggs are laid, at which time the most recently-deposited sperm are likely to be the most useful in fertilization. Thus, after mating with a female, the male attempts to guard her, driving off other males until egg-laying is accomplished. In some species, the male may continue to clasp the female, even going under water with her until she deposits her eggs. In some damselflies, a male may remove the sperm packets stored in the female before depositing his own. Observations by McMillan (1984) of *Plathemis* dragonflies during "mate guarding" showed that this activity is essential for both sexes to accomplish reproduction. A male has to guard to be sure of producing offspring, and a female needs protection from competing males to successfully deposit fertilized eggs.

Female dragonflies and damselflies may feed and roost in fields and yards a mile or more away from ponds, for days at a time. Infrequently, they arrive at a pond where

males hold territories, and are immediately pursued by a number of males. Even an aggressive male has difficulty keeping away the competition both before and after mating. About half the time, harassment of a female is so intense she cannot lay her eggs before another male has mated with her and she is being guarded anew. Observations of ponds where male density is low show that "guarding" is weaker during the egg-laying process. At ponds with high male density, females may allow multiple partners as an adaptation to finding a male that can guard well enough to allow her to lay all her eggs. (McMillan, 1984).

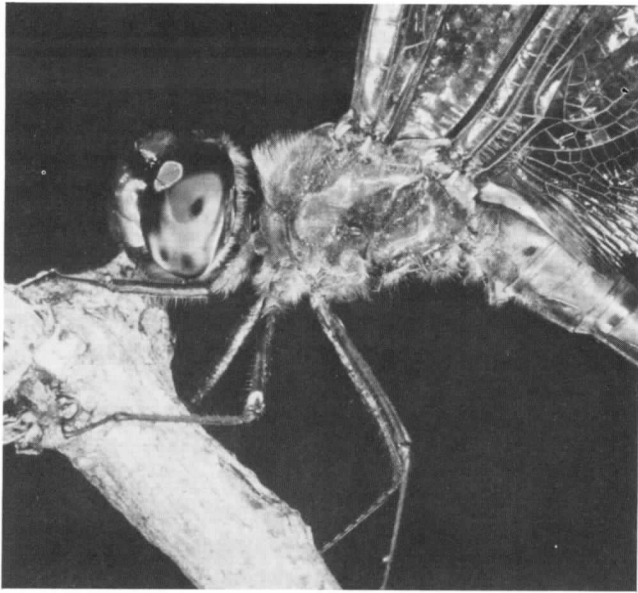


Figure 3. Adult dragonfly. (Photo: Entomological Society of America).

It is important that the adults choose a permanent body of water for the eggs, since the immature forms will spend the next one to four years entirely underwater before they are fully-developed adults. In urbanized areas, natural populations of aquatic insects such as dragonflies and damselflies are subject to loss or degradation of habitat. However, new habitats can also be created during urbanization, and urban stormwater ponds and backyard pools may be colonized by such insects. It is crucial to maintain a level of water year-round in ponds where adult populations have been active. The adult reproductive phase lasts only one season, and adults die off as cold weather arrives, except in those species of dragonflies that migrate, or hibernate. There are numerous studies in the scientific literature of migratory flights of dragonflies, and other types of insects (Johnson, 1963). Insects that migrate do so after emerging as adults, and before they begin to reproduce. A few species of Odonata hibernate during cold weather.

CHARACTERISTICS OF IMMATURE STAGES

Adult female dragonflies and damselflies deposit their fertilized eggs in one of several locations associated with ponds, lakes or other permanent waterbodies: (1) on the water surface; (2) in or on floating or submerged aquatic

plants; (3) in the stems of emergent aquatic plants; (4) in sand. Each species has a preferred location. Metamorphosis is incomplete; that is, there is a gradual change in the form of the insect as it develops from an egg into an adult. (In complete metamorphosis, there are four distinct stages, sometimes with dramatic changes in form as in the butterfly.)

Living submerged, at or near the bottom of the pond, the young dragonfly or damselfly nymph (naiad) goes through a series of growth stages, or molts, shedding its old skin up to 15 times. At each molt, the nymph emerges as a slightly larger version of itself. Close examination

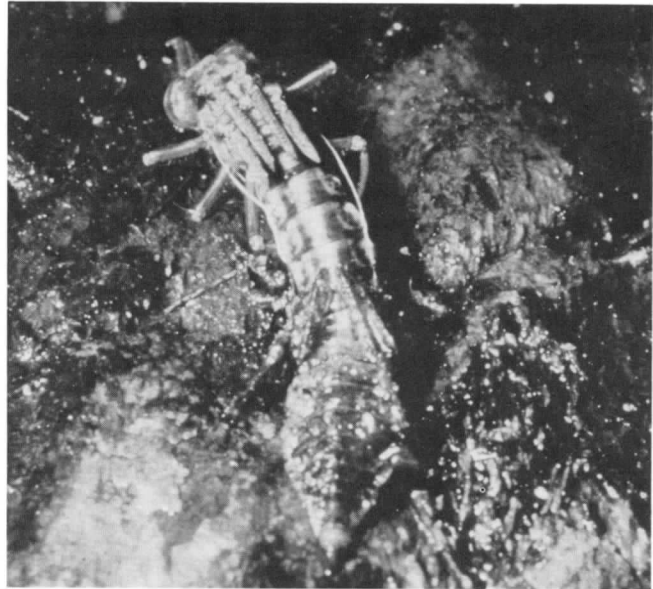


Figure 4. Dragonfly naiad. (Photo: Entomological Society of America).

shows that the compound eyes have increased the numbers of facets, the wing pads have lengthened on the way to forming four full-size wings, and other body structures are attaining adult proportions. Finally, after one to four years, the nymph emerges from the water for its final molt, and the familiar adult dragonfly appears.

The nymph is a voracious eater while it lives submerged. At first it feeds on microscopic water organisms and small insects, including mosquito larvae. As it grows, it consumes larger prey such as minnows and tadpoles (according to Farb, 1967; Palmer and Fowler, 1975; and Milne and Milne, 1980a). An enlarged lower lip, the labium, ordinarily is folded under the "chin" with part of it covering the lower "face" of the nymph. This lip unfolds and extends ahead of the body to catch prey. Hooks and jawlike organs at the end snare the victim and the "lip-trap" pulls it back to the nymph's mouth where true jaws take over. Nymphs have sensory organs on their legs sensitive to sound and to changes in water currents. These probably allow them to detect nearby prey (and predators). Their compound eyes already function well enough to allow the nymphs to judge the exact distance between the extended lip and prey.

Odonata nymphs themselves are important in an aquatic food chain, and are eaten by fish, turtles, frogs and salamanders. Because a female dragonfly may lay many thousands of eggs at a time, this predation helps keep dragonfly populations in check.

Dragonfly nymphs have internal gills in a cavity at the end of the body. Water is sucked into the cavity, and oxygen is extracted. When under attack, the nymph can expel the water suddenly, sending its body forward by "jet propulsion." Damselfly gills are external, attached at the rear of the body, which function in respiration and also as an aid to swimming.

Ordinarily, the young dragonfly or damselfly nymph crawls over the pond floor and among submerged plants, or swims, using its legs. Some nymphs are "climbers" and move up and down aquatic plants searching for prey. Other dragonfly nymphs are "sprawlers", lying quietly on the pond bottom, partially concealed from prey. Still others are "burrowers", rooting under bottom soil and lying in wait, with the tip of the abdomen sticking out to obtain oxygen. Despite their large appetites, nymphs may go for long periods between meals, especially during winter when prey is scarce.

When ready for its final molt, the nymph crawls out of the water onto an emergent plant stem, or onto land. The skin of the nymph splits down the back, but the adult waits for about 15 minutes while the wings harden before emerging. Over the next few hours it "pumps blood" into its wings, and is finally ready for flight. In late spring, one may find shed nymphal cases around a pond, evidence of breeding dragonflies and damselflies.

PAST HISTORY

Fossil remains of dragonfly-like insects that are 300 million years old are known. These fossilized remains are the earliest insects for which records exist. Scientists believe, however, there were earlier forms of winged vegetarian insects. Some of the ancient dragonflies were of great size, one fossil having a wingspan measuring 29 inches (74 cm). The largest present-day species has a wingspan of 4.5 inches (11.4 cm). Structurally, dragonflies have probably changed very little in the past 200-300 million years (Milne and Milne, 1980).

Popular myths about dragonflies still persist through the colorful names by which they were known in different regions. "Devil's darning-needle" referred to their supposed ability to sew up the ears and eyes of bad children. "Snake doctor" and "snake feeder" implied they brought dead snakes back to life. Other names that have been used include "horse stinger", "flying adder", and "mosquito hawk." The latter is the only worthy epithet of these harmless and beneficial organisms.

MANAGEMENT CONSIDERATIONS

Many of the following recommendations for attracting dragonflies and damselflies will be favorable for other forms of backyard wildlife. It may be necessary to consider the relative importance to you of the various types of wildlife in your backyard habitat. For instance, fish and waterfowl have urban wildlife values in their own right. However, their presence in a small pond may reduce Odonata production through predation. Suet attracts chickadees and woodpeckers to the delight of bird-

watchers. Suet also attracts starlings which may prey upon dragonflies.

If you decide your emphasis on management will be for dragonflies and damselflies, special measures can be taken to exclude fish and waterfowl from ponds. Suet feeders might be offered only in cold weather when adult dragonflies are not present.

STEPS TO ATTRACTING DRAGONFLIES AND DAMSELFLIES

1. Install a backyard pond and encourage permanent stormwater impoundments in your community.
2. The permanent pond should be filled year-round at a fairly constant level. Any potential breeding site for Odonata must not dry out. Aquatic insect prey is also likely to be present in a permanent water body.
3. The edges of the pond should include some sunny situations even if removal of some tall vegetation is required. Dragonflies and damselflies are sensitive to prevailing temperatures, and are most active on warm sunny days. Adults may also "sunbathe" for short periods on pond margins (or plant stems).
4. The pond should have mud and sand on the bottom. This provides adult Odonata with places for egg-laying, and nymphs with appropriate burrowing habitat.
5. Aquatic submergent and emergent vegetation is required, so a shallow pond is most desirable. The pondweed *Potamogeton*, duckweed *Lemna*, common rush *Juncus effusus*, and burreed *Sparganium*, are all good choices. Some of these will invade a pond in a year or two after flooding. Plant stems provide places for adults to rest and to lay eggs. Nymphs of some species crawl up stems for the final molt. Aquatic plants also provide a food supply for smaller insects upon which dragonflies feed.
6. For dragonfly and damselfly production, do not stock a pond with fish, or encourage ducks or waterbirds, all of which prey upon aquatic insects, including dragonflies. The droppings of aquatic birds add nutrients to the water, and may lead to eutrophication and deoxygenation.
7. Avoid the use of chemicals including herbicides, insecticides or fertilizers in or near the pond.
8. If possible, ponds should be situated near natural vegetation such as grasses and shrubs; if not, these should be added. Such areas provide adult dragonflies and damselflies with terrestrial feeding, resting and roosting sites.
9. Some song birds, such as house sparrows (*Passer domesticus*) and starlings (*Sturnus vulgaris*), prey upon dragonflies (Chelmick *et al*, 1980). To discourage sparrows, build birds houses with an entry hole no larger than 1-1/8 inches (2.9 cm). In your own house, cover open vents, utility boxes and unboxed eaves, all attractive for nest sites. Starlings are attracted to peanut hearts and suet, and both items should be excluded from bird feeders if production of Odonata is your objective.

10. If you have provided the amenities, and still no dragonflies appear on your pond, at least one author suggests it is practical to introduce common local species (Chelmick *et al*, 1980).

MANAGEMENT VALUES

1. These large, strikingly-colored insects are highly visible where present and add aesthetic interest to human environments.
2. Male territoriality is of educational interest, and can be observed and compared with this behavior in vertebrates.
3. Nymphs and adults prey upon human pests, including mosquitoes, but are completely harmless to humans. And, if you are successful in colonizing your pond with these insects, you can be sure the water is of good quality. Odonata will settle for no less.

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NOTES:

URBAN WILDLIFE MANAGER'S NOTEBOOK - 11

Urban Insects II: Butterflies in Your Garden

Robert T. Mitchell

ISSN 0882-584X

Birds are generally welcomed guests in our gardens. Many gardeners provide feeding stations, grow special food plants, erect birdhouses and maintain baths to make them feel at home. Butterflies are welcomed too, but little effort is made to accommodate them. This neglect is due more likely to ignorance of what can be done than to lack of interest.

Most of us are aware of diminishing numbers of butterflies nowadays. Habitat destruction and the frequent and widespread use of pesticides are mostly to blame. However, urbanization need not totally destroy habitat for butterflies. How can we counteract the losses? Suggestions are given in this guide that can help some butterflies survive and help create new habitat for others. At the same time you will enhance the beauty of your garden and become involved in fascinating and instructive sideline activities.

With proper food, butterflies are as easily attracted to the garden as birds. Feeding stations for butterflies are nectar-producing plants, which for maximum effectiveness and minimum care are perennials scheduled to bloom successively from spring into autumn.



Hedgerow in author's garden, highly attractive to both people and butterflies, is an interspersed of sweetpepper bush and smooth sumac under a canopy of flowering dogwood. Violets cover ground in shade, but in sunny spots winter cress blooms in spring and butterfly weed in summer

ATTRACTING ADULT BUTTERFLIES

The earliest butterflies to appear in spring are those that have spent the winter as adults in hibernation, including the Mourning Cloak, Comma, and Question Mark. These can be accommodated first by the blooming catkins of pussy willow and a little later by plum, peach, and cherry blossoms. Forsythia blooms at this time, but it fails to attract spring butterflies.



Pussy willow, serving as first butterfly feeding station in spring, supplies sustenance to overwintered Mourning Cloak

Next to appear are the butterflies that emerge from overwintering chrysalises.¹ Many gardens then are in gorgeous bloom with daffodils, tulips, very fragrant hyacinths, flowering cherries, and flowering magnolias. These flowers are attractive to us, but the butterflies on the wing at this time, such as the Orange-tip, Spring Azure, Tailed Blue, and the Cabbage and Clover Butterflies, favor the more lowly dandelion, chickweed, ground ivy, and winter cress in neglected lawns. Fastidious gardeners maintaining luxurious lawns of manilagrass (*Zoysia* spp.), which crowds out the "desirable" weeds, unfortunately ignore the needs of butterflies.

¹Chrysalises are pupae of butterflies that pass the pupal stage in a quiescent condition enclosed in a firm case.

The larger and more showy butterflies that emerge later from chrysalises, notably the swallowtails, welcome the availability of lilacs. Also, Monarchs returning to their northern breeding grounds from wintering sites in Mexico arrive at lilac time and renew their energy by sipping nectar from these fragrant blossoms.

From lilac time to mid-June, few noteworthy perennials especially attractive to butterflies are in bloom. Japanese honeysuckle blooms then and it is used by the hummingbird-like hawkmoths and the few butterflies that favor deeply-throated flowers. It is a troublesome weed, however, and it is not recommended for your garden. Sweet William is well attended by swallowtails on the wing at this time. It is a biennial rather than a perennial. However, an acceptable bed of the single variety of this old-time favorite can be produced yearly from a single planting if the planting is allowed to reset seed and 1-year-old plants are allowed to remain another year. Toward the end of May, the Viceroy and Red-spotted Purple appear. They have developed from small caterpillars that have spent the winter in a hibernaculum, which is a silk-lined tubular structure formed from a partly consumed leaf attached to the plant stem by silk threads.

By mid-June, the fritillaries, most commonly the Great Spangled Fritillary, have developed from the tiny caterpillars that braved the winter after eating nothing but their egg shells in the autumn. They are fond of milkweed blossoms and would welcome butterfly weed in your garden. Butterfly weed is a colorful milkweed that grows locally in abandoned fields and roadsides. Nurserymen have capitalized on the beauty of this easy-to-grow and very showy, orange perennial. They call it orange glory, tuberosa, butterfly flower, or some other name more appealing than butterfly weed.



Besides attracting beautiful butterflies, like this Tiger Swallowtail, butterfly weed adds great beauty to the garden

In summer, tall hardy phlox is ideal for floral color and as feeding stations, especially for the attractive swallowtails.

Clumps of graceful head-high sumac, smooth or dwarf, which must be transplanted from the wild, add land-

scaping beauty to the garden. The flowers lack color, but they rate exceptionally high in bee and butterfly attraction. In autumn, the seed heads become deep red, and the leaves acquire beautiful shades of orange and red.



Though not colorful, blossoms of both dwarf and smooth sumac are highly attractive to bees and butterflies

Noticeably more fragrant than the sumacs is another native shrub, sweet pepperbush. Bees and butterflies scramble over the dainty white blossoms as enthusiastically as they do on sumac. Usually only a pink variety of this shrub, if any, is available at nurseries.

From mid-summer through September, the traditional butterfly bush will be welcomed by all kinds of butterflies in your garden. Nurseries carry different color varieties of this shrub, but likely the natural lilac-colored variety introduced from Asia years ago is most attractive to butterflies.



Zabulon (*Poanes zabulon*), a colorful skipper, feeding on the well-known butterfly bush, a long-lived shrub with a long blooming season

In autumn, many gardeners rely on chrysanthemums for color, but for the sake of butterflies, hardy asters, available in several colors, should be substituted. The small white aster, a prolific weed in abandoned fields,

is ideal. Although not actually a perennial, once established in the garden it will produce a wealth of dainty blossoms yearly. The blossoms last after frost and provide feeding stations to migrating Monarchs enroute to their wintering grounds in Mexico.

Unlike perennials, garden annuals do not lend themselves to such a regular pattern of successive seasonal blooms to serve as feeding stations for adult butterflies. Few annuals develop before mid-summer because of their need to grow from spring-planted seeds. Two of the most popular garden annuals, zinnias and marigolds, are readily accepted by butterflies. Like the dandelion,



Tiger Swallowtail feeding on zinnia, a favorite annual of both gardeners and butterflies

thistle, Joe pye-weed, and many other attractive weeds, these flowers are composites. Their compact heads consist of many tiny flowers in a receptacle, where butterflies diligently sip from one flower after another at one "sitting." Nurseries now proudly feature double hybrids of many annuals -- hollyhock, petunia, larkspur, etc.



Beds of deep-throated flowers like single petunias are good feeding stations for certain butterflies and are especially attractive to hawk-moths, which may be seen at dusk feeding hoveringly at the blossoms like hummingbirds

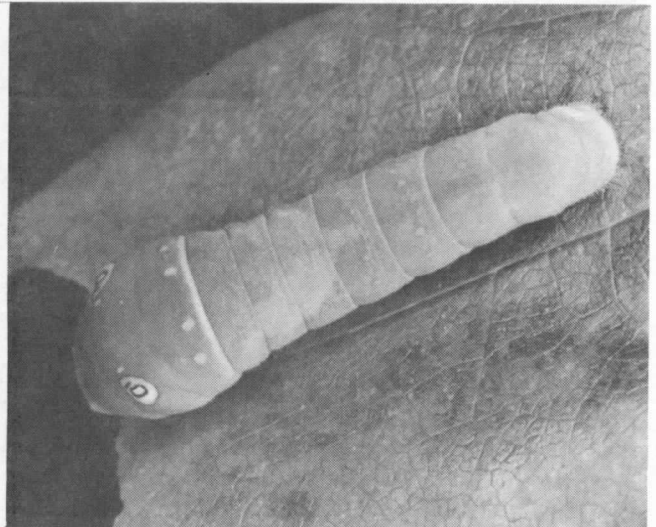
These may be tempting to you, but bees and butterflies prefer the single flowers from which to collect pollen and suck nectar. Some of the deeply-throated annuals, such as petunias, nicotiana, four-o'clock, and larkspur should be included in your garden flora to attract the hummingbird moths that feed while hovering on the wing, and to attract a few of the deeper dipping butterflies.

In summer, some butterflies, like the angle-wings and admirals, will come more readily to fermenting fruit than to flowers. Year-round use can therefore be made of a roofed and platformed winter bird feeder by supplying it with containers of overripe fruit or of fermenting juice. At night you might find your station being visited by the very striking *Catocala* moths with bright red or yellow underwings.

As butterflies keep coming to your garden, you will become increasingly interested in them, perhaps with the enthusiasm of the bird watcher. Keep a pair of binoculars handy to get a closer look at them. With a field guide you can learn to tell the butterfly species apart. There are good illustrated books on butterflies. A favorite of beginners is the Golden Guide, *Butterflies and Moths*, by Mitchell and Zim. This book more than others illustrates the immature forms of common butterflies and moths throughout the continental United States and Canada. You will find that helpful as you become interested in butterfly life-histories.

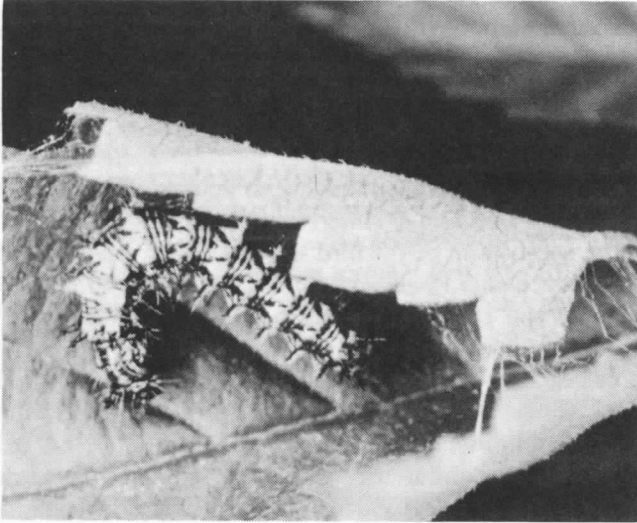
BUTTERFLY NEEDS DURING EARLY LIFE STAGES

Butterflies, as do birds, need food and cover and breeding opportunities. Instead of birdhouses where eggs are laid and nestlings are cared for, butterflies need uncontaminated foliage of plants to the liking of each species on which eggs can be laid and the emerging caterpillars can feed to maturity. In selecting acceptable plants, favoritism will have to be shown for caterpillar species that feed on trees, bushes, or other plants suitable to your garden conditions and landscaping features of your property.



Caterpillar of Tiger Swallowtail feeds mainly on wild cherry, tulip-tree, or white ash

Among the shade trees, high priorities should be given to tulip tree, wild cherry, and white ash, all three favored by the highly popular Tiger Swallowtail, and wild cherry also by the vivid Red-spotted Purple. American elm is the major food of the Mourning Cloak and Question Mark, and of the spring generation of the Comma. Black locust, with its clumps of white fragrant flowers, is the favorite food of the Silver-spotted Skipper, which feeds also on the Wisteria vine.



The spring generation of the Comma is almost entirely dependent upon elm foliage for food

If part of your property is a fairly open woods, a very productive and beautiful garden of native vegetation can be established with an understory of spice bush, sassafras, pawpaw, shad bush, and flowering dogwood. The Spice-bush Swallowtail feeds on both spice bush and sassafras, while the Zebra Swallowtail, a striped beauty with an unusually long tail, feeds exclusively on pawpaw. Besides being one of the food plants of the Red-spotted Purple, the shad bush bloom is an attractive harbinger of spring. Later the dogwood adorns the woods and is on hand to support the spring generation of Spring Azure.



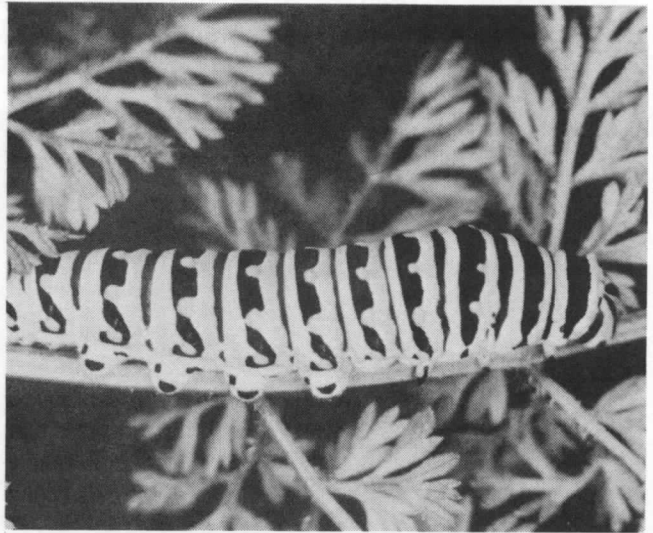
Zebra Swallowtail needs pawpaw for reproducing its kind

Very few of the plants forming the woodland ground cover are choice caterpillar foods. Wood nettle and false nettle are outstanding exceptions. Second and subsequent generations of Comma feed almost entirely on the nettles which also are the principal larval food of the Red Admiral. Because the stems and leaves of wood nettle are very irritating to human skin, false nettle is more desirable to propagate in your woodland butterfly garden. Toothwort also should be grown there. It blooms in early spring when the Orange-tip is on the wing, laying eggs on the toothwort, winter cress, and other mustards, usually along hedgerows and woods margins.

Monarch larvae feed exclusively on the plants of the genus *Asclepias*. Although common milkweed is preferred by Monarch caterpillars over butterfly weed, mentioned previously for attracting adults, the latter is a far superior garden plant.

Pussy willow is not only an early food plant for butterflies, it also is acceptable to the Viceroy caterpillar. It will supply you with downy catkins for late winter bouquets, but when you cut the stems you must make sure that you are not including any with Viceroy hibernacula where tiny Viceroy caterpillars spend the winter.

With a good parsley bed, you are almost certain to have Black Swallowtails breeding in your garden – probably more than you want if you expect to cut much parsley! To get a good supply of both parsley and Black Swallowtails, you should have a planting of parsnips in your vegetable garden or of snow-on-the-mountain in a shady place in your garden or woods margin. Keep your eye on the parsley, and when you see a small black caterpillar with a white saddle mark, transfer it to the broader-leaved parsnips or snow-on-the-mountain to become full-grown. In your vegetable garden, you also may find Black Swallowtail larvae on carrot foliage.



Caterpillar of the Black Swallowtail. Look for it in the parsley bed

Rather than weeding violets from flower beds or destroying violet seedlings in the lawn with mowings, transplant them to locations where they will be free to grow. Caterpillars of the Great Spangled Fritillary and other fritillaries are dependent solely upon violets for survival.

Gardeners who include the asters for feeding fall butterflies also will be providing food for the little Pearl Crescent, a very frequent visitor to the garden. Its caterpillar feeds on aster, but being secretive, is rarely seen.

Other plants could be mentioned to serve the needs of different butterflies occurring in your garden, but a better approach to determining what you should include would be for you to familiarize yourself with the butterfly species present. By consulting one of the butterfly guides, you can make a selection from among the larval food plants for the butterflies seen in your garden.

Growing plants as food for caterpillars does not provide for their entire needs. Caterpillar survival can be better assured if they are not exposed to excessive predator pressure, which means that for their sake your garden should not be the breeding territory of such highly insectivorous birds as house wrens (*Troglodytes aedon*) or the foraging grounds of colonies of the common paper wasp (*Polistes* spp.). Nor should the caterpillars be subjected to insecticide sprays. A gardener who values butterflies must be tolerant of some plant defoliation. With a great deal of effort, you could manage butterflies by rearing them through their early life stages in confinement, and then releasing the butterflies into the garden when they emerge as adults from chrysalises. That is complete butterfly gardening! Generally, however, gardening for butterflies will be very rewarding without this extra effort.

COMMON AND SCIENTIFIC NAMES OF BUTTERFLIES AND PLANTS

(Listed in order of appearance in text)

BUTTERFLIES

Mourning Cloak - *Nymphalis antiopa* (L.)
 Comma - *Polygonia comma* (Harris)
 Question Mark - *Polygonia interrogationis* (Fab.)
 Orange-tip - *Anthocharis midea* Hub.
 Spring Azure - *Celestrina pseudargiolus* (Bdv. & Lec.)
 Tailed Blue - *Everes comyntas* (God.)
 Cabbage Butterfly - *Pieris rapae* (L.)
 Clover Butterfly - *Colias philodice* Godart
 Swallowtails - Papilionidae
 Monarch - *Danaus plexippus* (L.)
 Hawkmoths - Sphingidae
 Viceroy - *Limenitis archippus* (Cramer)
 Red-spotted Purple - *Limenitis arthemis astyanax* (Fab.)
 Fritillaries - *Speyeria* spp.
 Great Spangled Fritillary - *Speyeria cybele* (Fab.)
 Angle-wings - *Polygonia* spp.
 Admirals - *Limenitis* spp.
 Catocala moths - *Catocala* spp.
 Tiger Swallowtail - *Papilio glaucus* L.
 Silver-spotted Skipper - *Epargyreus clarus* (Cramer)
 Spice-bush Swallowtail - *Papilio troilus* L.
 Zebra Swallowtail - *Eurytides marcellus* (Cramer)
 Red Admiral - *Vanessa atalanta* (L.)
 Black Swallowtail - *Papilio polyxenes* Fab.
 Pearl Crescent - *Phyciodes tharos* (Drury)

PLANTS

Pussy willow - *Salix discolor*
 Plum - *Prunus* spp.
 Peach - *Prunus* spp.
 Cherry - *Prunus* spp.
 Forsythia - *Forsythia* spp.
 Daffodils - *Narcissus* spp.
 Tulips - *Tulipa* spp.
 Hyacinths - *Hyacinthus* spp.
 Magnolia - *Magnolia* spp.
 Dandelion - *Taraxacum officinale*
 Chickweed - *Stellaria media*
 Ground ivy - *Nepeta henderacea*
 Winter cress - *Barbarea* spp.
 Lilac - *Syringa vulgaris*
 Japanese honeysuckle - *Lonicera japonica*
 Sweet William - *Dianthus barbatus*
 Milkweed - *Asclepias* spp.
 Butterfly weed - *Asclepias tuberosa*
 Hardy phlox - *Phlox paniculata*
 Smooth sumac - *Rhus glabra*
 Dwarf sumac - *Rhus copallina*
 Sweet pepperbush - *Clethra alnifolia*
 Butterfly bush - *Buddleia davidii*
 Chrysanthemum - *Chrysanthemum* spp.
 Hardy aster - *Aster novae-angliae* - New England aster
 Small white aster - *Aster vimineus* or *Aster ericoides*
 Zinnia - *Zinnia* spp.
 Marigold - *Tagetes* spp.
 Thistle - *Cirsium* spp.
 Joe pye-weed - *Eupatorium*
 Hollyhock - *Althaea* spp.
 Petunia - *Petunia* spp.
 Larkspur - *Delphinium ajacis*
 Nicotiana - *Nicotiana* spp.
 Four-o'clock - *Mirabilis jalapa*
 Tulip tree - *Liriodendron tulipifera*
 Wild cherry - *Prunus serotina*
 White ash - *Fraxinus americana*
 American elm - *Ulmus americana*
 Black locust - *Robinia pseudoacacia*
 Wisteria vine - *Wisteria* spp.
 Spice bush - *Benzoin aestivale*
 Sassafras - *Sassafras varifolium*
 Pawpaw - *Asimina triloba*
 Shad bush - *Amalanchier canadensis*
 Flowering dogwood - *Cornus florida*
 Wood nettle - *Laportea canadensis*
 False nettle - *Boehmeria cylindrica*
 Mustards - *Brassica* spp.
 Common milkweed - *Asclepias syriaca*
 Parsley - *Petroselinum crispum*
 Parsnips - *Pastinaca sativa*
 Snow-on-the-mountain - *Aegopodium podagraria variegatum*
 Carrot - *Daucus carota sativa*
 Violet - *Viola* spp.
 Aster - *Aster* spp.

ABOUT THE AUTHOR

Robert T. Mitchell is a Research Associate with the National Institute for Urban Wildlife. He retired from the U.S. Fish and Wildlife Service in 1976. A graduate of The Ohio State University and an entomologist by training, Mitchell has had a long-time interest in gardening for butterflies on his property in Maryland. He is principal author of *Butterflies and Moths*, one of the popular Golden Guide series of books on natural history which has undergone four printings, the last one including a revision. Mitchell was technical advisor for the Golden Guide *Insects*.

URBAN WILDLIFE MANAGER'S NOTEBOOK - 12

Saving Snags for Urban Wildlife

Louise E. Dove, Wildlife Biologist

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INTRODUCTION

Living trees are valuable components of the urban and suburban environment for both people and wildlife. Trees moderate the local climate, help slow stormwater runoff and soil erosion, and filter air pollutants and noise. They provide urban wildlife with food, cover, and space to reproduce. They satisfy a human need for aesthetically pleasing surroundings, when used for landscaping. But what happens when the tree is dying or dead? Will homeowners tolerate a *snag* on their properties -- a dead or partially dead tree from which the leaves and most of the limbs have fallen? If the tree is a hazard to people or property, *can* it be tolerated?

For some kinds of wildlife, dead trees are more useful than living ones. Countless insects burrow into decaying wood during their life cycles. Woodpeckers, nuthatches, and wrens search tree surfaces to find this insect food. Woodpeckers also excavate nesting and roosting cavities in the soft tissues of decaying trees. In turn, these cavities are sought by "secondary cavity nesters," birds and mammals that cannot create their own cavities.

In considering snags, the rules by which urban wildlife managers work may not be those of traditional wildlife managers. In managed forests, biologists can work with foresters to help manage snags for the benefit of wildlife, with due regard for safety and fire hazard. In developed areas, the interests and safety of people

must be considered first in any discussion of retaining snags for wildlife. In addition, there are compelling reasons to remove snags in order to discourage certain pests that find them attractive.

It is hoped the following discussion will be useful to homeowners and open space managers in urban/suburban areas who may have to reach appropriate decisions about retaining snags.

LAWS ON SNAGS

If foresters and wildlife managers are more aware recently of the need to retain snags for wildlife, it may stem from the 1977 federal snag policy requiring all U.S. Forest Service Regions and Forests to develop guidelines to "provide habitat needed to maintain viable, self-sustaining populations of cavity-nesting and snag-dependent wildlife species..." including "...retention of selected trees, snags, and other flora to meet future habitat requirements" (U.S. Department of Agriculture, Forest Service 1977). Snag retention in urban and suburban areas is generally regulated by local ordinances. Before making any decision about snags, homeowners and urban land managers should learn about the regulations of their town or city concerning dead trees.

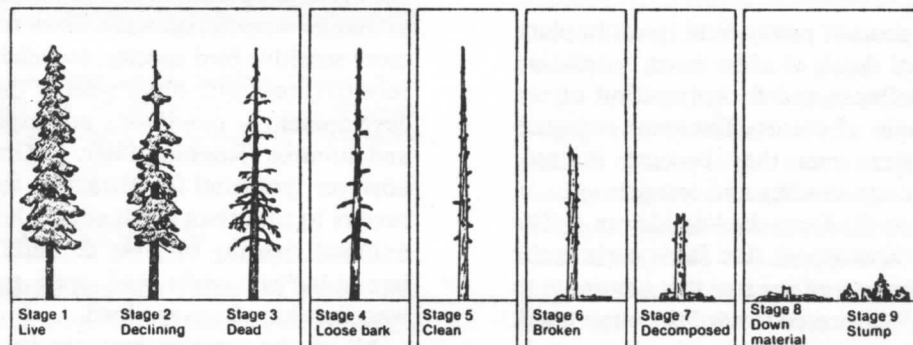


Figure 1. Snags are standing trees that are dying or dead. They undergo successional stages as they gradually decay. A hard snag becomes a soft snag between stages 5 and 6. (Adapted from Maser, *et al.* 1979, p. 80).

AN EXPERT'S POINT OF VIEW The Life of Dead Wood^a

If you have few trees, want a neat yard, and hate birds, read no further.

If you tolerate untidiness, like to annoy your neighbors, and also foster birds, read on.

Our yard between the house and the lake is unimproved -- it is a natural woods with an undergrowth of native laurel. When a tree of a half-foot or more in diameter dies in our "forest" it is a candidate for special treatment. Unless complete removal is dictated by its closeness to the house or property line, or for other reasons, 30-or-more-feet of the stem is left standing. As yellow pages of the telephone directory reveal, there are dozens of tree service outfits who, for a price, will be happy to comply with such specifications.

The standing stems fulfill a habitat need for wildlife, especially for woodpeckers. Insects such as bark beetles take up residence under the bark and in the wood, providing food for the birds. The large and handsome pileated woodpecker is one of the seekers of grubs. To watch this bird make the bark and wood chips fly is one of the rewards a snag creates. With time, decay softens the dead tree; woodpeckers then drill nest holes that also become cavities for non-woodpeckers, including flying squirrels.

If you join the dead tree cult, your stature may not be enhanced. A tree service crew had topped one of our trees. When finished with the job, curiosity caused me to inquire of the crew boss why they had not questioned this unorthodox practice. His answer: "Just figured you're one of those nuts who likes woodpeckers!"

^a From *Lake Barcroft Newsletter* (Virginia), April 1986, reprinted with permission of author, Lloyd Swift, who was formerly in charge of wildlife management for the U.S. Forest Service.

HOW TREES BECOME SNAGS

Snags are standing dead or partly dead trees. In plant succession, the gradual death of older trees, formation of snags, and final collapse and decomposition of the wood, is the usual chain of events. The same sequence may occur in younger trees that become injured, diseased, or killed through shading and competition.

A tree may be said to die from the "inside out." The center of the tree, the heartwood, dies fairly early in the life of a tree. The living part of the tree that continues to grow, the "sapwood," is located toward the outer trunk where the tree adds new layers and increases in diameter. Branches and limbs tend to drop off as the tree matures. This natural pruning leaves a circular scar, a "knothole," which the tree attempts to heal with the

next year's layer of growth. In older mature trees, the loss of larger branches leaves larger scars that may be too wide for the tree to repair. Bacteria, fungi, and insects invade these holes and begin to decay the injured limb. Fungus fibers eventually grow into the heartwood, and "heart rot" sets in. This is why mature trees may be hollow in the center. A natural cavity is formed as decay extends the knothole opening into the dead and hollow interior. The tree may still be far from dead, however. Typically, a tree dies in one small area while the rest of the tree continues to produce leaves and remains viable, perhaps for years (Jackson 1980).

Partly dead trees are called hard snags and usually retain their large limbs. The wood of hard snags is still fairly sound, and the top of the tree has not yet broken off. As the tree deteriorates and is completely dead it is called a soft snag. Soft snags rarely have limbs and their tops may be gone. Also, the wood of soft snags is well-decomposed, primarily through the action of fungi that attack decaying wood. The "shelves" of bracket fungi growing on a standing tree pinpoint a dying or dead tree. To attract many kinds of cavity-nesters, hard snags must be retained long enough to reach the soft snag stage.

WILDLIFE USE OF SNAGS

Each stage in snag succession (see Fig. 1) has the potential for wildlife use. For example, the bare branches of partly-dead snags are useful as look-out perches for flycatchers and hummingbirds. The broken top of a soft snag may be a nest site for raptors or a singing perch for the northern mockingbird (*Mimus polyglottos*). Woodpeckers seek snags that are hollow and reverberate loudly, for their drumming activities. When loose bark still clings to the snag, at least one bird, the brown creeper (*Certhia familiaris*), may nest under the bark. Cavities in snags are sought by mammals, such as squirrels, raccoons and opossums, and by many birds for nest sites, roosts, escape cover, winter shelters, food storage, and foraging. At least 85 species of birds are cavity-nesters and/or cavity-roosters in North America (Scott *et al.* 1977), and more than 20 species of mammals are known to use cavities (Devlin and Payne undated; Thomas *et al.* 1979). Many of these species do not breed in developed areas because the original stands of native woodlands have been too fragmented. The more sensitive bird species, especially, require extensive forested areas with older trees of the size present before development -- conditions not available in most cities and suburbs (Robbins 1980; DeGraaf 1986). There is, however, potential for attracting some breeding cavity-nesters to suburban residential habitats where there was minimal clearing of trees to build homes; and to urban/suburban parks and open spaces where natural woodlots have been retained.

All of the woodpeckers are "primary excavators," able to drill out a cavity in snags. The larger species, such as the hairy woodpecker (*Picoides villosus*), are able to excavate the horizontal entrance to their cavities

in hard snags, but they seem to deliberately choose trees having decayed heartwood to excavate the "vertical" part of the cavity. In fact, woodpeckers that start nest holes in trees in which the interior is not yet decayed abandon those holes in favor of trees with heart rot (Connor *et al.* 1976). Only the powerful pileated woodpecker (*Dryocopus pileatus*) is able to excavate a complete cavity from a hard snag (Miller and Miller 1980). The smaller downy woodpecker (*Picoides pubescens*), common in urban woodlots, excavates only in soft snags where the sapwood and the heartwood are both decayed. There are a few non-woodpeckers that can also drill cavities in soft snags, among them the chickadees. Chickadees are also secondary cavity nesters, using old woodpecker holes where available. Cavities made by the larger woodpeckers through sound sapwood are the safest, because predators (raccoons, house cats, etc.) cannot rip open the nests. They are also less likely to weaken the tree and cause it to break off (Miller and Miller 1980) Because nest holes and winter roosting holes are usually in separate locations, and are rarely used a second season by woodpeckers, these cavities are soon available for other cavity-nesters that cannot excavate their own.

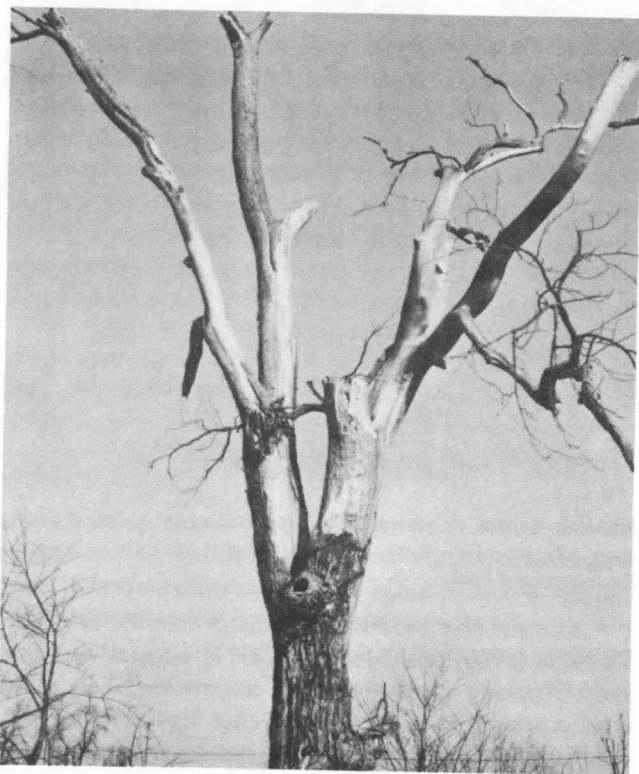


Figure 2. The knothole, loose bark, and bare limbs of this snag make it attractive to wildlife for nesting, roosting and perching. (Photo: Mark Raab, Howard County, MD Department of Recreation and Parks).

WHEN THE SNAG IS DOWN

Wind, ice, lightning, and the forces of decay will finally bring down the snag. The remaining stump, logs, and other woody debris may persist for years, if humans do not "tidy up" the area. Certain vertebrate and invertebrate populations will exploit this "new" habitat for

cover, food, and reproductive sites, and add to the urban wildlife community. Small insect-eaters such as shrews, voles, and toads, find cover and food in and under small logs. Tree frogs may be found in rotted logs in summer, and lizards and salamanders make use of logs during both winter and summer. The white-footed mouse (*Peromyscus leucopus*) may never range more than 500 feet (153 m) from its birthplace in a stump. Larger logs are exploited by skunks, opossums, and snakes for cover, feeding and nesting sites, and sometimes for hibernating by land turtles.

The downed wood decays gradually as invertebrates such as termites (Isoptera), carpenter ants (*Camponotus spp.*), and beetles channel into the wood. Other wood-dwelling invertebrates move into these channels along with soil-dwelling species, fungi, and bacteria that continue the decay process. A variety of prey is available to vertebrate and invertebrate predators at each stage of decay. (See also Maser *et al.* 1979.)

GUIDELINES FOR OPEN SPACE MANAGERS

Persons who manage land within developed areas, containing old stands of trees, must be diligent in retaining these wooded areas. Trees that have been planted in the urban/suburban environment, even when mature, do not replace native woodlands as breeding habitat for the insectivorous warblers, woodpeckers, and other "sensitive" forest breeders (DeGraaf 1986). (Planted trees *are* important habitat for many of the "edge species" of birds, however, and should not be underestimated.) The larger the native stand, the greater the number of "forest interior" species likely to be protected in woodlands. Studies by Robbins (1984) suggested the minimum area to maintain most of the breeding bird species of central Maryland is approximately 85 acres (34 ha) of circular habitat in the interior of a woodland.

Most urban/suburban forest managers will be dealing with much smaller areas and will not be able to attract some of the sensitive forest interior species. Certain guidelines can be suggested to maximize the habitat that is available:

- Generally, it is desirable to retain any snag at least 4 inches (10.2 cm) in diameter at breast height (d.b.h.), and 6 feet (1.8 m) tall. These measurements are the *minimum* diameter and height of dead trees used by birds for nesting (Thomas *et al.* 1979). The actual height and diameter of the snag determines which wildlife species might move in. The larger species obviously require a trunk whose minimum diameter will accommodate their nest hole. Evans and Conner (1979) determined snag requirements of the following woodpeckers that are likely to be found in urban woodlands. Although their data were collected in nondeveloped areas, these guidelines may be helpful to urban forest managers considering the immediate value of a snag to wildlife:

Species	Snag Diameter (in.)	Snag Height (ft.)
Downy Woodpecker	5-10	10-30
Hairy woodpecker	10-15	20-40
Northern flicker ^a	5-20	20-40
Red-bellied woodpecker ^b	15-20	30-50

^a *Colaptes auratus*

^b *Melanerpes carolinus*

- Preferably, snags should be retained long enough to become soft snags to meet the requirements of more wildlife species. If the requirements of the primary excavators are met, then those of the secondary cavity-users (e.g., titmice, swallows, squirrels, raccoons) should be taken care of. Balda (1975) stated, "The presence and density of snags may play an important role in determining the density and diversity of secondary cavity-nesters."

- The successional stage of plants in the vicinity of the snag is known to influence wildlife use of the snag. The eastern bluebird (*Sialia sialis*) uses old woodpecker holes in trees, or hollows in fence posts, located in forest openings or fields. The nearby plant life must include grasses and forbs, or shrubs and seedlings, with opportunities for the bluebirds to hunt insects on the ground. Hairy woodpeckers tend to choose snags in areas of open understory, whereas downy woodpeckers prefer areas of dense understory. Cavity trees used by gray squirrels (*Sciurus carolinensis*) and fox squirrels (*Sciurus niger*) are often near other trees with hollows. Snags situated in large openings are used by northern flickers. Snags adjacent to live trees offer cavity-dwellers protection from weather and from predators.

- How many snags must be present in an urban or suburban wooded area to meet the requirements of wildlife? Data are available only from rural forest managers, but they give us a starting point. Thomas *et al.* (1976) determined that 45 snags per species pair were the snag requirements for woodpeckers in the Blue Mountains of Oregon and Washington. Evans (1977) stated that for nongame-bird management, "The land manager should strive to maintain a mixture of successional stages and forest age class categories in different size stands." He suggested that 10% of each stand be in old growth timber. Bull and Meslow (*in DeGraaf 1978b*) found that a pair of pileated woodpeckers required 320 acres (130 ha) of land, with 45 snags and 45 replacement trees. They suggested that, because it may take 100 years for a tree to mature and die, several trees per acre should be allowed to become snags. In New Mexico, Forest Service biologists recommend that three snags per acre be retained if the snags are within 500 feet of forest openings and water; or two snags per acre in the forest interior (Scott *et al.* 1977). Evans and Conner (1979) used the value 10 to estimate the number of snags needed to provide one cavity for a pair of woodpeckers. This value allows for unusable snags, feeding habitat, replacement snags, and secondary users. Devlin and Payne suggested retaining 1 to 5

snags and 5 cavity trees per acre as good wildlife management practice in Pennsylvania woodlands, with a mixture of both live and dead cavity trees on the same acre, if possible.

In most urban/suburban woodlots there is likely to be a paucity of snags of the proper height and diameter unless pre-development stands exist. To the extent possible, the urban wildlife manager should protect all snags that meet the minimum size mentioned earlier, unless they are a potential hazard to woodlot users.

- Some species may be more attracted to cavities facing in a certain direction. The screech owl (*Otus asio*) seems to prefer cavities facing north, with poor interior lighting. However, woodpeckers seem to favor a southern exposure; Lawrence (1966) found that 54% of the woodpecker cavities she studied in Ontario faced southward.



Figure 3. Several woodpecker holes are evident in this south-facing snag. (Photo: Mark Raab, Howard County, MD Department of Recreation and Parks).

- Certain precautions about snags may be in order. Robbins (1980) and Mayfield (1977) pointed out that snags reaching above the forest canopy are likely to attract cowbirds (*Molothrus ater*) that seek elevated perches in order to spot potential nests to parasitize. In fragmented forest areas, such as those found where development has subdivided larger woodlands, Robbins suggested that snag retention may threaten the native breeding bird population. Mayfield believes the decline of populations of some of the flycatchers and warblers is due to parasitism by cowbirds. Flycatchers and warblers breed in the forest interior and are less adaptable than species found at wood margins. Open space managers with large blocks of woodland that support breeding flycatchers, warblers and other species sensitive to predation and competition (e.g., vireos and thrushes) should "retain snags judiciously" (Robbins 1980), to minimize attracting cowbirds to the area.



Figure 4. This snag on a suburban open space system provides important habitat for various types of wildlife, and should be retained.

- Nest boxes and nesting platforms can be placed in urban woodlands to supplement snags and to attract cavity-nesters and other species that use snags. The Hamilton County Park District of Cincinnati, Ohio has been successful in attracting eight species to bluebird-type boxes installed throughout the Park District, has had breeding great horned owls (*Bubo virginianus*) on nest platforms, and has installed multipurpose nest boxes with 3-inch entrance holes for the potential use of small raptors and four species of squirrels.

In wetland areas, nest boxes for wood ducks (*Aix sponsa*) are particularly successful, for this species is known to prefer boxes to natural cavities where both are available (Strange *et al.* 1971). Many state fish and wildlife agencies can provide plans for nest boxes. An excellent source of information is Henderson's Minnesota Department of Natural Resources publication (see bibliography).

- Downed trees, logs and other woody debris provide additional wildlife habitat and should be retained as a good management practice. (See *WHEN THE SNAG IS DOWN* section of this publication.)

GUIDELINES FOR HOMEOWNERS

Any plan for managing wildlife in urban/suburban settings must be concerned with the preferences of people, and with their health and safety. There seems to be an instinct among urban dwellers to "neaten up the landscape" (Hawkes 1977), including the removal of dead trees and downed limbs and logs. There is also a natural instinct of people to enjoy wildlife, however. If they are made aware of the relationship between snags and cavity-dwelling wildlife, many people may choose to keep their properties less tidy. The ragged appearance of a dead tree will be less important than the opportunity to attract woodpeckers, wrens, and chickadees.



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On some properties, snags will be absent or are impractical. A snag that is potentially hazardous -- located on a small lot where it could fall on a home or on pedestrians -- may have to be removed. If it is only a damaged limb that threatens property or a thoroughfare, removal of the limb would allow the snag to remain in place for an indefinite period. It is wise to seek professional advice from tree surgeons. An alternative to a natural snag is to provide bird houses at several locations. This is not a substitute cavity for woodpeckers because they seem to need to excavate as part of their breeding cycles (Thomas *et al.* 1979). However, wrens, chickadees, purple martins, bluebirds, titmice and squirrels are some of the cavity-nesters known to accept appropriately designed and placed bird houses.

Besides human safety, a possible reason to eliminate a snag on an urban lot is its attraction to starlings (*Sturnus vulgaris*) and house sparrows (*Passer domesticus*) for nesting. These aggressive birds are generally undesirable and should not be encouraged (Federal law allows their eggs and nests to be destroyed). Usually, however, the value of the snag for other species far outweighs the negative potential of use by sparrows and starlings.

In areas devoid of snags, Decker and Kelley (undated) suggest creating snags and den trees by deliberately girdling suitable trees, or by cutting off limbs or chopping out a section of bark to allow fungus to enter the wounded areas. Suitable trees are those at least 6 in (0.2 m) d.b.h., and of a species prone to forming natural cavities, e.g., elm (*Ulmus spp.*), ash (*Fraxinus spp.*), sycamore (*Platanus spp.*), and basswood (*Tilia spp.*). Snag formation takes a number of years to accomplish, however, even with human intervention.

CAVITY-NESTERS AND INSECT CONTROL

Cavity-nesting birds are generally insectivorous, and it is known they can influence insect population levels. In forests, insects are adapted to attacking and breaking down damaged and older, weakened trees. In developed areas where the environment places stresses on trees that may encourage insects even in young trees (Nielsen 1975), insectivorous birds should be encouraged.

Trees with sizable cavities may be used by a colony of bats for shelter, and these voracious insectivores will help control flying insects during their nightly forays.

CONCLUSIONS

1. Dying and dead standing trees -- snags -- are important in the life cycle of many wildlife species.
2. Woodpeckers are primary excavators, and drill cavities that are later used by many other types of birds and mammals.
3. Individual homeowners and open space managers should retain snags on their properties if the snags are at least 4 in (10.2 cm) d.b.h. and 6 ft (1.8 m) tall, and if they are not a potential hazard.
4. To the extent possible, open space managers should preserve pre-development wooded stands that may attract some of the forest-interior birds for breeding.
5. There are valid arguments, in addition to safety factors, for not retaining snags, including their attraction to cowbirds, house sparrows, and starlings, all of which compete with more desirable bird species.
6. Homeowners and urban foresters should retain downed snags and logs as additional wildlife habitat.
7. Cavity-nesters are generally insectivorous and help control insect population levels.

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NOTES:

URBAN WILDLIFE MANAGER'S NOTEBOOK- -13

URBAN INSECTS III: STINGING INSECTS AND YOU

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INTRODUCTION

It has been estimated that a single acre of land can support 425 million insects (*in* Frazier and Brown 1980). Some of these insects are so small they cannot be seen unmagnified, while others are large and highly visible. Few of us will spend much time outdoors without encountering some examples of insects.

At some point many of us will be inconvenienced by the sting of a bee, a wasp or some other member of Hymenoptera, the taxonomic Order of stinging insects. For most of us, the discomfort of a sting is short-lived and trivial. For a very few individuals, an insect sting is a fearful life-threatening event because of a severe allergy to insect venom. Fortunately, the number of persons having such allergies is believed to be small, currently estimated at 0.04 to 4% of the U.S. population (Evans and Summers 1986). Experts suggest, however, that the immune system of *anyone* who is stung responds to the event, and up to 20% of those stung show evidence of being "sensitized" to the insect's venom, a precursor to any serious allergic reaction (Valentine 1987). Studies are progressing to be able to identify early the small percentage of cases that become clinically relevant. There has already been significant progress in treating insect allergies. Hypersensitive individuals who are at greatest risk can be immunized against specific insect venoms and assured of relative safety if they are stung again. The management of urban wildlife can take many forms, and medical intervention to protect us from stinging-insect allergies is one of the more interesting.

At the same time, it falls on biologists and environmental educators to help change widespread negative attitudes toward the stinging insects. Many people who have no known insect allergies still have what Rood (1976) called an "irrational fear" of stinging insects, not unlike those who fear all snakes. Because the Hymenoptera can sting, we tend to overlook their interesting life cycles and the beneficial role they play in urban ecology. For example, they prey on more harmful insect pests, and they are the primary pollinators of flowering plants, including fruits and vegetables. These insects are encountered frequently in urban/suburban situations, and both allergic and non-allergic persons should

know their distinguishing characteristics and be able to identify them (see Figure 3, below). By taking an "educational" approach to the stinging insects, perhaps our tolerance level for them will be raised, and the overall benefits of the Hymenoptera

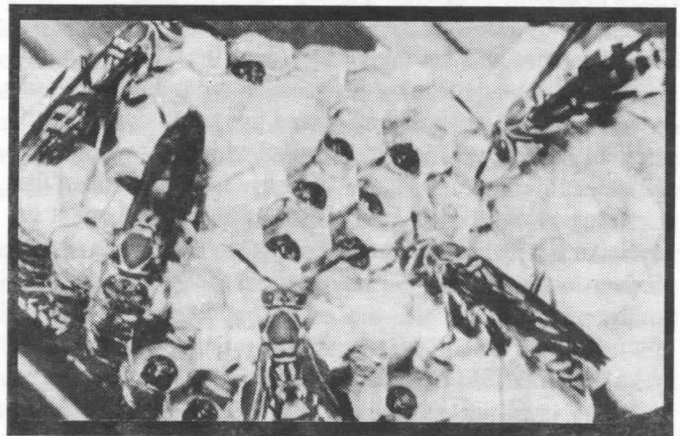


Fig. 1. The paper wasp (*Polistes*) often suspends its nest from a house eave or rafter, and is quite tolerant of human presence. (Photo: American Academy of Allergy and Immunology)

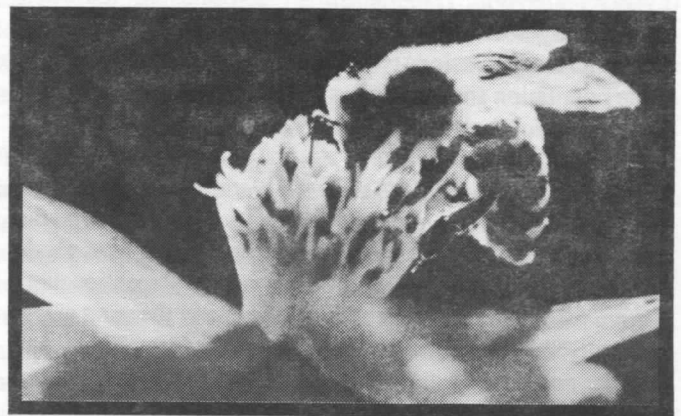


Fig. 2. The docile honey bee (*Apis mellifera*) is frequently implicated in human insect stings because it forages in areas of human activity. (Photo: American Academy of Allergy & Immunology)

will strike a positive chord in even the most fearful.

CAN YOU RECOGNIZE THESE INSECTS?

HONEY BEE (*Apis mellifera*)

PAPER WASP (*Polistes spp.*)

YELLOW JACKET (*Vespula spp.*)

BALDFACED OR WHITE FACED HORNET

(*Dolichovespula maculata*)

YELLOW HORNET (*Dolichovespula arenaria*)

FIRE ANT (*Solenopsis spp.*)

HARVESTER ANT (*Pogonomyrmex spp.*)

Many people do not recognize these various insects and call any stinging insect a "bee." Because there are only five "bees" (and two ants) that are of most concern in insect-related allergies, an effort should be made by everyone to learn to distinguish them from other common insects. Proper identification of the insect that stung is important information for the allergist who must treat a specific insect allergy. Ideally, the allergic patient will be able to kill the offending insect and bring the specimen to the medical consultation. The specimen (or fragments of it) should be placed in a small container of alcohol (any type will do), and labelled with date and location of capture, and captor's name. If the type and location of the nest can be described, this is also helpful. If the patient or physician is not able to identify the specimen, it can be sent to a university entomology department, a science museum, or the Smithsonian Institution.

WHAT ARE INSECT ALLERGIES?

Frazier and Brown (1980) described an allergy as "an abnormal reaction to substances most people tolerate without problems." Lockey and Bukantz (1987) stated that allergy is "the concept that after the first encounter with a foreign substance, the specific responsiveness changes and the reaction to the foreign substance is ...increased (hypersensitivity)..." *Hypersensitive* and *allergic* are often used synonymously to describe this exaggerated response which can lead to various types of tissue damage. About 80% of the population show allergies to substances in the environment, of which only about 1 to 4% show insect-venom hypersensitivity.

Most persons have a normal reaction to insect stings, experiencing a few symptoms in the immediate site of the sting. These may include redness, itching, swelling, and a little pain, lasting a short time. In a more serious local reaction there is more pain, itching and swelling at the site of the sting and in areas surrounding it, perhaps lasting several days. There may be hives and some asthma-like symptoms. This exaggerated type of local reaction should be reported to a physician.

In a severe *allergic* reaction, the symptoms move away from the sting site and can involve the whole body. The process is apt to begin quickly after the insect sting occurs. Some or all of the following symptoms may occur in the victim: generalized hives, swelling of the lips or tongue,

wheezing and difficulty in breathing, nausea, weakness, gastrointestinal involvement such as stomach cramps and subjective symptoms such as confusion. In the most extreme, life-threatening situations, there is a generalized systemic response of anaphylactic shock, with a drop in blood pressure and unconsciousness. Usually such victims have a history of a previous exaggerated or severe reaction to a sting, and death may occur within minutes without medical intervention. Studies indicate there are one to two million systemic reactions to insect bites in the U.S. each year. Fortunately, fewer than 100 known deaths occur, indicating that a fatal outcome is indeed rare (Frazier and Brown 1980; Valentine, 1984, 1987; Schwartz 1984; American Academy of Allergy and Immunology, undated).

Allergies are closely tied to the immune system, which defends us against invading disease organisms and other foreign substances. In a normally-functioning immune system, the body reacts to the foreign substance (called the *antigen*, or in the case of allergies, the *allergen*) by manufacturing *antibodies* to suppress the substance. Antigens and antibodies are specific to one another and react because they have matching sites at the molecular level. Their physical/chemical structures have been described as fitting together like a lock and key.

Antibodies are also called *immunoglobulins*. Immunoglobulin E (IgE) is the antibody most closely associated with allergies. It is the nature of IgE to cause havoc in allergic individuals rather than to protect them from allergens.

What actually happens in an extreme case of insect allergy? It is believed that the patient's immune system reacts to the first insect bite by manufacturing antibodies (IgE) specific to the allergen (insect venom). The IgE antibodies attach themselves to the surface of mast cells, skin cells which contain high concentrations of the chemical, histamine. When the patient is stung again by the same type of insect, the venom reacts with the specific IgE present on the patient's mast cells, and sets into motion reactions that damage the body. Rather than suppress the allergen, IgE "mediates" the release of histamine and other substances into the circulation, and it is these substances that cause tissue damage and help bring on the acute life-threatening symptoms of insect allergies (Townley 1987; Valentine 1987).

WHO IS AT RISK?

Adults over 40 who had a severe reaction to a sting (such as a drop in blood pressure) are at highest risk of anaphylactic shock from repeat stings, according to Valentine (1987). The first sting sensitized the victim to the insect's venom, and a subsequent sting may be life-threatening.

Sometimes patients show a bad reaction to what they claim was the first sting they've ever had. Probably these individuals forgot they were once stung as a child, or they have been sensitized passively by contact with insect hairs, scales, or other insect debris in the air, food or water (Frazier and Brown 1980).

Persons with a history of a systemic reaction are usually given skin tests, in which drops of diluted venoms are

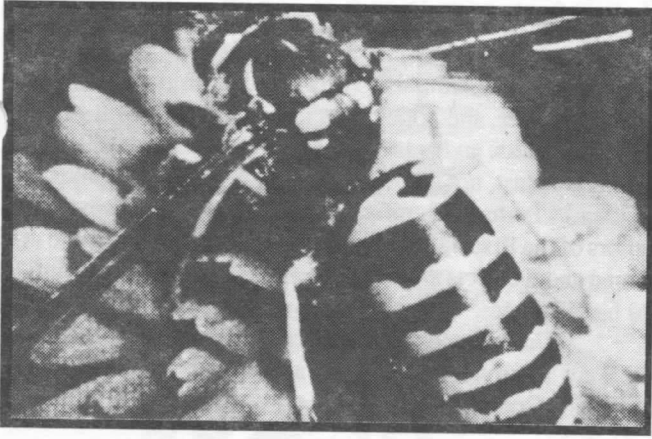


Fig.4. Hornets (*Dolichovespula spp.*) are the most aggressive of the stinging insects, and may sting their victims multiple times. (Photo: American Academy of Allergy and Immunology.)

injected under the skin. (Currently there are five available venoms—from honey bees, two hornets, *Polistes* wasps, and yellow jackets. Bumble bee venom is not available because this insect is a minor problem in these allergies; and venoms of fire and harvester ants are not available for testing.) If positive, the skin tests help to confirm that the patient is allergic to the specific venom that tested positively. A local skin reaction also gives the physician an indication of which venom to use for immunotherapy. (A person allergic to honeybees will not necessarily be allergic to yellow jackets).

However, as in any area of medicine, there are exceptions to the rules! Not everyone with a history of a systemic reaction will have a positive skin test. And, the sensitivity of a patient to skin tests does not indicate whether or not anaphylaxis will occur on a subsequent sting (Lichtenstein, *et al.*, 1979). Moreover, there is known cross-reactivity between some of the different venoms, confusing the allergist who is trying to choose the culprit insect (Reisman 1985; Richman and Baer 1986). If the treatment of insect allergies sounds complex and not always precise, this is true. Yet, there have been giant strides in this field in recent years which should encourage anyone with known allergies.

Studies are continuing to help identify those with milder allergies but who may also have the potential to react violently when stung. It is sometimes difficult for the allergist to decide whether or not a person is at great enough risk to undergo immunotherapy, which is expensive, time-consuming, and has a small risk of causing a reaction. Insect allergies in children are being given particular scrutiny, since children often lose an allergy spontaneously, and their second reaction is seldom worse than the first. Adults who have a severe first reaction to an insect sting have a 60% chance of a repeat reaction when stung again (Valentine 1987). In children, the rate of repeat reactions is much lower and the incidence of death from insect-allergies is extremely low in the young.

What *can* be stated, is that persons who have a severe reaction to a sting, and a significant positive venom skin test,

are considered definite candidates for immunotherapy. At The Johns Hopkins University School of Medicine, where an insect-venom vaccine was developed, both adults and children with this profile are routinely immunized. There is a 95-97% protection rate against anaphylaxis with future stings when immunotherapy is carried out. An exaggerated local reaction does not indicate immunotherapy to Hymenoptera (Lichtenstein *et al.* 1979; Yunginger 1987; Valentine 1987).

LONG-TERM MANAGEMENT OF INSECT ALLERGIES

In the past, persons undergoing immunotherapy were given whole-body extracts of stinging insects, and were not always fully-protected from later stings. Current experts go so far as to state this method was "clinically and immunologically ineffective" (Reisman 1985). After methods were developed to extract pure venom from insects, immunization procedures became routinely effective. Persons in immunotherapy now receive a series of injections of purified venom for several months, and then periodic "booster" injections of venom indefinitely. When patients are given venom vaccine, a protective antibody, *Immunoglobulin G (IgG)* forms, specific to the allergen. This IgG helps prevent reactions to stings by overcoming the harmful effects of *IgE*. IgG is relatively short-lived, however, which is why booster doses of vaccine must be given indefinitely (Valentine, 1984, 1987).

The *IgE* antibodies in the patient's serum are the antibodies that maintain a sensitivity to insect venom. Some individuals who had a systemic reaction will lose their sensitivity spontaneously, and are no longer at risk unless re-sensitized by a sting. Although IgE is responsible for the patient's reaction to insect venom, allergists have not been able to determine a simple relationship between the level of IgE antibody and the severity of the clinical reaction (Reisman 1985).

At Johns Hopkins, more than 300 insect-allergic patients have been part of a significant study in which they were immunized and then "challenged" with an in-hospital sting of the offending insect. Less than 2% of these patients had symptoms that required any treatment following the challenge sting (Lichtenstein *et al.*, 1979). The remarkable, almost 100%-success rate of immunotherapy, should be reassuring to anyone with severe insect allergies.

Although immunotherapy to protect individuals from the stings of honey bees, wasps, hornets and yellow jackets is most commonly discussed, it is also possible to obtain immunization to ant venom if an allergy to fire ants (especially the imported species) or harvester ants has been demonstrated. Ant stings commonly cause large local reactions, and a few deaths have been recorded following anaphylactic reactions. Pure ant venoms are not yet available, however, and whole-body extracts are used for ant immunotherapy. (American Academy of Allergy and Immunology, undated). Because imported fire ants are most common in the Southern states, they are expected to present a greater clinical problem as the human population increases in the Sun Belt.

Many physicians prescribe an insect-sting kit for severely-allergic patients which includes injectable epineph-

rine, an emergency measure in anaphylaxis. For such individuals, it might be wise to invest in three kits—one for home, one for the car, and one to keep on one's person at all times. (There may not be time to go back into the house if a sting occurs.) Another practical idea is for the allergic person to wear a medical tag to inform a physician of the insect allergy should unconsciousness occur after a sting. Information on obtaining tags is available from the Medic Alert Foundation, Turlock, CA 95380. Most pharmacies can also help you obtain the tags, as well as insect-sting kits. Be sure to follow your physician's directions carefully for the use of kits. It is also a good idea to read over the instructions each spring as insects start to become active again.

WHAT YOU SHOULD DO IF STUNG

If you are under the care of an allergist for a known insect allergy, you have likely been given directions on how to use an insect-allergy kit if a sting occurs. Anyone who begins to have severe symptoms should call for an emergency vehicle or have someone drive them to the nearest physician's office or emergency room (never try to drive yourself). If there is a stinger in place, scrape it out with a knife or your fingernail (it keeps pumping venom for several minutes while in place, and immediate removal may lessen your symptoms. Do not squeeze it between thumb and forefinger as that will inject more venom).

If you have no known allergy and experience only a local reaction to a sting, scrape out any stinger as described above, and wash the area well with soap and water. An ice pack can be used for swelling, and some people find a paste of baking soda and water to be soothing. The irritation of "normal" reactions to a sting should disappear within a few hours. Do not overlook a "delayed reaction" that occurs later, particularly if swelling extends to two or more joints. Treat this situation as an EMERGENCY and consult a physician.

Multiple stings by a number of insects, such as might occur if someone steps into a fire-ant mound, mobilizing dozens of ants, or disturbs a hornet's nest, is a serious situation for a non-allergic person, as well as the allergic individual who has been immunized and would ordinarily be protected from a single sting. Immediate medical attention is required.

BENEFICIAL ACTIVITIES OF HYMENOPTERA

Several recent surveys of urban residents showed that about half of those interviewed either disliked or were afraid of arthropods encountered outdoors. In one survey, 50% of the respondents liked some arthropods, in the following order of preference: ladybugs, butterflies, praying mantids, bees, spiders, grasshoppers, crickets, and dragonflies. It is surprising that bees—with the potential to sting—rated higher than dragonflies, which are perfectly harmless to people. Among the reasons given for liking the insects named were, (they are) "fascinating," "lucky," "colorful," "a part of life," "cause no personal harm" (Levenson and Frankie 1983). A second survey found that 72% of those interviewed were aware of some of the beneficial insects (Bennett *et al.*, 1983). In a third

survey, only 6% admitted they liked some outdoor insects (Byrne *et al.*, 1984), and in this survey, the respondents were asked to rate nine animals. After the bald eagle, butterflies, ladybird beetles, and honey bees rated 2, 3, and 4, but garden spiders, crickets, and ants rated lower than a skunk. (Scorpions came in last, not surprising since the survey was taken in Arizona.) Perhaps significant to all of these surveys, the authors of the first study proposed that if people were more informed about insects they might be more aware of both helpful and harmful ones. (See also Barrows *et al.*, 1983).

What are specific beneficial values of Hymenoptera that may improve their image among all urban/suburban residents? Consider the following:

- Insects pollinate the flowers of many plant species important to humans, such as fruits, legumes, vegetables, and ornamental flowers. Honey bees accomplish 80% of insect pollination (Vansell and Griggs 1952), but bumble bees, wasps, and ants are also pollinators, ensuring the production of fruit and seeds of many types of plants.
- Many of the Hymenoptera prey on other insects, an important natural control of insect populations. Ants are among the leading predators of insects in most terrestrial habitats (Wilson 1985). Wasps feed primarily on other insects (Bishopp 1952), and the larvae of *Polistes* (paper wasp) are fed caterpillars which harm crops. (In fact, where nest boxes were installed experimentally in cabbage plots to provide shelters for wasp nests, there was significant reduction in damage from the cabbageworm, *Pieris rapae*, larvae). Yellow jackets extract juices from soft-bodied insects and feed this to their young (Bishopp 1952; Wilson 1985; Redmond 1984).
- Honey bees produce honey, a favorite food of humans.
- Fire ants and harvester ants turn over soil in building their mounds. Like earthworms, ants aerate the soil and make it pervious to water. There may be hundreds of colonies per hectare, each of 100,000 or more ants, which has a significant effect on soil quality.
- Hymenoptera are part of the food chain in urban ecology. Ants are a major source of food for the Northern flicker (*Colaptes auratus*); praying mantids capture and eat honey bees; small mammals such as voles are insectivorous, as are amphibians such as frogs and toads, and are likely consumers of some of the stinging insects.
- Hymenoptera are excellent study subjects for schools, youth groups, nature centers, museums, etc. Casual observers can gain an appreciation and understanding of the insects in a non-threatening setting such as observing a working bee hive behind glass.

A QUICK OVER-VIEW OF STINGING-INSECT LIFE CYCLES

Bees, wasps and ants are called "social insects," and

HONEY BEE

Only the female stings. She has a squat hairy body with bright yellow or black markings and is generally found around flowers or blooming plants, particularly clover. Like most stinging insects, the honeybee is attracted to bright colored clothing. Her stings are the easiest to identify because her barb-shaped stinger usually remains in the victim's skin when she pulls away or is brushed off.



YELLOW JACKET

The body of the Yellow Jacket is similar in shape to the hornet, but is smaller with bright yellow and black markings. The nest is composed of paper cells like that of the wasp, but it is completely enclosed except for a small opening. They are usually built in the ground, in piles of lumber, or in compost heaps.



HORNET

These insects are usually larger in size than most other stinging insects of the same family. Their black body with either yellow or white markings is distinguished by a narrow, thin waist and a shortened abdomen. Their nests which are oval in shape may be found in trees or shrubbery either in wooded or open areas.

WASP

The most notable feature of all wasps is the narrow pinched waist which separates the upper chest area from a cigar-shaped abdomen. Most wasps are nearly hairless and are black, brown or red in color. They usually build their nests under eaves and attics. The nest itself is a horizontal comb of paper cells with the under side completely exposed.

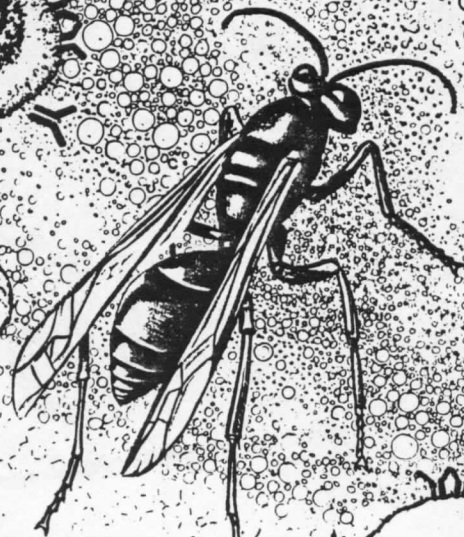


Figure 3. A chart of the common stinging insects (Courtesy of Pharmacia Diagnostics)

are usually part of colonies that are populous and highly-organized. Wilson (1985) feels this high degree of organization is the source of their ecological success.

Colony members are differentiated into physical castes that determine their function within the group. Within the worker caste, there is a progression of the infertile female workers through different types of jobs as they age. The usual sequence is that at first the worker has tasks inside the nest, caring for the eggs and developing young, or for the queen. Next, it helps to build or repair the nest. The next task is to defend the nest; and finally, it forages for food outside the nest.

Honey bees form large, perennial colonies of up to 65,000 workers, building nests of beeswax, mostly in man-made hives.

Hornets, yellow jackets, and *Polistes*, all build paper-like nests, either in the ground, in shrubs and trees, and/or in or on human dwellings.

In North America, the colonies are annual. A single, over-wintering queen initiates a colony in the spring, accomplishing all the tasks herself until the first workers emerge. The queen then "retires" to a summer of egg-laying. In late summer, reproductive males and females are produced and the females soon seek individual wintering sites. The remaining workers, the males, and the old queen do not survive the winter. *Polistes* wasps do not have a caste system, however. Fertile females live cooperatively in the nest, with one becoming the dominant queen. Un-fertilized eggs produce fertile *Polistes* males.

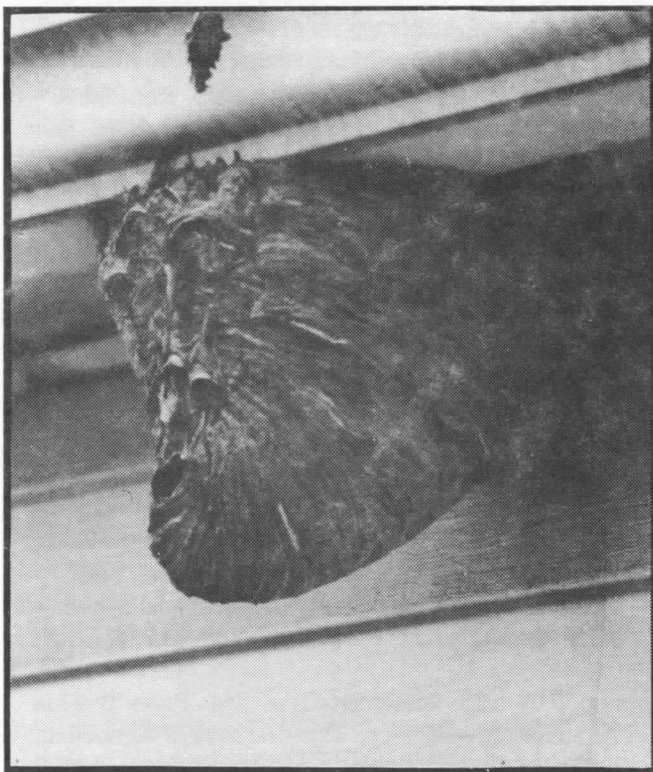


Fig. 5. The large, football-shaped nest of the bald-faced hornet (*Dolichovespula maculata*) is always found in the open, suspended from a tree, shrub, or building. (Photo: Mark Raab, Howard County, MD, Dept. of Recreation and Parks)

The role of bumble bees is minimal in causing insect allergies, because they are not aggressive and sting only when the nest is disturbed. They produce small colonies (50-250 workers), often using underground abandoned rodent nests, and they have an annual life cycle like true wasps.

The stinging apparatus is most useful toward the end of the worker insect's life cycle. It is used defensively to protect the colony from predators, and offensively to obtain food prey. The Hymenoptera are capable of multiple stings, with one exception. When a honey bee stings a human, the barbed end of the stinger cannot be withdrawn and the bee leaves the stinger in the victim, losing its own life. The honey bee can sting other insects, however, without losing its stinger. A honey bee is generally docile and stings only when provoked. Multiple wasp stings are unusual, because *Polistes* is mostly active at night, and is also more tolerant of human presence than the other Hymenoptera. Spoczynska (1975) points out that to cause a wasp to sting in self-defense, "someone or something must actively interfere with it." Yellow jackets and hornets are the most pugnacious of the stinging insects and multiple stings are common. Honey bees and yellow jackets are implicated most frequently in human stings, perhaps because they occur more frequently in areas of human activity.

COMMON-SENSE SUGGESTIONS TO AVOID STINGING INSECTS:

- If picnicking in warm weather cover all food containers; do not bring sweetened juices or sodas (wasps commonly crawl into opened cans, inflicting stings around the mouth of the unwary drinker); outdoor cooking areas are likely to attract insects; keep trash containers and garbage cans clean and covered.
- Persons with insect allergies, or persons wishing to avoid stinging insects should not do yard work such as mowing lawns, pruning shrubs and trees, cutting tall weeds, stacking logs or rock piles, etc. Also be wary around flower beds and flowering trees and shrubs. Using paint outdoors may bring Hymenoptera to the area.
- Stay out of orchards where overripe fruit may be underfoot; avoid clover fields, a favorite foraging area for bees.
- Do not apply perfume, after-shave lotion, hair spray, suntan lotion, or other scented cosmetic products before going outdoors.
- In summer, avoid bright colors and blacks in clothing, wearing khaki, white, or pale green garments; wear long sleeves and long pants when likely to encounter Hymenoptera. Never go bare-footed or even in sandals outside, if you are hypersensitive.
- If an insect gets into your car while driving, stop and get

out, leaving doors and windows open (insects usually fly toward a source of light). If you are hypersensitive, carry an insect-sting kit and an aerosol can of insect-spray in the glove compartment.

- Avoid areas close to ponds, birdbaths, puddles, and dripping hoses where paper-making wasps (*Polistes* spp.) are likely to collect water used to make paper from wood for their hives.

- Ask a non-allergic family member or friend to knock down wasp nests from under house eaves or from walls, using a broom handle. Do not stay in the area while this is being done. Search for new hives weekly during warm weather. Insects sometimes build hives behind vines growing on buildings

- If you discover yellow-jackets nesting in the ground and you want to destroy them, cover the area with a transparent bowl at night; they will not be able to escape and will soon starve to death. Search for a commonly-found second opening to the nest. An alternate suggestion is to drop several mothballs at the hole entrance after dark. Use a flashlight covered with red or blue translucent paper, so the insects are not mobilized.

- Have large hornets' nests in tree branches removed by professional exterminators.

- Screen vents and other entrances to attics and crawl spaces in your home where insects could hibernate in cold weather. Screen windows and doors of your home. Inspect regularly to ensure that screen is intact.

- When stinging insects approach, do not wave your arms or start to run, as movement may irritate insects. Retreat slowly and cautiously, keeping calm, with no sudden movements. If retreat is impossible, lie face down and cover head with arms.

- Avoid ant hills and ant mounds. Fire ants are most common in the South, the Gulf states to the west coast, and north to British Columbia. The range of the harvester ant is the Southwest.

- Perhaps most importantly, learn to recognize the common stinging Hymenoptera.

(Adapted from Frazier 1978, Frazier and Brown, 1980; Milne and Milne 1980, and Schwartz, 1984).

CONCLUSIONS

(1) Bees, wasps and ants—members of the taxonomic Order, Hymenoptera, occur frequently in urban/suburban habitats near and in human dwellings, and in parks and recreational areas.

(2) The stinging insects have a beneficial role in urban ecology, including pollination of flowering plants, and predation on insect pests.

(3) About 0.04 to 4% of the U.S. population is severely allergic to insect venom, but hypersensitive people can lead normal lives after immunotherapy is begun.

(4) Common-sense behavior will avoid many encounters with stinging insects.

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NOTES:

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URBAN WILDLIFE MANAGER'S NOTEBOOK—14

URBAN REFUGES I: HIGH-RISE WILDLIFE GARDENS

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INTRODUCTION

Some cities recognized early in their development the value of setting aside large parks and open space areas for the benefit of residents. While such green areas are important to urbanites, studies reviewed by Leedy *et al.* (1978) have shown that apartment-dwellers use adjacent open space less often than do residents of single-family homes adjacent to open space. Yet, apartment dwellers are probably in most need of relief from the city's environmental ills—the noise, crowding, and lack of aesthetics that exist in any city. Where there are gardens associated with apartments, city living is made more tolerable. Such gardens exist on roofs, terraces, balconies, in window boxes, and on window ledges, and can be found in all large cities. "High-rise"



Fig. 1. Window boxes project out over a canal in Venice, Italy. (Photo: W. F. Dove).



Fig. 2. A bird's-eye view of a Manhattan roof garden. (Photo: Jonathan Atkin., Reprinted by permission, *National Geographic WORLD*, © 1988 National Geographic Society.)

gardens, gardens that are above ground level, use space that would otherwise be wasted, and appear to offer both physical and mental health benefits to the people who use them.

Trees and shrubs in high-rise gardens help act as buffers against noise, and modify the effects of temperature and wind conditions. Because plants filter dust, chemicals, and other pollutants from the air, roof-top plantings are encouraged in many countries to help counteract urban pollution. A study of the health of apartment dwellers showed that residents of conventional high-rise buildings (without terrace gardens) were more susceptible to illness (Oeter 1971, 1974 in Bernatzky 1975). Certainly, these gardens beautify the surroundings, and bring pleasure and recreation to their owners. City dwellers with gardens look forward to returning to these oases to relax at the end of the day.

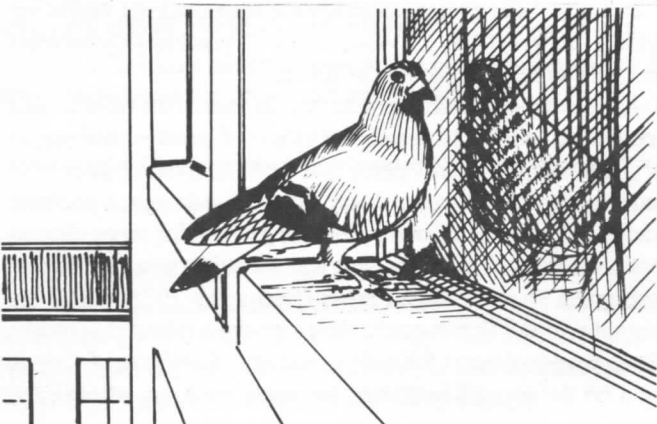
Garland (1974) has described the city roof as "the garden of the future," and in some European countries, architects already include roof-gardens and balconies as amenities for city housing. Seventy percent of the built-over surface in one Swedish town includes such outdoor areas. More than a decade ago, a member of the German Academy of Towns and Country Planning called for more stepped terrace housing blocks, where each dwelling unit was allotted a small garden, as a method to increase green space in urban areas (Bernatzky 1975). In West Germany today, it is not unusual to see garden areas on the roofs of downtown buildings to provide recreational areas for office workers. Residents of Tokyo, Japan, have gardened on the tops of buildings for years, in a city of crowded

housing conditions, and with few parks and greenspaces. In the U.S., our most populated metropolis, New York City, is acknowledged as the "capital" of roof gardening. However, there are gardens located on buildings all over the country, from the Ritz Hotel in Boston to the Kaiser Center in Oakland, California. Their popularity is growing as land becomes costlier and more scarce in heavily-developed areas.

For city dwellers who derive pleasure from viewing wildlife, high-rise gardens can be planned to attract some types of urban wildlife. It may surprise you to learn that wildlife is attracted to a tiny green area in a large city! In fact, wildlife that finds a city garden will return if the area provides one or more of its basic requirements—food, cover, water, and living space. The animals may be residents of the area such as the ubiquitous house sparrow, but also some of the migrating birds and butterflies that pass through our largest cities may stopover to rest and feed. In New York City, the greatest variety of species is seen during migration seasons. Of the more than 250 species of birds that have been recorded in Manhattan's Central Park, the majority were during migration. Forty or more butterfly species also migrate through the New York area (Garber 1987). Sometimes unusual weather conditions will divert nonresident wildlife into a city, and anyone ready with a "minirefuge" in a city garden, will benefit by seeing the wildlife that shows up in the neighborhood. It has even been suggested that roof-top refuges could be used to place and protect endangered species, such as herptiles, that are suffering due to the loss of urban habitat.

Wildlife managers are familiar with the importance of providing protective vegetative cover for wildlife as it moves through an area. A high-rise garden may be a link in a city-wide network of green spaces for wildlife. According to Leedy *et al.* (1978) the "string-of-pearls" effect of linked open space areas encourages retention of the area's wildlife species. The closer you live to other rooftop gardens and to major parks, the better your opportunity to attract a diversity of wildlife species through this "linked" effect.

If you are a city dweller, perhaps this Notebook will give you some new insights into plants and animals in urban areas. If you have an outdoor area attached to your high-rise property, or if you garden in a confined space at ground level, consider planting it to attract wildlife as well as to beautify your surroundings. The aim of a high-rise wildlife garden should be to design an area that will make city living more tolerable for you and wildlife.



WHAT'S NEEDED?

- Permission from the landlord or building superintendent to have a garden.
- A flat or gently-sloped roof, or a balcony, or terrace, that will support the extra weight of soil, containers, and people.
- A design scheme, including a list of plants to be used.
- Containers.
- Soil mixes.
- A source of water.

Why landlord permission?

The landlord or building supervisor must be consulted to determine if outdoor plantings are allowed on the building. Building codes may forbid adding weight to the roof, or there may be a required building inspection before significant weight is added. New buildings are often designed to accommodate extra weight added to the roof or balcony, but older buildings may not have been.

If the structural integrity of the building has been established, and there is resistance to your idea, try using the argument that roofscaping is good for the building. Soil and plants increase the roof insulation, stabilizing the effects of temperature on roof structure. A garden also adds to the value of the real estate, by providing an "extra room" for residents, and a safe place for families to take their children.

Is the roof really strong enough?

It is probably important to have an architect or structural engineer evaluate the potential roof garden area, if planting is to be extensive, even if the superintendent gives you the go-ahead. According to Fenyvesi (1984), a concrete slab can support a load of 40 pounds per square foot. A wood framework covered with metal sheeting can support no more than 30 pounds per square foot. The areas that can support the most weight such as large containers planted with trees are those over load-bearing walls, preferably brick. In order to distribute weight safely over the walls, and to protect the roof surface, many professionals will recommend that a wooden deck be built over a structure of pressure-treated beams. This base also makes it easy to anchor railings, screens, trellises, and built-in plant containers that you may wish to add later. A wooden deck is also more attractive than a plain concrete or tar roof to use as an extension of your living space.

Of course, this extra construction adds considerably to the cost of your once-simple plan to add a few plants outside your apartment window. It is not necessary if expert opinion has convinced you that the surface will support the extra weight, and you are satisfied with its appearance.

A design scheme

In a small space, your planting design must be constricted and easy to maintain. It must take into account the *physical aspects of the site*:

- (1) How much space is available? Is the area long and narrow, and only suitable for planters attached to railings?
- (2) How much light is available? Would floor containers, window boxes and hanging baskets be in partial or full sun during the day?

(3) Is solar radiation reflected by nearby structures, increasing the temperature on your rooftop?

(4) Are the wind conditions extreme, requiring screening plants or structural screens?

(5) Must large containers be located in a specific location to support their weight (i.e. over a load-bearing wall)?

(6) What is the view beyond your garden site? Are there buildings, or dreary pipes or chimneys that you wish to camouflage? Your answers to these questions will influence your choice of plants and where you locate them.

How to plan your garden design:

(1) *Your aim is to create a small outdoor "room."* The boundaries of your "room" are the railings, walls, screens, or fencing on each side of the rooftop, balcony or terrace. (Note: Some sort of guard-railing, fencing, or parapet, is important for your safety and privacy, in any area you plan to garden.) By using all of the boundaries as potential gardening areas, you maximize the space available to you.

(2) As in any garden, *trees and shrubs are used as the "backbone" of your garden design.* In a high-rise garden, gardening must be carried out in containers, and it is easy to move the containers around to work out a design. Trees and shrubs can be grouped together or placed individually for the best effect. Trees give height to the design and cast shade, which is often welcomed. Shrubs are useful as windbreaks and screens, and as a background which can be enhanced by the addition of flowering plants. Most trees and shrubs provide some cover for wildlife. Those plants that bear seeds, nuts, fruits, or nectar will provide food for various types of wildlife. The section on *Choosing Plants*, and Tables 2 and 3, below, will help you select appropriate plants to attract wildlife, after you have determined your site conditions.

(3) After trees and shrubs, *additional plants are added to fill in spaces.* Annual and perennial flowering plants may be grown at the base of trees and shrubs, or in separate containers. Quick-growing vines will twine around poles and chimneys and help camouflage these undesirable features. Vines also can be grown as screens against unattractive walls, balcony dividers, or along railings. "Espaliered" trees and shrubs may be trained to grow in unusual configurations, for instance, flat against a wall. In a narrow space, they help create a sense of depth. Espaliered trees also allow rooftop cultivation of species that would ordinarily be too large or too spreading, such as fruit trees. Table 4, below, lists some wildlife-attractive plants that lend themselves to espalier.

(4) *A source of water for wildlife* can be incorporated as part of the design. Providing water for wildlife is as important as a careful selection of plants, and in large rooftop gardens, a birdbath or a pond is feasible. (See the National Institute for Urban Wildlife's *A simple backyard pond*, for information on using preformed containers in lightweight materials to create ponds.) For smaller terraces and balconies, water can be offered in small dishes placed in a window box, or in a hanging container.

Table 1. "Space-Savers" in City Gardens

- An old-fashioned trellis to support climbing plants
- Trellis, also used as a privacy screen
- Espaliered plants against walls
- Window box on edge of railing, out over street
- Branches trained out past railing, over street
- "Weeping" trees (they grow down, useful on balcony with overhead ceiling)
- Dwarf varieties of trees & shrubs
- Hanging baskets
- Annuals placed in larger container with tree or shrub
- Vegetables interplanted with tree, shrub, or annuals

(5) Unless space forbids it, *a bench or chairs* should be part of the garden design for the human occupants. An adjustable awning may be useful to protect plants and people from intense sun.

Containers

High-rise gardening is gardening in containers. There are gardens to be found where truck-loads of soil have been carried up to cover an entire roof. A series of London roof-gardens, built on top of a seven-story department store in 1938, contains a base of gravel and 30 inches of topsoil. In five decades, 5,000 plant species have been added and trees, shrubs, vines, and a stream attract countless birdlife. It's a wonderful place to visit, but not applicable to your situation! Your roof, terrace, or balcony cannot be approached as if it were a country estate, or even a suburban backyard.

Still, you can do some remarkable things in a very small space. Baines (1985) described a terrace garden in Holland of just a few square feet in which the owner had created three habitats in miniature in concrete tubs—a sand dune, a chalk grassland and an acid bog. By providing the right soil and drainage conditions, he was able to grow the appropriate wildflowers for each type of community.

For ordinary roof gardens, there are many possibilities from which to choose plants to create your ideal habitat. You may wish to begin by choosing interesting and suitable containers. A container should be attractive, but durable in the local weather conditions. In northern winters, the container must not crack when soil freezes and thaws. In Southwestern desert conditions, it must tolerate extreme heat. In windy conditions, it must be heavy enough when filled with soil so it is not blown over. It should be between six inches (15 cm) and two feet (61 cm) in width, and have good drainage to prevent root-rot.

Large tub planters are used to grow trees and large shrubs. They should hold soil to a depth of at least two feet (30 cm) to allow root development. Tub planters are typically available as circular or square redwood tubs, nail kegs, concrete urns, and ceramic containers. In the north, oak casks (cut in half), seem to withstand the winters well. On the West Coast, Japanese soy tubs are popular tub containers.

Long rectangular wooden floor planters, suitable for small shrubs, annuals and perennials, can be bought or made. Window boxes come in wood, concrete, metal, or plastic, or you can build your own. Window boxes are most appropriate for annual flowering plants and vines, although some gardeners use them for more permanent perennials and small shrubs where the winters are mild.

If you decide to construct wooden floor planters and window boxes yourself, use one-inch (2.5 cm) lumber of pine, red cedar, Douglas fir, or redwood. The average floor planter is 12 in (31 cm) wide X 12 in (31 cm) deep X 36 in (91 cm) long. A floor planter up to 60 in long (152 cm) is practical where there is adequate floor space. Window boxes average 6-8 in (15-20 cm) wide and deep, and 24-36 in (61-91 cm) long. If you use pine, it must be treated with a wood preservative, painted (with a light color), or stained and varnished. Drill several drainage holes in the bottom of the planter. The average life of wooden containers is seven years (Truex 1964).

Other types of containers that may be used for small plants include glazed or unglazed ceramic pots and dishes, molded metal containers, fiberglass planters, strawberry pots, plastic or wire hanging baskets, or even rocks and pieces of driftwood with crevices.

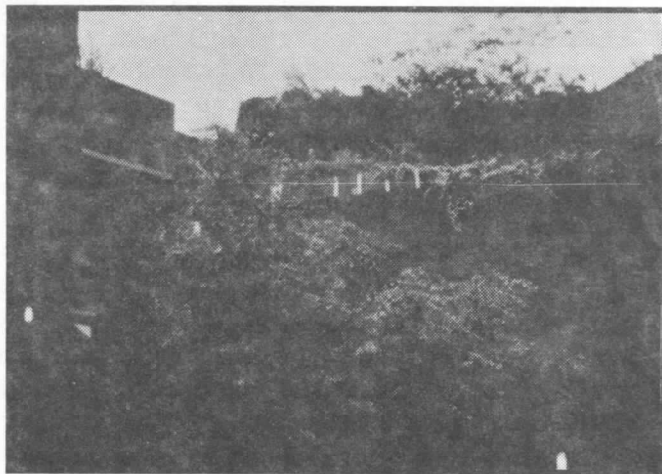


Fig. 3. The Odham's Walk housing development in London won a landscaping award for its multi-level vegetation design. Although not planned specifically for wildlife, some birds use the "high - rise" gardens. (Photo: L.W. Adams)

Truex (1964) discussed in detail the possibility of building permanent masonry retaining walls to form raised planting beds in roof and terrace gardens. These beds are able to contain soil to a depth at which root development of large trees is a possibility, and where additional extensive plantings can be carried out. However, their construction involves hauling in concrete, bricks or concrete blocks, large amounts of soil, and sizable trees and shrubs. Although such a project is beyond the scope of this Notebook, those with the space and resources should seek professional advice if they are interested in creating permanent, raised planting beds.

Otherwise, on terraces and rooftops, use large planters that rest on the floor to contain small trees, shrubs, and most vines. Plant perennial and annual flowers around the periphery of the containers, as well as in smaller floor and window boxes. Hanging baskets are best used for annuals and vines that are discarded at the end of the season. Generally, balconies are too small for planters to occupy floor space, unless one fits in a corner or at the end of a long narrow balcony. Window boxes and hanging baskets are the rule on balconies, but their placement needs special mention. Because they look out of place on the floor, always mount them at a higher level. On a large window sill or a balcony railing, use two small window boxes rather than one large one, because of the difficulty of anchoring the structure. Plants usually thrive in window boxes because they are exposed to good light, rain, and air circulation on all sides. Space-stretching ideas for using a variety of plantings in small areas are found in Table 1, above.

Raise any planter or tub slightly above the floor, to allow water to drain away and to facilitate air circulation. To raise the container, space bricks under it [use three bricks per round tub, and one brick every 2 ft (61 cm) under a rectangular planter box, to prevent sagging]. Tiles, pieces of wood painted with a preservative, or other suitable supports can be substituted for bricks.

Water

Plants tend to dry out more quickly on rooftops than at street level, because of the windy conditions, sunlight, and increased air circulation. You may need to water your plantings daily, especially in summer. Experts seem to agree that early morning is the best time to water.

Getting water to a rooftop garden can be tricky. An outdoor spigot is ideal, but expensive to install. With great effort, you can haul water from indoors, but outdoor watering will be simpler if you can run a hose from a kitchen or bathroom faucet through a window, door, or hatch, to the garden. A "snap coupler" purchased at a hardware or plumbing supply store provides screw threads for the hose-sink attachment (see Nelson and Nelson 1981, for details).

Drainage from containers should run off to an appropriate collection area, not to the downstairs balcony or apartment. If your apartment house has tiered balconies, no rain nor snow will reach outdoor plants sheltered by the balcony above, and it will be necessary to water plants year-round.

If you go on vacation during the growing season, you may wish to invest in the "Hydromat Watering System" to automatically water up to 50 potted plants at once, from an outdoor faucet. This drip system can also be used on a regular basis to deliver a consistent amount of water and fertilizer to your plants. For information on this product, contact the Gardener's Supply Company, 128 Intervale Road, Burlington, VT 05401, [802] 863-1700.

Soil Mixes

All-purpose potting soil can be purchased ready to use, or you can mix bulk quantities yourself. The neutral mix given below can be adjusted with lime for alkaline-loving plants, or dried cow manure for acid-loving plants.

POTTING SOIL MIX IN BULK
(Roscoe, in Mitchell 1985)

12 cubic ft. sphagnum peat moss
6 cubic feet vermiculite
6 lb. 5-10-5 fertilizer
6 cubic feet perlite
2 lb. superphosphate
5 lb. ground limestone

Mix well 4 times

Filling Containers

Fill containers before you bring home your plants. The following suggestions should make the task easier:

- At the bottom of the container, place shards (pieces of broken, clay flower pots) over the drainage holes so that the concave side of the shard is down. Shards are inexpensive to obtain—if you don't have any broken pots, buy several and break them up for this purpose.
- Place a 1 in (2.5 cm) layer of sphagnum moss or peat moss over the shards, to prevent loss of soil and nutrients, and to conserve moisture when water drains.
- Place soil mix next. For balled trees and shrubs, fill container half-full. For herbaceous plants (flowers, vines), fill to brim of container.
- Place balled tree or shrub in container and adjust soil level in container so upper soil surface of the ball will rest approximately 2 in (5 cm) below the top of the planter (at the level of the planter's soil surface).
- Add soil around ball until two-third's covered; make sure tree is upright; cut cord around ball and fold back burlap.
- Fill with soil to 4 in (10 cm) below top of container, and pack soil with fist or your foot.
- Water well; add loose soil to 2 in (5 cm) of top.
- Add a mulch on top (gravel, wood chips, peat moss) to conserve moisture.
- Support tree if exposed to winds.

Choosing plants

When buying plants for a garden, be certain they are hardy for your locality. Experienced gardeners are familiar with the climate zones by which the U.S. Department of Agriculture has classified plants according to their winter-hardiness. Because of the more shallow root systems in containers, and the drying effects of winds, one should subtract one climate zone for container-grown plants. Thus, while New York City is situated in Zone 7a for plant hardiness, gardeners there should select plants that are hardy to Zone 6a. Maps of plant-hardiness zones are available in many gardening books, and in some nursery catalogues. See also page 58 in Kress' *Audubon Society Guide to Attracting Birds*, 1985.

Plants that are native to your area will be better adapted to the general locality, although the city habitat requires that

plants be tolerant of somewhat extreme conditions. A number of hardy exotic plants are better able to withstand the drying effects of wind, reflected light, and container culture than are some of the native trees and shrubs. The plants recommended in Table 3 are a mixture of natives and exotics, and have all been recommended for use in cities. They are also known to have some wildlife value. We recommend highly that you also visit local nurseries, botanical gardens, plant societies, and the agricultural extension service for more information on native and exotic plants that will survive well in the conditions of your city.

When choosing shrubs and trees, look for features that are attractive in more than one season. You will be viewing your garden year-round from inside. An excellent example is the flowering dogwood (*Cornus florida*) that has spring flowers, summer foliage, autumn leaf color, and red berries lasting into the early winter.

Trees and shrubs should be container-grown, or "balled and burlapped" (not bare-rooted). Compare the size of the ball to that of the receiving container. For trees, the container should be about 6 in (12.5 cm) wider than the diameter of the ball. Thus, a 12 in (31 cm) ball should be placed into an 18 in (46 cm) tub. The size ratio for shrubs can be smaller. Limit the tree size to 7 ft (214 cm) high and 2 in (5 cm) trunk caliber, in order to transport it upstairs in an apartment freight elevator.

For small garden areas, look for "fastigiata" ("upright") and dwarf varieties of trees. However, growing plants in containers tends to restrict their growth and many of the tall-growing trees will not reach their potential height in high-rise gardens.

Try to place shrubs in individual tub containers, as their roots tend to take over small planters and window boxes.

Vines should be purchased "pot-grown." To encourage rapid vine growth, work in peat moss, cow manure and superphosphate into the bottom layer of the transplant container.

Follow-up Care

Prune the top growth of a large plant in fall to restrict its size and spread. Do not fertilize trees and shrubs at the time of planting. The following spring, add 1 lb (0.45 kg) of a tree fertilizer (4-8-4) per 1 in (2.5 cm) trunk diameter. Eventually, the roots of a tree or shrub become "tub-bound," and if you cannot move it to a larger container, try root-pruning as in the Japanese Bonsai tree-culture. Otherwise, donate the plant to a "downstairs" garden plot and start another smaller plant in its place.

Table 2. Plants for screens, hedges, and windscreens

Ash, green	Euonymus
Barberry	Japanese holly
Black pine	Juniper
Chokecherry	Serviceberry
Crabapple	Snowberry

TABLE 3. WILDLIFE-ATTRACTIVE PLANTS THAT WITHSTAND CITY CONDITIONS

Key: NE = Northeast; SE = Southeast; PP = Prairie and Plains Region; MD = Mountain & Desert Region; PC = Pacific Coast. The following plants will grow in all areas, except as noted. [Sources: DeGraaf and Witman 1979; Kress 1985; Yang 1975; and others.]

SMALL DECIDUOUS TREES

Ash, Green (*Fraxinus americana*) Not in MD, PC
 Cherry, Weeping flowering (*Prunus serrulata*)
 Chokecherry, Common (*Prunus virginiana*) NE, SE
 Crabapple, Flowering (*Malus spp.*) Not in MD
 Dogwood (*Cornus spp.*)
 Hawthorn (*Crataegus spp.*)
¹Maple, Japanese (*Acer palmatum*)
 Mountain ash (*Sorbus spp.*)
 Olive, Autumn (*Elaeagnus umbellata*) Not in MD
 Olive, Russian (*Elaeagnus angustifolia*)

¹Protect from wind

DECIDUOUS SHRUBS

Barberry, Japanese (*Berberis Thunbergii*) NE, SE, PP only
²Bayberry; Waxmyrtle (*Myrica spp.*) Not MD
 Beautyberry, American (*Callicarpa americana*)
 Buckthorn (*Rhamnus spp.*)
 Chokeberry, Red (*Aronia arbutifolia*) NE, SE, PP
 Coralberry (*Symphoricarpos orbiculatus*)
 Elder or Elderberry (*Sambucus spp.*)
 Euonymus (*Euonymus spp.*) NE, SE, PP
²Firethorn (Pyracantha) (*Pyracantha coccinea*)
 Best in SE, MD
 Honeysuckle, Bush (*Lonicera spp.*) Not PC
 Rose (*Rosa*)
 Serviceberry (*Amelanchier spp.*)
 Snowberry (*Symphoricarpos spp.*)
 Viburnums (*Viburnum spp.*)

²Semi-evergreen in some areas

EVERGREEN SHRUBS

Cactus, Prickly pear (*Opuntia spp.*) MD, PC only
 Christmasberry (Toyon) (*Photinia arbutifolia*) PC only
 Holly (*Ilex spp.*) Not MD
 Holly, Japanese (*Ilex crenata*) Not MD
 Juniper (*Juniperus spp.*)
 Manzanita (*Arctostaphylos spp.*) MD, PC only
 Oregon grape (*Mahonia aquifolium*)
 Palmetto, Dwarf (*Sabal minor*) SE only
 Pine, Dwarf Mugho (*Pinus mugo mughus*)
 Pine, Japanese black (*Pinus thunbergii*) NE
 Saltbush (*Atriplex spp.*) MD, PC only
 Yew (*Taxus spp.*)
 Yew, Japanese (*Taxus cuspidata*)

PERENNIAL VINES

Ampelopsis, Heartleaf (*Ampelopsis cordata*) NE, SE, PP
 Bittersweet, American (*Celastrus scandens*) NE, PP
 Clematis (e.g. *Clematis alpina*)
 Euonymus, climbing (Wintercreeper) (*Euonymus fortunei*)
 Grape (*Vitis spp.*)
 Honeysuckle (*Lonicera spp.*)
 Ivy, Boston (*Parthenocissus tricuspidata*)
 Ivy, English (*Hedera helix*) NE, SE
 Trumpetcreeper, Common (*Campis radicans*)
 Virginia Creeper (*Parthenocissus quinquefolia*) Not in PC
 Woodbine (*Parthenocissus vitacea*) PP, MD

WILDLIFE VISITORS

Once your high-rise wildlife garden is in place, what animals are likely to show up? As in any garden, the flying birds and insects will be early visitors.

House sparrows (*Passer domesticus*) will stop by more often than will colorful warblers or goldfinches. Pigeons (*Columba livia*) and starlings (*Sturnus vulgaris*) are also common city dwellers that nest in small nooks and crannies above city streets, and are likely to find your haven. These opportunistic birds are able to exploit city food sources and building sites and often seem to be the only wildlife around.

It is easier to attract desirable birds and butterflies to a high-rise garden if your building is adjacent to a park or greenbelt, or if you live at treetop level. This is true for spring and fall migratory wildlife as well as for resident species. Cerulean (1987) stated, "Discontinuity of habitats can be a limiting factor for many species, which can be a problem for the small lot owner. Animals can only be attracted to a yard or property from the larger surrounding landscape. The lack of a connective open space system is one of the factors that limits the amount of diversity of wildlife in urban and suburban areas." Because wildlife seeks protective travel lanes of vegetative cover ("corridors") in moving from place to place, a rooftop, balcony, or terrace garden may become a link in the total "open space net" (Leedy *et al.* 1978) of a city.

Truex (1964), Yang (1975), Wiley (1985), and others recorded wildlife species they observed on city terrace and roof gardens. Truex was able to attract hummingbirds to his terrace in Manhattan every August. He also noted that the roof garden on the eleventh floor of Rockefeller Center attracted 17 bird species one season, including a screech owl (*Otus asio*), whip-poor-will, (*Caprimulgus vociferus*), and golden-



crowned kinglet (*Regulus satrapa*). Yang observed hummingbirds in a 19th-floor terrace, and has observed woodpeckers, goldfinches, blue jays, and other resident birds in her street-level Manhattan garden (personal correspondence, 1987). In her book on terrace gardening, Yang (1975) recommended plants that provide food and cover, and a source of water, to attract wildlife. However, she also suggested hanging a wild bird feeder to attract more birds in New York. Feeders are difficult to find in city stores but can be ordered through mail-order catalogues. Ortho Books (1984) also stated that plantings alone are not enough to retain bird visitors in small city gardens, but that "concentrated resources of food and water" would ensure their return. Baines (1985) noted that (in

England) "every tower block has its high rise nature lovers, tempting bluetits up to the tenth story with bags of peanuts and lumps of fat." Rothman, owner of an Urban Wildlife Sanctuary certified by the National Institute for Urban Wildlife, in Washington, D.C., has attracted 18 different species of birds to her fourth-floor 100 square-foot porch close to Rock Creek Park, a major urban park. Her most common visitors are house finches (*Carpodacus mexicanus*) and house sparrows. Her most unusual sighting was an American kestrel (*Falco sparverius*) that, following a heavy snowstorm, tried to catch small birds at a feeder for several weeks. She fills bird feeders and dishes of water year round to augment a variety of wildlife-attractive plantings in hanging containers and window boxes. Birds and squirrels also benefit from large trees and other abundant vegetation in the surrounding neighborhood. Rothman's Sanctuary also attracts bees, butterflies, praying mantids, and other insects; and gray squirrels (*Sciurus carolinensis*) (personal correspondence, 1987). Williamson (1974) studied birds in Washington, D.C. in relation to the human environment east and west of Rock Creek Park. House sparrows, pigeons, and starlings were the most abundant, especially east of the park, an area of high-rise apartment buildings and sparse vegetation. A number of desirable songbird species occurred west of the park, an area of dense vegetation where homes were surrounded by trees, shrubs and flowering plants. Generally, the numbers of starlings tended to increase with distance from the park in both locations.

Wiggin (1974 and personal communication, 1987) recorded birds found in or around the Prudential Center in Boston, Massachusetts, from 1967 to 1974. This high-rise downtown office building has courts and escalators that are open to the sky, in which Wiggin observed that birds tended to become trapped. Migrating birds, disoriented in stormy or foggy weather, and less often, on clear nights, were attracted to the light atop the building. At daybreak, they found the vegetation at street level surrounding the building, and eventually worked their way into the courts and escalator areas of the building. Other migrating birds banged into the reflective windows of the building, and were killed or stunned, falling into the same indoor areas. The birds that were trapped did not discern they could escape by flying upwards. During his study period, Wiggin freed an average of one to five birds daily, and observed live birds of 91 different species in and around the Prudential. Wiggin noted, "On migration, birds alight with complete disregard for normal habitat preferences..." In the same study period, Wiggin also picked up dead birds of 67 different species. Hawks, swifts, hummingbirds, woodpeckers, flycatchers, nuthatches, wrens, kinglets, pipets, thrushes, vireos, wood warblers, sparrows, and finches were among the families of birds that he recorded. Probably his most unusual sightings at the Prudential were short-billed marsh wrens (*Cistothorus platensis*) an extremely rare bird in Eastern Massachusetts. White-throated sparrows (*Zonotrichia albicollis*) were clearly in the majority among the total dead birds recorded. He was instrumental in persuading the Prudential management to install four nets on the glass faces of the building which cut down on the number of deaths recorded due to window impacts. His interesting observations underline the

potential for attracting a great variety of bird species in cities during migrations.

It is common to find insects like wasps, honey bees, yellow jackets, ladybird beetles, praying mantids, dragonflies, and butterflies in cities, which means they must find suitable food and nest sites there. Garber reported seeing swarms of honey bees several times near Rockefeller Center in Manhattan, indicative that a nearby honey bee colony had reached a large size and a group of bees had left to establish a new colony. For bees and for butterflies, there are sources of natural nectar and pollen in flower beds in parks and gardens, flowering street trees, window box plantings, and grasses and other wild plants blooming in vacant lots. These insects may also exploit man's more artificial environment. Urban honey bees can be seen consuming "man-made nectar" from soda cans and other sugary trash. The carnivorous ladybird beetles, praying mantids, and dragonflies consume other insects in the urban food chain, many of them considered pests. Nineteen types of dragonflies and damselflies have been recorded around a lake in Central Park, New York City (see *Urban Wildlife News*, Vol. X, Nos. 1-2, 1987), where they consume mosquito larvae and flying insects.

Spiders, earthworms, ants, and caterpillars may arrive in a high-rise garden in the soil or on plants that were carried in, as could other soil- and plant-dwelling wildlife species. Many of the invertebrates are important members of the urban food chain, and they attract desirable birds. They should not be dismissed immediately from your garden!

Squirrels may arrive at your high-rise garden by walking along wires and telephone lines, and by climbing up and down chimneys and pipes. Yang had a visit from a squirrel on her 19th-floor Manhattan terrace, and Rothman reported seeing squirrels regularly using a fire escape to visit her fourth-floor porch (personal correspondence, 1987). Larger mammals are less able to scale chimneys, pipes and wires although raccoons (*Procyon lotor*) may occasionally be seen above ground level.

If you are interested in attracting butterflies, Tekulsky (1985) suggested that "elevated" sources of nectar are particularly attractive to the insects. Truex (1964) stated that butterflies will visit gardens as high as ten stories. An urban window box with flowering plants such as zinnias (*Zinnia elegans*) and impatiens, is an oasis for butterflies that find it. A fence or railing could also be planted with vines such as trumpet creeper. To attract butterflies through the growing season, a garden should have a selection of plants for continuous bloom. In addition to cultivated flowers, flowering trees and shrubs are sources of nectar for butterflies (e.g. barberry, hawthorn, and viburnum). Because the butterfly bush (*Buddleia*) has spreading growth, the best way to include it in small areas is to train it to grow laterally by the espalier technique. Bush honeysuckle (e.g. *Lonicera maackii*) will also do well if espaliered on a balcony or terrace wall. If you wish to integrate vegetables into available spaces, herbs such as parsley (*Petroselinum crispum*), peppermint (*mentha x piperita*), and dill (*Anethum graveolens*), and vegetables like carrots (*Daucus carota sativa*) and parsnips (*Pastinaca sativa*) are not only attractive and edible, but are also food plants of various butterflies. (For more information on butterfly gardens, see R.T. Mitchell,

1986.) One butterfly-enthusiast raises Monarchs through their various stages on appropriate plants in a Manhattan advertising-agency office. When they emerge as adults, she releases the butterflies "high above New York" from an office window (see Anonymous 1979a).

These are some of the possible wildlife visitors to your city garden, although there is no guarantee you will attract all of

Table 4. Wildlife Plants That Lend to Espalier (flexible branches)

Bush honeysuckle
Climbing rose
Crab apple
Dwarf fruit trees (pear, plum, cherry)
Euonymous
Firethorn
Flowering cherry
Holly
Japanese black pine
Juniper
Mugho pine, dwarf

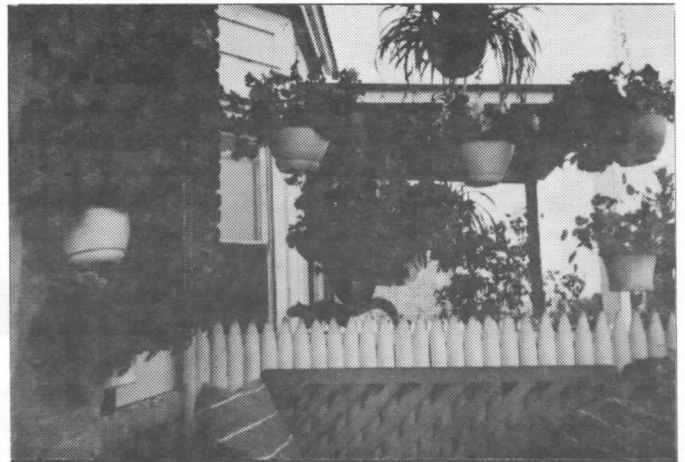


Fig. 4. A 100-square-foot porch of a fourth-floor apartment in metropolitan Washington, D.C., is managed to attract urban birds and squirrels. Food is provided by hanging seed feeders, flowering plants in containers, and offerings of fresh fruit; cover and living space are available in trees, shrubs, and vines in the immediate vicinity; and water is provided in hanging dishes and other containers. Among the annual flowering plants grown in containers which attract hummingbirds, and butterflies and other insects, are begonia (*Begonia*), geranium (*Pelargonium*), hibiscus (*Hibiscus*), impatiens (*Impatiens*), nasturtium (*Tropaeolum*), parsley (*Petroselinum crispum*), petunia (*Petunia*), and verbena (*Verbena*). (Photo: I. Rothman).

them.

The following statement by Bradshaw, Goode, and Thorpe (1986, p. 321) summarizes well why urban wildlife managers should be concerned about developing high-rise gardens:

"The disturbance and disruption of ecological interactions caused by buildings, should be minimized. In densely developed areas, natural growth on roofs as well as facade vegetation increases the habitats available for wild flora and fauna."

CONCLUSIONS:

- (1) Trees, shrubs, vines, and flowering annuals and perennials, can be grown in containers in gardens on city buildings to improve living conditions for both people and wildlife.
- (2) Plants can be chosen for their aesthetic and microclimate-control properties, as well as their wildlife values.
- (3) Gardeners on balconies, terraces, and rooftops must contend with the problems of confined space, weight of containers, extreme wind, and drying of plants.
- (4) The closer a city garden is to a major park or other green space, the more likely it is to attract urban wildlife.
- (5) The greatest variety and numbers of wildlife are seen in cities during migratory seasons, and small gardens may serve as "minirefuges" for some of the visitors.
- (6) The suggestions for high-rise gardens can be used in gardens at ground level—on decks, porches, patios, and in other small areas.

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YOU CAN HELP: The staff of NIUW is interested in hearing from anyone with a "high-rise" city garden who has kept records of wildlife observations in the garden. There are too few data on this important habitat, and you can be part of an effort to learn more about wildlife in the city.

URBAN WILDLIFE MANAGER'S NOTEBOOK—15

TAKING THE MOUNTAIN OUT OF THE MOLEHILL

Louise E. Dove, Wildlife Biologist

ISSN 0882-584X

INTRODUCTION

When homeowners consider the kinds of wildlife they would most like to have visit their properties, birds and butterflies come easily to mind. They are colorful and highly visible, and are generally perceived as attractive and beneficial kinds of animals to have in the backyard. If it were suggested that moles rated consideration as a benefit to property owners, the idea would surely be rejected. The mole is neither colorful (its coat is usually dark brown or black) nor visible (it spends virtually all of its life underground). In fact, it is almost unknown, except for its ability to create ridges or mounds in manicured lawns, which hardly endears it as a beneficial animal.

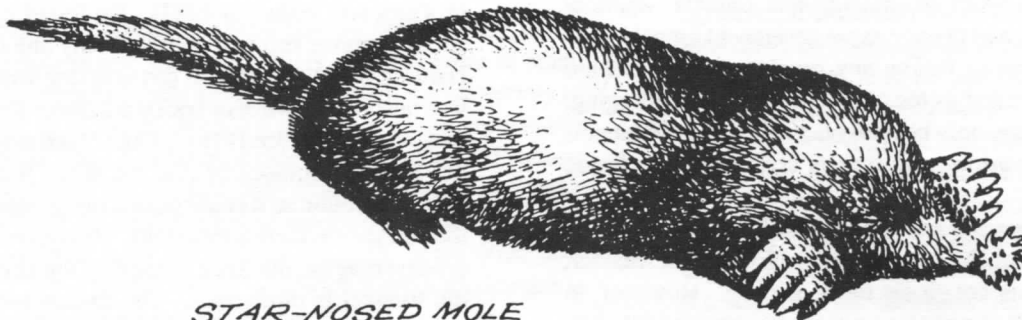
Many homeowners assume moles dig under lawns and gardens in order to eat bulbs and vegetables, and the roots of valuable shrubs and trees. This is simply not so! Moles dig underground tunnels in search of insects, insect larvae, earthworms, and slugs, the majority of which would do harm to a lawn and landscaping plants if moles didn't help keep them in check. Moles also loosen and aerate the soil, making it easier for plants to obtain oxygen, water, and nutrients.

Are you a victim of these unseen creatures, and not easy to convince of their benefits? Read on—and let us try to give moles a place next to birds and butterflies in your backyard haven!

JUST WHAT ARE MOLES?

Moles are small mammals, measuring only 6-8 in (15-20 cm) from tip of nose to tip of tail. They are also insectivores, a group of mammals that feeds primarily on insects, worms, and other invertebrates. Insectivores are characterized by long, sensitive noses; small eyes (if present) that are covered with skin; and numerous, evenly-spaced teeth.

In addition, moles have conspicuous front feet that are enlarged into "paddles", with webbed toes and claws to aid in digging. Their dark fur is soft and velvety, and can be brushed easily in either direction, which allows them to move forward and backward in their tunnels. The fact that their body is streamlined in shape, with a short neck, also helps them in living underground. There is a thick tail, about a quarter of the total body length, except in the star-nosed mole (*Condylura cristata*), where the tail is about the length of the body and is used as a scull by this semi-aquatic species. The eyes of all moles probably function only to detect light, and moles have no external ears although it is believed they hear well. Any sense of smell is poor until the animals are close to or in contact with prey. However, an acute sense of touch helps moles to function in darkness, and both the nose and the tail are considered tactile structures. (The tail is useful when the animal is moving backwards.) Twenty-two fleshy projections around the nose of the star-nosed mole are also believed to have a tactile function.



STAR-NOSED MOLE

(Artwork by Ned Smith, used with the kind permission of Mrs. Ned Smith and the Pennsylvania Game Commission.)

MOLES OF NORTH AMERICA

(Yates and Pedersen 1982)

¹ Eastern mole	<i>Scalopus aquaticus</i>
¹ Hairy-tailed mole	<i>Parascalops breweri</i>
¹ Star-nosed mole	<i>Condylura cristata</i>
² Broad-footed mole	<i>Scapanus latimanus</i>
² Coast mole	<i>Scapanus orarius True</i>
² Shrew mole	<i>Neurotrichus gibbsii</i>
² Townsend's mole	<i>Scapanus townsendii</i>

¹East of Rocky Mountains

²West of Rocky Mountains

THEIR HABITS AND HABITAT

Moles live solitary lives, except when mating and during the 6 weeks the young stay with the female. Reports of some species living communally probably resulted from aggregations seen around food sources. With the exception of a few species, moles spend almost their entire lives underground.

They dig and forage continuously for soil-dwelling worms and insects to fuel their activity, and can be found at work both night and day and in all seasons. A rapid rate of digestion forces them to eat at frequent intervals and moles in captivity have been observed to eat more than their own weight every 24 hours.

They dig two types of underground tunnels—shallow surface “runways”, and deeper, more permanent tunnels. The tunnels do not seem to follow any regular pattern, and are probably dug as needed as the animal moves about foraging. Surface runways may only be used once, although old tunnels are reused if earthworms and insects continue to be found there.

The surface runways are dug 5-8 in (13-20 cm) below the surface of the ground. They are more shallow in wet weather, because earthworms are closer to the surface. However, in time, the more shallow passageways tend to become filled in, especially after showers. In dry weather and in winter, moles dig tunnels at greater depths, and deep winter tunnels, below

the frost line, may be more permanent. Deep tunnels have been located 6-24 in (15-60 cm) below the surface, depending on the species involved. Mole tunnels are only 1-1/4 to 1-1/2 in (3.2 to 3.8 cm) in diameter, just wide enough to accommodate the occupant.

Here and there, tunnels are interrupted by “nesting” and “resting” chambers that may contain a lining of grass and leaves, especially in the breeding season. Nesting chambers for the young are generally larger than resting chambers, and both areas have multiple exits. It is usual to find one exit that drops immediately below the chamber. These “home” areas are in dry locations, where there is little chance of flooding. The tiny shrew mole (*Neurotrichus gibbsii*) may raise its young above ground, however, where it has been observed building a nest in a stump. It also enlarges a section of an underground tunnel as a resting chamber for itself.

Moles prefer loose, sandy, well-drained soil, generally avoiding clay and other compacted soils that are hard to dig. They are unable to tolerate arid conditions, and none are found in desert regions. In addition to suburban lawns and gardens, moles find suitable habitat in golf courses, thin woodlots, and in fields and meadows. “Hunting” runways are usually in moist, shaded soil, where earthworms and other prey live. The star-nosed mole is more at home in wet situations, and its tunnels in mucky fields may exit into a stream or pond. It is an adept swimmer, and captures aquatic insects, crustaceans, and other food in wetland areas. This species is seldom a problem on manicured grass.

If there is a mole under your lawn or garden, “upheavals” of soil will indicate its presence. Extensive ridges may be produced on the surface of lawns and gardens as a mole digs its tunnels. Mounds of earth (molehills) indicate where the animal has pushed up excess dirt from its excavations, forming symmetrical, volcano-shaped piles above ground. “Molehills” are most typical of moles in the western U.S., especially Townsend's mole (*Scapanus townsendii*), which digs intricate networks of deep tunnels. Fortunately, the home range of a mole is large enough that several urban backyards probably support only one to two moles. Harding (undated) stated that this animal typically occupies an area of one acre (0.405 ha) or less.

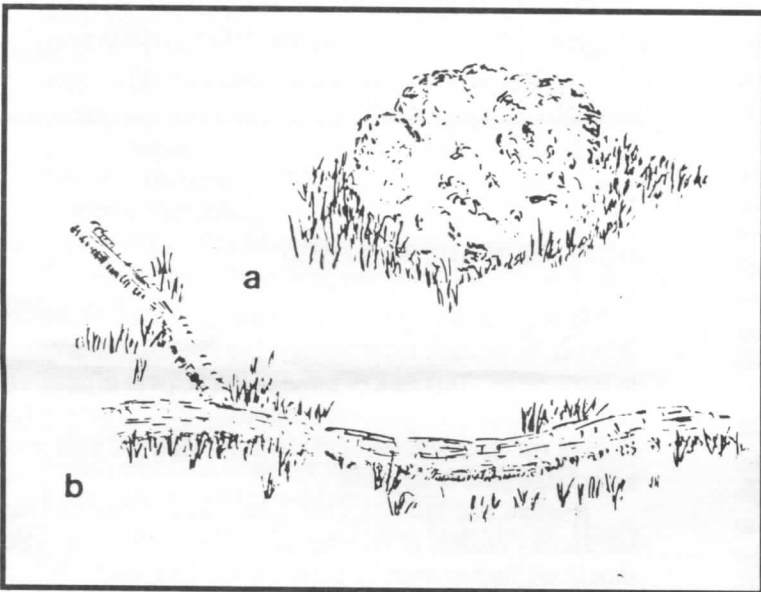
Many sources on mole behavior stated that they “swim through the soil” as they dig tunnels, pushing soil aside with their large forefeet in a breaststroke-like movement. One authority, however, disagreed with this analysis (Hisaw 1923, in Yates and Pedersen 1982). He found they used a lateral stroke to move soil that involved only one forefoot at a time. Harding noted also that as dirt was dug with the front feet, it was pushed sideways or backward under the body to the hind feet, which were used to kick it out of the way. After sufficient dirt had accumulated behind the mole, it turned or “somer-saulted” around so it could push it into a nearby chamber, or to the surface (to form a molehill). Whatever the exact digging process may be, the force exerted by the strong movements of the forefeet is prodigious. The eastern mole (*Scalopus aquaticus*) has been estimated to dig at a rate of 12 feet (360 cm) an hour (Carrington 1963). There are few mammals that work as hard to make a living!

DAMAGE DONE

As moles tunnel, they may disturb root systems and cause other structural damage to plants. The roots of grass and other plants might also be subjected to drying as soil is displaced. Lawns sometimes have brown patches as a result of subterranean mole habitation.

The ridges and mounds resulting from mole activity mar the appearance of manicured lawns, golf courses, and other turf. The erupted surfaces also make mowing difficult. Flower beds and vegetable gardens are also often disrupted by digging moles.

Apparently the mole does not totally disdain vegetation, because the examination of stomach contents of moles has revealed they eat small amounts of plant fibers, rootlets, seed pods, and grain. However, at least 80% of their diet is insectivorous (Harding, undated). The stomach contents of three moles revealed they had consumed 175, 73, and 55 white grubs, respectively (Henderson 1983). You could not hope to find a better control for this major insect pest of lawns!



Mole excavations: a. Molehill, b. ridges of a surface tunnel. (Adapted from U.S. Dept. of Agriculture, Massachusetts Cooperative Extension Service: *An Animal Damage Identification Guide for Massachusetts*, undated.)

GUESTS OF MOLES

If moles get blamed for damaging lawn grass and other plants, it may be because of interlopers that use their tunnels. Several types of small mammals move in and out of mole tunnels in search of a wide variety of plant materials that they prefer. Meadow mice (voles) are particularly destructive (*Microtus* spp.), and because they tend not to lay aside winter stores, they are active in the tunnels year-round. White-footed mice (*Peromyscus* spp.) and the common house mouse (*Mus musculus*) also use mole tunnels as travel lanes and to find plant food. In the West, deer mice (*Peromyscus* spp.), pocket mice (*Perognathus* spp.), and kangaroo rats (*Dipodomys* spp.) intrude in mole tunnels.

Shrews (*Sorex* spp. et al.) are known to use mole runways, but they are insectivores like the mole, and eat principally invertebrates found in the soil. Shrews and moles are probably competitors for prey in the

tunnels, although the smaller shrews spend more time on the surface under leaf litter and moss, and create elaborate runways of their own.

In the West, true molehills (probably of Townsend's mole) may be confused with mounds of western pocket gophers (*Thomomys* spp.). Pocket gophers dump armfuls of excavated soil to one side of a burrow exit and create fan-shaped mounds. However, unlike moles, they are rodents and strict vegetarians. They even dig their burrows differently—holding their forepaws under them much as a dog digs a hole. And, gopher activity is known to have a significant effect on vegetation. They are notorious for girdling trees and shrubs, and eating the shoots of young trees that are not yet established.

MOLE MANAGEMENT

Like most urban wildlife, moles and mole activity must be considered in relation to public interest. Mole activity in naturalized fields and in many lawns can usually be ignored, and once their place in urban ecology is understood, moles may be seen as important controls for Japanese beetle grubs and other harmful insects of lawns and gardens. Their presence may indicate to the homeowner for the first time that the lawn is infested with insects. The digging activities of moles also loosen and aerate the soil, a definite asset to the home gardener.

However, it is unlikely that moles can be tolerated where their tunnels have damaged an expensive golf green, or a manicured lawn that was the pride of its owner, and control methods must be undertaken.

It is not easy to rid an area of moles! The most encouraging aspect is that there are probably not more than one or two moles to worry about in a small backyard. One of the most effective methods for controlling moles is to kill them with spear-type traps placed in tunnels where they are active. It may be necessary to obtain a permit to trap moles in your location, however. Before undertaking trapping, contact your state fish and wildlife agency, or the agricultural extension agent in your area, to determine laws on trapping that apply where you live.

Mole traps may be purchased at many hardware and garden supply stores, and should be used in accordance with the manufacturers' directions. Generally, directions call for caving in a short section of the tunnel, and placing the trap on the soil blocking the tunnel, aligned with the runway system. The animal is snared when it arrives to remove the soil from the damaged runway. If nothing is caught within a day, the trap should be relocated to a new tunnel. Trapping is most effective if done in early spring and after rains in autumn, but moles are

often difficult to trap because they tend to avoid foreign objects. The dead animal should be buried or disposed of in a sanitary method. For more information on using traps, consult an extension agent or game warden.

Setting out poison bait, or using gas canisters in tunnels, is dangerous and often prohibited by state or local law. The operator may harm himself as well as other wild animals, pets, and children, in using these lethal materials. Serious mole infestations should be handled by persons licensed as pest control operators, working under the proper ordinances.

Another method of control involves watching to detect a mole moving just below the soil surface, rapping the area sharply with a shovel, and quickly digging out the stunned mole and placing it into a container for relocation or disposal. Another approach is creating openings in the surface tunnels by pushing down ridges from above, and then waiting for the mole to appear in the tunnel to repair them. Tunnels can be flooded with water from a hose in an effort to drown the animal. This might be most effective in April and May when there are usually young in the nest, and they, too, can be destroyed.

In small gardens, one can take measures to protect plants. An underground fence of concrete block, wood, sheetmetal, or hardware cloth can be placed below ground around the planting area. Three meshes per inch (per 2.5 cm) of hardware cloth will keep out mice, voles, and moles, and the cloth will last for years. The fence should start at ground level, go to a depth of 1 ft (30 cm), bend outward from the garden at a 90° angle, and continue on for an additional 10 inches. Joints in the fence must be tight or the mole will find the break and get through.

In some circumstances, moles may be discouraged by tilling two inches of one-half-inch size gravel into home gardens.

Sometimes, it can be effective to reduce the invertebrate prey of moles. An effective control method for Japanese beetle grubs is to apply milky spore disease to the lawn (and neighbors' lawns). However, this may take several seasons to become effective. Insecticides applied to lawns must be considered carefully, because they may affect birds and other wildlife, and pets in the area. Reducing the amount of water applied to lawns forces earthworms to a deeper level in the soil, and subsequently, their predator, the mole.

A number of "old-wives' tales" exist concerning the control of moles. Plastic windmills placed into the lawn, and narrow-necked bottles buried in the soil are said to set up wind vibrations at frequencies disturbing to moles. Another method advocates planting "gopher plant" (*Euphorbia lathyris*) or castor bean (*Ricinus communis*) in gardens to repel both moles and pocket gophers. Still another approach is to place moth-balls, ground glass, or thorns directly in the tunnels. None of these folk methods has been proven effective.

NATURAL ENEMIES

Dogs and cats are probably the most successful predators of moles in urban/suburban areas. However, they must be able to dig them up before they escape, or to catch them out of their tunnels. The shrew mole and the star-nosed mole both leave

their tunnels more than the other mole species, which makes them easy prey for their enemies. The hairy-tailed mole may occasionally also go above ground at night.

Among the natural enemies of moles are hawks, owls, skunks, weasels, and foxes. Snakes are known to crawl directly into tunnels and catch moles. Most of these are not common in developed areas, although mole populations in more remote areas might feel the effects of their predation. Opossums, bullfrogs, and Eastern chipmunks, predators that occur more frequently in some urban locations, have been seen eating the hairy-tailed mole. Because it frequents waterbodies, the star-nosed mole may be caught and eaten by predatory fish.

"The occasional damage by *Condylura* and *Parascalops* to lawns, flower beds, and golf courses is more than offset by their destruction of harmful insects and tilling of the soil."

— Yates and Pedersen, 1982, p. 47.

MORE RESEARCH NEEDED

It is generally agreed that there is a lack of complete information on basic mole biology, and that research is needed in many areas. This lack of information helps to explain why control methods are generally unsatisfactory. The management of the mole will be more effective when the gaps in our knowledge have been filled.

Redfern and Mitchell (1987) have recently worked out a satisfactory method of keeping live moles in captivity, which should aid further study of these elusive animals.

CONCLUSIONS

1. Like many forms of urban wildlife, moles may be considered beneficial or harmful, depending on their location in the human-dominated environment.
2. Moles tunnel through moist soil in search of animal prey, including larval and adult insects, earthworms, slugs, and other soil-dwelling invertebrates.
3. Their effect on vegetation is secondary, resulting from disruption of root systems during digging activities, or from small rodents that are vegetarian, and use their tunnel systems as travel lanes.
4. By loosening and shifting soil particles, moles aerate and improve the fertility of garden soil.
5. Moles have large home ranges, and there may be only one or two in a moderate-sized backyard.
6. Unless you demand a perfect lawn, no control may be

needed for moles; their beneficial activities probably outweigh the disrupted appearance of the turf.

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URBAN WILDLIFE MANAGER'S NOTEBOOK--16

KEEPING THE WILD IN WILDLIFE!

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ISSN 0882-594X

THE PROBLEM

It happens to almost everyone at some point. While out working in your yard or hiking through the woods, you encounter a wild and apparently abandoned young animal. Perhaps you come upon a bird that has fallen from the nest. Or, you find a tiny squirrel, rabbit or raccoon that appears helpless. Rarely, you may stumble upon a beautiful fawn curled up on the forest floor. It is understandable that your first instinct is to rescue these small creatures. In most cases, it is probably the worst way to react to the situation.

When you find a young animal, there may be no adult in sight. It is normal behavior for the parents of some species to leave their young unattended for periods of time. Adult birds must search for food to supply their demanding brood. Male rabbits have nothing to do with their young, and the female visits the nest only two or three times in 24 hours. If she stayed at the nest, she would attract attention to her well-hidden, mostly-scentless, offspring. Likewise, a doe deer often hides her fawn and feeds or rests some distance away.

What should you do? How can you tell if a young bird or mammal needs your help? Rather than feeling helpless or hopeless, if you are aware of certain facts you will be able to judge the situation properly. Below are some general guidelines to use when faced with the dilemma of whether to "save" a young animal. Generally, chances are good that it does not need saving at all, and your efforts will make it an orphan, or worse, cause its death.

WHEN A YOUNG ANIMAL DOESN'T NEED HELP

If you encounter a young animal, and the following conditions apply, turn on your heel and walk away:

1. The animal appears healthy and its eyes are open (injured, sick or abandoned animals often have a matted coat, glazed eyes, and are weak).

2. It runs from you or tries to defend itself with bared teeth, raised fur or feathers, and/or noises like growling or chattering.
3. It is in a natural setting—not in a street or parking lot.



Fig. 1. Deer fawn—one of nature's most appealing sights.

It is likely the young animal has just started out on its own or has been temporarily separated from its mother. It is part of normal development for many wildlife species to fend for themselves at an early age, sometimes within hours of birth. Other animals need parental care for longer periods of time. In either case, if you come upon a healthy young animal in a natural setting, it is unlikely to have been abandoned or orphaned. If you are not sure, and want to check on it later, leave the animal as you found it, and come back to the area the next morning.

UNDERSTANDING NORMAL BEHAVIOR

Becoming familiar with the habits of wildlife can help you better judge when something is awry. The following information should be useful to all well-meaning individuals who spend time in the out-of-doors and are likely to encounter wildlife—which includes just about all of us!

Young Birds

Songbirds

Now and then, a person may find a very young, unfeathered, flightless baby bird on the ground. Probably the bird fell out of a nest. A *nestling* is a baby bird that has just begun to develop feathers and can neither fly nor walk. Every effort should be made to return a nestling to its original nest. Search the area near where you found the bird; look in tree branches, shrubbery, vines, and in grasses closer to the ground. When you locate a nest, make sure the other young in the nest look like the one you are replacing. If you are pressed for time, it may even be possible to place the bird in the nest of another species; the adult there may accept and feed it. It is not necessarily true that adult birds will abandon nestlings that have been touched by humans. In fact, it is believed that birds generally have a very poor sense of smell.

If you discover a fallen nest with one or more young, the nest should be placed as close to its original site as possible. Tie it to a branch, or put it in a container the same size as the nest and fasten that to a branch. Adult birds sometimes abandon a nest with eggs—perhaps the birds have gone somewhere else to start a new brood. However, a nest with nestlings will rarely be abandoned. If the bird cannot be returned to a nest, or if it appears to be injured, line a small covered box with some paper tissues or a soft cloth. Be sure there are ventilation holes in the box. Do not try to give the bird food or water. Put the box in a warm, quiet place and leave it alone until you can call an expert, such as a registered wildlife rehabilitator (see below).

Perhaps you will find a young bird that is feathered and definitely more advanced than a nestling, but that appears to have difficulty flying; a *fledgling* is almost fully feathered and is ready to practice flying. In fact, if you try to return it to a nest, it will probably jump back out. It may have been out of the nest for some days. A young bird with a short, feathered tail that can stand on a twig has probably left the nest and is learning to fly, although its parents are still feeding it. Put an uninjured fledgling in a bush or tree close to where it was found and its calls will help

Wildlife Rehabilitators

A wildlife rehabilitator is a person who has requested and qualified for a permit from an official agency (usually at the state level) to care for abandoned and injured wildlife. Those who care for birds must also receive a permit from the U.S. Fish and Wildlife Service. These volunteers have taken the time to educate themselves on the requirements of young and injured wildlife so that they can provide the best care possible. "Rehabers" are prepared to give the specialized and time-consuming care required by young wildlife, and it is with them that abandoned or injured wildlife have their best chance of survival.

A local conservation organization, nature center, library, or agriculture extension agent should know the names of certified rehabilitators in the area.

the parents locate it. Do not assume that a fledgling is orphaned because you can't see the adult birds.

Hawks and Owls

Hawks and owls often spend a couple of weeks on the ground or on low tree branches before they learn to fly. Owls are especially prone to leaving the nest while very young and still covered with down. You should not try to catch these birds to place them back in their nests. Raptor nests are often built high in trees or on rocky cliffs, and you may endanger yourself in trying to reach them. If you are concerned, leave the young raptors overnight where you found them, and check them in the morning. If they have not moved, and appear to be deteriorating, call the nearest rehabilitator, or county or state wildlife officer for advice.

Ducks and Geese

With the exception of a few species such as wood ducks and mergansers, which nest in hollow trees (or in nest boxes provided by humans), waterfowl nest on the ground near water. Ducklings and goslings can walk and feed themselves a few hours after hatching. The mother leads them away from the nest, and they do not return to it. However, "downy" young depend on the mother to protect them and keep them warm at night. If you find a young downy bird all alone, scour the area to locate its family, or try to find an adoptive family.

Half-grown ducklings and goslings look a little ragged because they have started developing feathers. If you discover one in its normal habitat, it should be left alone. Even if the original family is unavailable, it will probably tag along after an adoptive mother. It may not be totally accepted by a strange adult, but it will be warned of danger and at this age it no longer needs to be kept warm at night. If you cannot locate a family for a downy animal or if the half-grown duck or goose is in a dangerous place, contact the local wildlife officer for instructions.

Rabbits

It has been estimated that 75% of all wild "orphans" rescued were not orphaned at all and should have been left alone. With young rabbits, the figure probably goes up to 95% (McKegg 1986c).

A rabbit nest is a depression in the ground about 4 inches deep, lined and covered with grass and fur. The female rabbit is gone from the nest most of the time, which makes sense because the nest is much less conspicuous when she is not on it. She nurses her young at dawn and dusk and perhaps during the night, covering them with a mat of grass and fur after each visit. The rest of the time, she is out foraging for food or resting nearby. If she returns to the nest and it has been disturbed (for instance, by mowing or heavy rain), she can and usually will move the young to a safer spot. You can make her job easier! If you find a disturbed nest, cover it as well as you can, and then leave.

The breeding season for cottontails depends upon the temperature and availability of green vegetation. The young develop so quickly that they can eat green plants 8 days after birth, and are completely weaned by 15 days (Chapman and Feldhamer 1982). Rabbits begin to venture from the nest at about this time and are on their own while still very small. A rabbit is fully furred but only about 4 inches long when it leaves the nest. Although small enough to fit in your cupped hand, a 15-day-old rabbit may be quite capable of taking care of itself. If, when you investigate a nest, little rabbits dash in all directions, leave them alone. A rabbit that runs away from you doesn't need your help.

Remember—if you have to chase it, it is not an orphan.

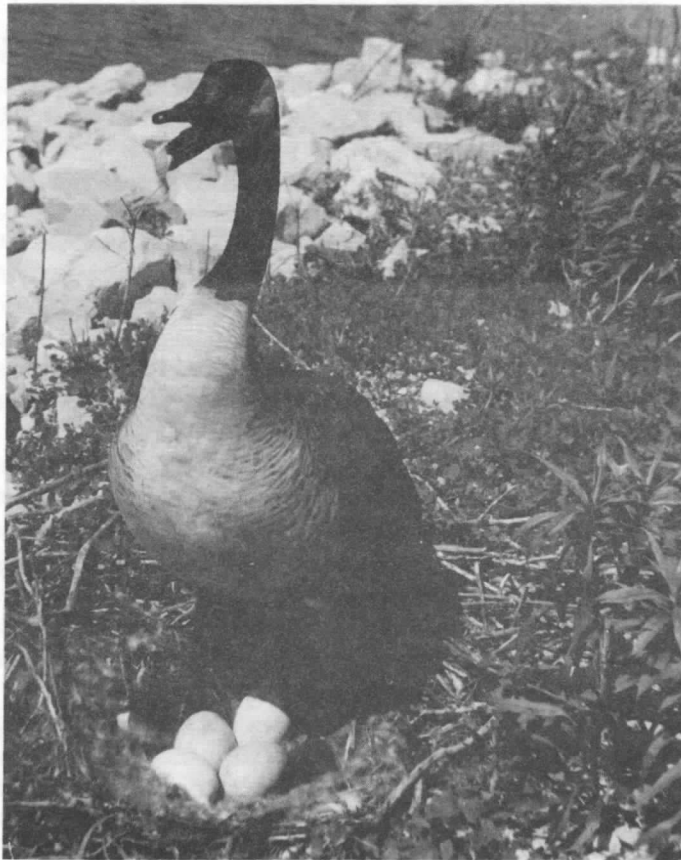


Fig. 2. Canada goose guarding its eggs.

Fawns

White-tailed deer can be found in 45 of the 48 contiguous states, and the fawn is one of the most beautiful and appealing sights in the world. With the increase in suburban deer populations in many areas, fawns are becoming easier to find. You can sometimes see them trailing after an adult female, or playing "tag" in a grassy field. If you find one in late May or June, however, it may be curled up in the woods or a field by itself, with no parent in sight. Is it an orphan? Almost certainly it is not.

A doe's method of rearing its offspring is designed to protect it from predators for the first few weeks of life. The adult eats the afterbirth and within hours of its birth, the fawn is led to a secluded spot and is taught to hide. The doe nurses and grooms the fawn every few hours, then leaves it to feed and rest herself, out of sight but within earshot. If there were two in the litter (usual among adult, well-nourished females), the second fawn will be hidden up to 200 feet away. The adult follows a pattern of nursing and grooming the hidden young for about 3 weeks, at which time the fawns are strong enough to outrun predators, and to travel with her.

Deer have evolved a number of special adaptations that make this approach successful. Fawns have almost no odor, which protects them from predators. Their white-spotted coats provide excellent camouflage when they are lying on the forest floor. For the first week of life, frightened fawns instinctively freeze, making full use of their protective coloration. Older fawns will lie until it appears they have been discovered, and then jump up and bound away. A deer's primary protection from predators is its great speed. Newborn fawns are not fast enough to outdistance predators, so they must depend on their ability to hide for protection.

Although these adaptations work well against natural predators, they do not work as well with humans. The fawn's hiding instinct makes it easy for humans to catch, at least for the first week. For the next few weeks, the fawn's curiosity may entice it to approach a person who stumbles upon it. This is often the period of development when the doe's absence leads a well-meaning person to believe that the fawn has been abandoned.

When you encounter a fawn, *never* try to catch it. If it is "hiding," admire it for a moment and then quietly walk away. If the fawn tries to follow you, gently push on its shoulders until it lies down, and then leave. You can enjoy the encounter without describing the fawn's location to others. If someone you know has found a fawn and taken it home, ask the person to return it to where it was found, even if several days have passed. Research has shown that a doe rarely abandons its fawn because of human scent (McKegg 1986a). The doe stays within a home territory in summer and travels through every part of it regularly. An adult can locate a misplaced fawn by calling, and likewise, a lost fawn will make calling sounds.

Fawns need the care and training of an adult deer to learn to survive in the wild. Those raised in captivity have a very poor chance of making it in their natural habitat, nor do they adapt well to life in a pen. As they reach maturity, they can become unpredictable and dangerous. Captive deer have even been known to kill people with their sharp hooves. When people try

to make deer into pets, the animals lose their natural fear of humans. If released to the wild, these "pets" will be more susceptible to predation.

Deer are also potential disease carriers. They are susceptible to rabies, with two cases having been confirmed in Maryland during the current outbreak (McKegg 1986a). No vaccine is available to protect deer from contracting the disease.

Raising and keeping deer and other native wild animals in captivity without the approval of the state wildlife agency may be against the law. If you think you have found an orphaned or injured fawn, or have found one in an unnatural habitat, get professional help, but do not pick it up.

Young Squirrels

Squirrels can have two litters a year, usually in March and July. The average litter size is three, but varies with season and habitat conditions. Although squirrels prefer tree cavities for nesting, they will build leaf nests in tree tops if no cavities are available. Both gray and fox squirrels are born without fur, and with their eyes and ears closed. They develop rather slowly, not opening their eyes until about 5 weeks of age, and not being weaned until 8-9 weeks old (Flyger and Gates 1984).

Squirrels usually move their young if the nest is disturbed. If you find a fallen nest or a nest in a downed branch or tree, give the adult a chance to relocate them. The mother will return for them for up to 48 hours. If you find an apparently healthy young squirrel on the ground, you can use heavy gloves or a jacket to pick it up and put it on a tree branch or trunk. It will probably cry out or use its well-developed claws to scamper up the trunk to safety.

Young Raccoons

Raccoons are born in April or May, usually in tree dens. Their eyes open in two and one-half weeks, and at eight weeks they are ready to travel with their mother. About this time, she often moves them to a ground-level den. The young are weaned at about 14 weeks, but travel with their mother well into the

winter. Female raccoons have a strong instinct to protect their young, and can react viciously if the young are threatened. They will reclaim their young for up to 48 hours after they have been separated.

Raccoons are often the primary victims of a rabies epidemic in wildlife populations. Do not approach any raccoon, young or old, healthy or sick. There is a period during the course of the disease when the animal can transmit rabies but show no outward signs of being infected. Tiny, helpless young can be infected with the disease from contact with their mothers.

CARING FOR YOUNG ANIMALS IS NOT EASY!

Before you interfere in the lives of young animals you should consider the following sobering facts:

1. Removing animals from the wild and attempting to care for them is probably against the law where you live! This is particularly true of migratory birds and birds of prey, and your holding these animals may result in your being fined and/or prosecuted.

2. If you want to show kindness to what you believe is an injured or orphaned creature, the most appropriate act on your part may be to leave the animal undisturbed, and to locate a "rehabber" to take over. Unless you are a veterinarian or a trained rehabilitator, you probably do not know how to care for young animals.

3. A nestling bird must be fed at least every half hour during daylight. Longer intervals between feedings may weaken the bird so severely that it will not survive.

4. Any wild animal should be dusted carefully with an insecticide before it is brought into your home. Most baby birds are infested with mites and lice from the nest, which may infest your home and furnishings.

5. In many locations, rabies is a serious disease problem, and all mammals are potential carriers of rabies. Young may be carrying the rabies virus, although symptoms of the disease may not show up for some time. (Animal-control officers and biologists who work regularly with wild animals protect themselves from rabies by undergoing a rabies vaccination procedure. Are you prepared to do the same?)

6. There is no rabies vaccine for wild animals that has been approved by the U.S. Food and Drug Administration. No studies have been completed in the U.S. which prove that existing vaccines protect wild animals from rabies. If a wild animal is vaccinated, and then bites someone, it must still be euthanized and its brain checked for rabies virus.

7. A young fawn quickly develops sharp hooves, and can kick when restrained. If placed in a car or truck, it may try to leap through a closed window.

8. Baby squirrels are born hairless, blind,

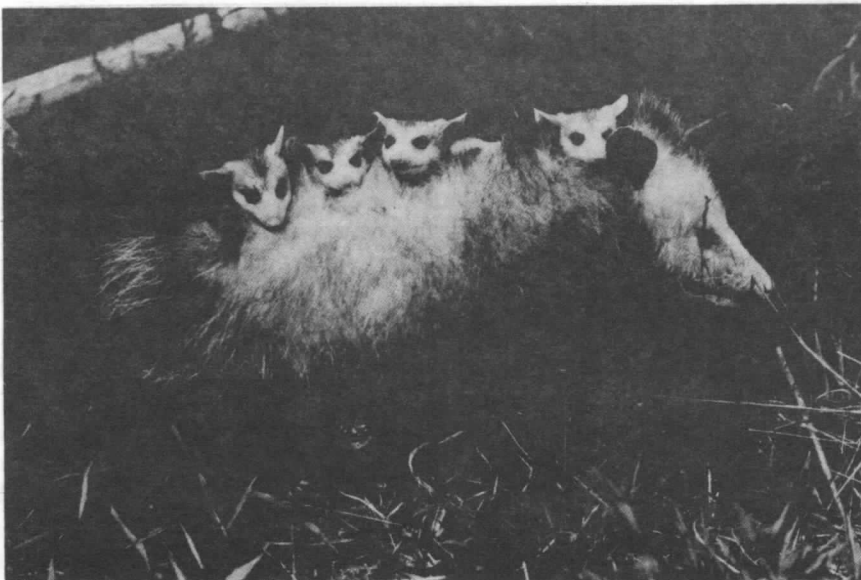


Fig. 3. Opossum with young. No help needed here!

and helpless, and require frequent feedings; they soon have sharp teeth and can inflict a serious bite. (Adapted from Spaulding and Spaulding 1979.)

NATURAL CONTROLS AT WORK

Sometimes, the young birds you find are nature's failures—the weak, the incautious, or the offspring of careless nest builders. In the wild, such birds are almost certain to die.

In addition, many types of animals ensure that their species will continue by over-producing young animals. A large portion of the new generation does not make it through the first year. If all of the offspring survived, overcrowding and starvation would be the rule within many wildlife populations.

If you feel obliged to help one of these natural failures, and you cannot give it back to its parents, place it with a wildlife rehabber so that it may have a chance for survival.

WHAT TO DO UNTIL HELP ARRIVES

If you are sure that a tiny squirrel or rabbit is abandoned (for instance, you find the adult dead in the nest), cover the young animal with a box or garbage can to keep it contained. If you must handle it, use heavy gloves because even young animals can give a severe bite. If it is very small, put it in a covered box with some ventilation holes in it, and place the box in a warm, quiet place. Do not try to feed the animal and handle it as little as possible. Even though your intentions are good, petting or trying to comfort a wild animal is more likely to send it into shock than to make it feel better. Call the state wildlife officer for further advice.

A FINAL WORD

Young wild animals need a parent's care and training to survive. All animals have very specific dietary needs that are hard to duplicate. They must learn from their parents what to eat, how to find it, and what to fear. If we disrupt this process by abducting them from the wild, they will not be prepared for life in their natural habitat. Wild creatures are not good pets because they are unpredictable—they have not been domesticated over thousands of years like dogs and cats. If they survive human care and are later released back to the wild, their survival abilities may be impaired. Should they be released into the home range of another member of the species, the competition may be too great and they will be driven out (N.Y. Dept. of Environmental Conservation, undated). If raised in a home with a dog, they may lose a natural fear of dogs and be easily killed by one in the wild. The same is true of their contact with human "friends"—they will not fear humans encountered in the wild, such as hunters.

Wildlife can transmit parasites and diseases to humans, as well as severely injure children and adults by biting, kicking, and scratching.

It is inhumane to subject wild animals to the unnatural conditions of life in captivity, not to mention the malnutrition, injury, and emotional stress that can occur at the hands of an unknowing captor.

Remember, chances are excellent that it doesn't need your help.

With this information, you need not risk making a normal, healthy young animal into an orphan.

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URBAN WILDLIFE MANAGER'S NOTEBOOK--17

URBAN REFUGES II. CEMETERIES AND CHURCHYARDS

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INTRODUCTION

Urban cemeteries have long been recognized as refuges for migrating birds, and may also be used year-round by many types of wildlife. Cemeteries represent a form of land use that is considered nearly permanent for, once established, they are seldom relocated. This permanency serves to increase the value of cemetery land as wildlife habitat. Trees and shrubs and other natural features are landscaping elements of most cemeteries, and can provide food, cover, and living space for wildlife. In older cemeteries, mature trees may attract arboreal birds such as Northern orioles (*Icterus galbula*) and red-headed woodpeckers (*Melanerpes erythrocephalus*), and cavity trees can be home to owls and to mammals such as

raccoons.

Green areas in cities help retain the wildlife species of a region, particularly if they are linked together to form travel lanes for wildlife. Studies of birds and mammals that have been conducted in urban cemeteries have helped to confirm that such areas can provide significant habitat for a variety of urban wildlife species. This urban open space is also important to people who enjoy seeing wildlife in natural settings.

In recent years, urban planners have recognized the potential for auxiliary uses of cemetery lands in crowded metropolitan areas. The public demand for recreation has made cemeteries attractive for bike-riding and picnicking and other activities that were traditionally banned in cemeteries. There has also been a recent trend to designing cemeteries with more grassy expanses and fewer with upright monuments.

There is reason for concern that the value of cemeteries as wildlife refuges will decrease as society accepts new concepts of cemetery land use. It is of interest to explore the data available on the value of urban cemeteries to wildlife, as well as to consider objectively some of the planning considerations for their multiple use. Cemetery managers also need to be made aware of opportunities to enhance the grounds to attract wildlife, while the primary function of the area as a cemetery is retained.

CEMETERIES AS WILDLIFE REFUGES

How can the needs of wildlife be met in cemetery habitat? Food may be provided by mast, fruit, seeds, nectar, and other parts of plants growing in the cemetery. Nesting and roosting sites and other types of cover are available in trees, shrubs, and herbaceous vegetation. In churchyards, a nearby church with a belfry also may be habitat for nesting and roosting bats, owls and other raptors, swallows and swifts; and headstones and other monuments provide numerous perches for birds.

Mount Auburn Cemetery in Cambridge, Massachusetts, was developed in the early nineteenth century during the "naturalistic" movement in landscape design. It was laid out with woodlots and ponds and an arboretum, abutting the Charles River. Today it comprises 171 acres of urban land. From the beginning, the proprietors deliberately planted trees that were attractive to birds; and birdhouses, bird baths, and supplemental winter-feeding programs were soon added. In addition to serving as a cemetery, Mount Auburn became noteworthy for its flora and fauna, and has been used by bird watchers for years. According to Howard (1987),



more than 200 different bird species have been recorded on the grounds. Mount Auburn is one of 50 cemeteries in the Boston area, where cemetery lands incorporate 35% of the open space available to residents of Boston and its suburbs. Four of the cemeteries, including Mount Auburn, have wildlife management programs where the landscape managers consider wildlife when new plantings are added. In addition to birds, numerous mammals, and amphibians and reptiles, which are often scarce or absent in cities, have been identified in Boston's cemeteries (Thomas and Dixon 1974, Laurie 1979, Spirm 1984).

The 181-year-old Congressional Cemetery in Washington, D.C., is also managed for wildlife. Birds and rabbits have responded to a reduced mowing policy, and turtles are common in the section bordering the Anacostia River (Wheeler 1988).

In Great Britain, churchyards have usually been carved out of old pastures or meadows, and may contain a variety of habitats. They commonly have over a hundred different types of flowering plants and ferns per acre, including many rare species. The flora and fauna present in chapel graveyards, cemeteries and churchyards are monitored by specialists who survey plants and wildlife throughout each county. They can be contacted for information on the species present in these areas, and for management guidelines. The British Butterfly Conservation Society conducts a Churchyard Butterfly Survey, and churchyard conservation projects are considered for national conservation awards. The Church and Conservation project of the Arthur Rank Centre (1988) has stated that "Churchyards in towns and cities are often obvious refuges for wildlife in an otherwise completely unsuitable environment." The Centre has published a pamphlet of conservation guidelines for churchyards that includes the following suggestions:

- Paths and other areas used by the congregation may be mowed as frequently as a lawn.
- Areas between older and less-visited gravestones may be mowed once a month, to a height of 3 inches; mowing should stop in June and July, to allow some plants to flower and seed.
- Areas distant from the church and rarely visited require cutting only once a year, in late summer, and can be left as "conservation areas" for plants, small mammals, and overwintering butterfly and moth eggs.
- Lichens and mosses growing on gravestones and church walls do not harm the stone and should be left untouched.
- A thick hedge provides shelter for wildlife, and should be trimmed by hand, leaving a few feet of uncut grass next to the hedge.
- Native trees and shrubs are particularly recommended for their wildlife value.

Biologists have found cemeteries useful as field study

areas because of the ease of making observations that might be more difficult in the wild:

(1) The bird studies of Lussenhop (1977) in ten Chicago cemeteries will be discussed in some detail in the next section.

(2) Thompson and Thompson (1980) carried out studies of the food-caching habits of gray squirrels in Mount Pleasant Cemetery in Toronto, Ontario, because of the excellent conditions for their experiments. Within the grounds was a noted arboretum with large numbers of mast-producing trees, an important habitat component of their studies. The density of squirrels in the cemetery was high, probably because of the good food supply. The squirrels in the cemetery were also less tame than those in nearby residential areas, and they never sought nor received food from visitors.

(3) Harrison's studies (1981) in two of Macon, Georgia's older cemeteries (one of 45 acres, founded in

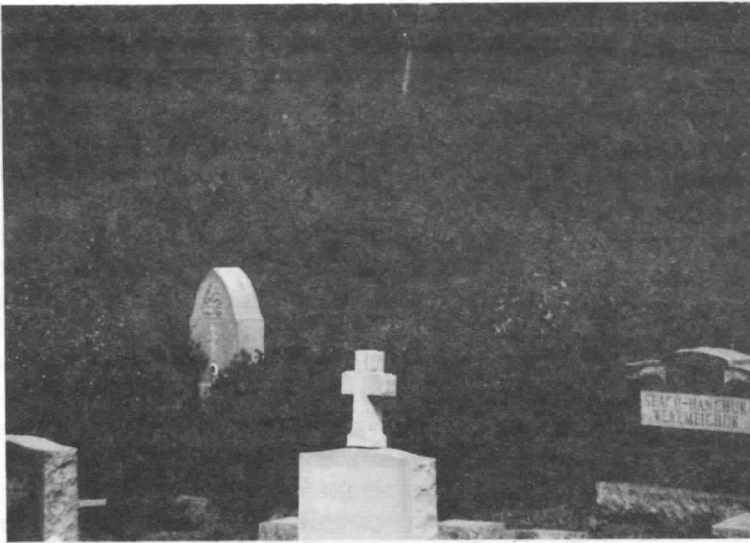
"Churchyards in towns and cities are often obvious refuges for wildlife in an otherwise completely unsuitable environment"

1840, and one of 120 acres, founded in 1887) led him to conclude that they showed a species diversity of plants and animals within an urban environment similar to some rural areas of Georgia. He identified 125 species of native plants, 40 birds, 3 amphibians, 5 reptiles, and 6 mammals (with signs of 5 others seen or reported seen) in the cemeteries. Also, at least 20 orders of invertebrates were represented in samples collected from the two cemeteries.

(4) Plant (1980) described the unusual behavior of a rare moth species in a churchyard in London. He observed about a dozen of the insects "spiralling" on a limestone grave marker, at St. Mary Magdalene Churchyard Museum Nature Reserve.

Emmet (1982) conducted further studies on the moth in the same location, noting that its food plant was a willowherb that grew abundantly in the churchyard.

(5) The biological literature from other countries, notably Germany and Russia, indicates that a number of wildlife studies have been carried out there in urban cemeteries (e.g. Dobberkan *et al.*, 1979; Nowicki 1983; Schmidt and Steinbach 1983; Vízova 1986).



Trees, shrubs, and grasses that are landscaping elements of most cemeteries can provide food, cover, and living space for wildlife. (Photo: L.E. Dove.)

Urban Cemeteries as "Habitat Islands"

One way to think of a cemetery as a refuge for wildlife is as an isolated "island," surrounded by the city instead of by water. Just as offshore islands are colonized each spring by migrating birds looking for nesting habitat, "habitat islands" exist on the mainland that can be exploited by birds and other forms of wildlife. Many urban cemeteries contain suitable wildlife habitat and, isolated from development, might be considered examples of "habitat islands."

Several decades ago, MacArthur and Wilson (1967) published their "Theory of Island Biogeography" for isolated oceanic islands and archipelagoes. This theory stated in part that the number of species found on an island is related to the area of the island, and to its isolation from the mainland. A large island is expected to support more species than a small island, and this area effect has been confirmed by many studies. Also, if an island is near a source of species to help colonize it, such as the mainland, it will have more species than will an isolated island. Studies have also confirmed the isolation effect on island species.

It was logical for research biologists to try to apply the island biogeographic theory to mainland "habitat islands." Little is known about how large an area should be reserved to protect various wildlife species, and more information is needed on the usefulness of isolated "patches" of habitat for conserving wildlife. In fact, many studies have been carried out in areas identified as "mainland islands," and the theory of island biogeography has been successfully applied in a number of cases. Most investigators have agreed that area alone is significant in predicting the species richness of urban habitat islands. However, inconsistencies between other aspects of the theory and its application to the mainland have been reported, perhaps for one of the following reasons: (1) Mainland areas may be quite small compared with those of oceanic archipelagoes. (2) Unlike water around an off-shore island, the landscape around a land-based habitat island may be diverse and contain species that are readily available to colonize the "island." (3) The factor of human disturbance must be considered in mainland habitat islands.

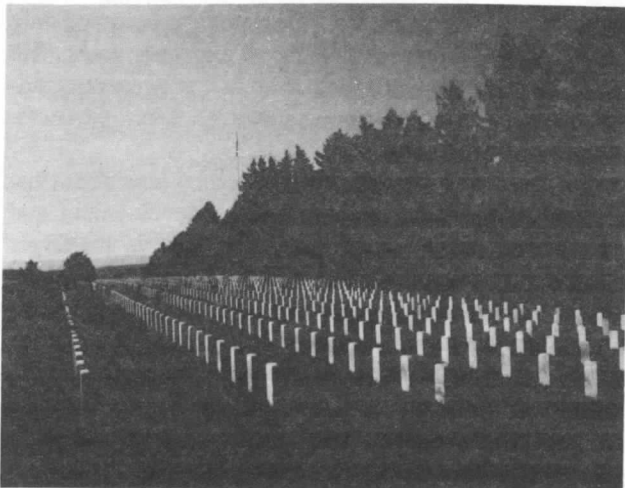
Lussenhop's work (1977) illustrated some of the problems of applying island biogeography to urban cemetery "islands." He tested the theory while looking at the number of bird species breeding in ten urban cemeteries of different sizes. First, he compared the number of species in cemeteries

with the number breeding in an equal-sized area of the neighborhood adjacent to each cemetery. In both cemeteries and adjacent neighborhoods, he found that the larger the area, the larger the number of different bird species. So far his work agreed with that of the island biogeographers. However, he also observed that species were added to larger cemeteries at a faster rate than to similar-sized areas of neighborhoods. And, there were other inconsistencies. The theory held that birds on islands became extinct as others immigrated there and competed successfully for space. MacArthur and Wilson had themselves suggested that in mainland habitat islands, competitors from the surrounding city would "spillover" and cause the extinction of birds that had immigrated to those "islands." Lussenhop looked for a spillover of urban birds, such as starlings, house sparrows, and pigeons, into his cemetery islands. Starlings were the only typically urban birds nesting in the cemeteries and they did not appear to displace other cavity-nesters of cemeteries, such as woodpeckers. He found, instead, that birds typical of cemeteries sometimes "spilled over" into the city. In several smaller cemeteries, with a limited number of nest sites, "cemetery birds" moved out to nest in the adjacent neighborhoods, although they continued to forage in the cemeteries. He also found that only a small sample of the potential breeding species in the Chicago area "colonized" the cemeteries. Although 106 bird species regularly breed in the Chicago area, Lussenhop recorded only 22 species nesting in his study areas. He attributed this to a rather homogeneous landscape and human disturbance in some cemeteries.

From his data, Lussenhop calculated that if there were complete development and increased human disturbance in his larger cemeteries, several of the bird species now present would disappear. Restricted human access in cemeteries ordinarily helps make these green areas more beneficial to wildlife. Lussenhop concluded that for some native birds, cemeteries were "enclaves" rather than habitat islands, from which the birds were "spilling over" into other urban habitats. [An enclave is an area that is not self-sustaining, although it may support wildlife. Usually, there is some exceptional feature that attracts wildlife, but there are not enough resources for populations to obtain everything needed to sustain them indefinitely (Lyle 1987).]

If you are interested in additional information on habitat-island studies, see, among others, the reports of Moore and Hooper 1975; Whitcomb *et al.* 1976; Margules *et al.* 1982; Ambuel and Temple 1983; Harris and Wallace 1984; Rafe *et al.* 1985; Vizyová 1986; and Dickman 1987.

What, then, can be said about cemeteries as urban refuges for wildlife? Whatever the mechanisms at work in mainland "habitat islands," biologists seem to agree that no area that can be protected is "too large," and that a small reserve is better than none. In some areas, cemeteries may comprise a significant portion of the urban open space. The results of years of observations in larger cemeteries, such as Boston's Mount Auburn, suggest they are important urban refuges, especially when they are close to natural areas and are a link in the wildlife corridor system of a city. Such travel corridors minimize the isolation of cemetery "islands," allow the dispersion of animals (and plants) into and out of the reserve, help to replenish wildlife populations, and accommodate species that require larger home ranges. Biologists also recognize that different kinds of animals will respond differently to small areas of habitat. Amphibians will never be found far from a source of water. Some uncommon bird species that require isolation will never be found dispersed throughout a community. Isolation may be important to other groups of animals as well, such as certain insects and sedentary animals, and to some plant species that are poor at dispersing their seeds. Cemeteries with little human disturbance may provide the isolation needed for some species, and also attract many species that are more adaptable.



The cemetery at Custer National Park, Montana, maintained in closely-mowed grass, is not wildlife-attractive, although the evergreens planted to each side may serve as travel lanes for some species of wildlife. (Photo: J.T. Engle.)

CEMETERIES AS PLANT REFUGES

One group of German investigators has called for preserving naturalized vegetation that springs up in urban areas, particularly where little mowing is done (Sukopp *et al.*, 1979). New forms of plants and even new ecosystems may originate there, which would be better adapted to surviving in cities. Sukopp suggested that "field laboratories" to study and to preserve new plants could be located in less-frequented areas of old cemeteries, and similar protected areas of the city.

Simple plants called lichens exist in certain habitats, particularly on rocky substrates. Lichens are useful as indicators of environmental change because they respond to air pollution by undergoing a change of color. Of interest in cemetery ecology is the fact that lichens may become established on the surfaces of monument stones and on stone walls, typically in moist and sunny locations. Limestone monuments appear to provide the right alkaline medium for them to grow, and older cemeteries and churchyards are among the best places to observe these primitive plants. Lichens may serve as indicators of pollutants such as sulfur dioxide (which can be transformed into acid rain), and lead from automobile exhaust, and are easily monitored in urban areas. In cities with severe air pollution, some species of lichens will not survive at all (Seaward 1982, Fox 1986, Brody 1987).

Mosses may also grow on monuments if humid conditions exist. In more tropical climates, moss spores are able to develop from spore to sprout in as little as 30 minutes. Some mosses may lie dormant through years of droughts, but start to grow when the rain returns (Perry and Merschel 1987). Presumably some wildlife might use moss for food or cover where it grows in cemeteries.

In some areas of the Midwest, native U.S. prairie grasses persist and are protected in cemetery habitats.

CEMETERIES CAN PROTECT RARE SPECIES

Cemeteries may be useful as refuges for plant and animal species that are threatened or endangered elsewhere. Such species may already be present on cemetery land, or may be introduced there for protection. Many cemeteries have areas set aside for expansion that are not visited by the public, which would be particularly valuable for protecting rare flora and fauna. Aquatic species could be placed in ornamental ponds, plants could be grown specifically for rare insects such as some of the butterflies, and birds that are intolerant of human activity might be attracted to more isolated areas. Infrequently-mowed meadows would encourage wildflowers and grasses to bloom and produce seed, and provide important habitat for some kinds of wildlife.

CEMETERIES AS OUTDOOR CLASSROOMS

A number of cemeteries provide educational experiences to visitors by marking the various trees, shrubs, and other plants, with their botanical names. The arboretum and botanical garden in Mount Auburn Cemetery, Cambridge, Massachusetts, attract garden clubs, school children, and other visitors to see the plantings. Some cemeteries have nature trails and distribute pamphlets to help visitors enjoy the natural features seen there. Forest Lawn Cemetery in Buffalo, New York, has printed "The Birds of Forest Lawn" for birders visiting the area (Finkler 1972).

Urban residents with an interest in geology are often able to study a variety of rock types in cemeteries by observing the stone monuments. Abney Park Cemetery in North London provides a geological walking tour of the Cemetery and a descriptive booklet to help identify rock quarried both locally and in other countries. The cemetery geology includes sandstone, granite, limestone, and metamorphic and artificial rock types (Robinson *et al.*, undated).

Historical markers and gravesites may be found within older cemeteries that are of particular interest to tourists and school classes. Persons searching for their ancestors often obtain significant help with the genealogy by studying information recorded on monuments. Allegheny Cemetery in Pittsburgh, Pennsylvania, was incorporated in 1844 and is one of the oldest urban cemeteries in the U.S. The cemetery is on the National Register of Historical Places and offers a walking tour to points of interest within its 300 acres.

In moderate climates, some cemeteries feature outdoor displays of works of sculpture and related art. These displays further enhance the educational experience of visitors to the area.

RECREATIONAL USES OF CEMETERIES

In some urban areas, cemeteries may have the only safe roads for bike-riding, and bicycling through them has become a popular pastime for children and adults. Walking or jogging on thoroughfares is also acceptable in many cemeteries. If lakes or ponds are present on cemetery grounds, the public may be invited to participate in fishing and ice skating. Undeveloped cemetery property is sometimes used for active sports such as baseball, and several cemeteries have developed golf courses in these remote areas. In a Pittsburgh suburb, a high school cross-country team was permitted to practice and race opponents over a 2.5-mile course in a memorial park (Malcolm 1972). Picnic tables and benches were placed within a secluded old cemetery in Washington, D.C. to encourage people to use the grounds.

Passive forms of recreation may include bird watching and other nature study, and reading or sitting quietly on benches or the grass. Where permitted, some visitors bring special crayons and paper for making grave-stone rubbings, which are considered art-forms.



A young visitor to a cemetery in Putney, Vermont, tries his hand at making a grave-stone rubbing of an old slate monument, a recreational pastime permitted in some cemeteries. (Photo: J.T. Engle.)

Surveys by Thomas and Dixon (1973, 1974; and *in* U.S. Dept. of Agriculture, undated) showed that in one summer season there were 86,000 visitors to 50 Boston cemeteries, engaged in 29 different recreational pastimes. The use of cemeteries for multiple purposes has been a fact there for some time.

OTHER INNOVATIVE USES FOR CEMETERIES

A large cemetery in Hillside, Illinois, has a nursery to grow its own supply of trees, and offers surplus trees to neighboring communities. In the Pocono Mountains of Pennsylvania, a private rhododendron nursery operates within the grounds of a cemetery, beautifying the surroundings. Undeveloped land in cemeteries may be offered to neighborhood residents for community garden plots. In Forest Hill Memorial Park in Wisconsin, trees are planted on a nature trail as tributes to the living or memorials to the deceased. A marker on the tree identifies the tree variety and the person being honored. Forest preserves as memorial sites are innovations in cemetery design that have the potential to enhance botanical specimens as well as to attract wildlife.

Unmarked burials in woods, parks, and other wild areas, are among more controversial ideas that have been suggested. (From Finkler 1972).

CHANGES IN CEMETERY LANDSCAPES

Gill and Bonnett (1974) classified cemeteries as "parkland," which unfortunately calls to mind the idea of sterile, mowed expanses of grass to which current thinking on cemeteries is moving. According to an official of the American Cemetery Association (personal communication 1988), the motivation for these trends in cemetery maintenance is probably an economic one. The president of one of the largest cemeteries in New York State recently sent this message to plot owners: "Again I urge you, install flush instead of raised monuments and markers in order to help management control the increase in the cost of care" (Kleiman 1988; see also Mitford 1963). Those who maintain cemeteries know it is more time-consuming and thus more expensive to cut grass where there are narrow spaces between grave stones, and around the base of trees and shrubs. They would much prefer to use 72-inch lawnmowers of the kind used on golf courses where there are few obstructions.

Wildlife managers know that areas of closely-mown grass, and with few trees and shrubs, are poor habitats for wildlife. However, at the other extreme are the neglected, overgrown cemeteries and churchyards that are rich, ecologically, but which are unacceptable to society. Somewhere in between is the traditional cemetery setting of peace and dignity, with many kinds of trees and shrubs in a semi-parklike setting.

Owners and managers of cemetery lands should be made aware of the opportunities available to provide habitat for wildlife in these areas. With a few changes in planning and vegetation management, more wildlife can be encouraged without restricting human use of the area. As trees and shrubs need to be replaced, new ones with wildlife value can be selected. Ground covers that require less mowing can be used, which would alleviate some of the cost of maintaining cemetery lands. The county cooperative extension service, state wildlife agency, and local nurseries should be able to advise cemetery grounds managers on types and sources of wildlife-attractive plants. There are also many publications that discuss different plant species suitable for wildlife food, cover, and nesting sites (e.g., see DeGraaf and Witman 1979; Dove *et al.* 1985; Kress 1985; Leedy *et al.* 1978; and Martin *et al.* 1951). The addition of a pond to a cemetery setting would add important wetland habitat for many types of wildlife.

From a conservation standpoint, it may be necessary to restrict recreational opportunities only in those cemeteries with remnant populations of plants and animals.

CONCLUSIONS

Wildlife can be promoted in areas of the city where there is open space and some heterogeneity in the vegetation. Areas that are permanent and that may have existed for long periods of time, such as cemeteries and churchyards, can serve as valuable refuges. A primary goal of conservation is to maintain species diversity in an area, and cemeteries can help to achieve this goal in the urban environment. Cemeteries may contain some of the last examples of plant and animal communities that existed before the city grew up around them. If they are links in a corridor system that allows dispersal of plants and animals in and out of the region, cemeteries can help to maintain plant and wildlife populations in cities.

People who live in cities have the opportunity to experience a somewhat natural setting in urban cemeteries, often within walking distance of the residential district. Where permitted, multiple-use of cemeteries for certain recreational pastimes is good use of this open space. It is not advantageous for cemetery owners and managers to promote sterile, golfcourse-like settings with flush markers. Good wildlife habitat is scarce in cities, for wildlife and for people.

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URBAN WILDLIFE MANAGER'S NOTEBOOK--18

RISK IDENTIFICATION TECHNIQUES FOR LAND MANAGERS — AN ANALYSIS OF CURRENT LEGAL STANDARDS

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Introduction

Land managers focus their attention on two important missions:

- (a) Protection of resources
- (b) Providing access to and use of the resources.

In undertaking these "missions" one of two philosophical approaches may be used:

- (a) Damage control
- (b) Anticipation/prevention

Management by damage control is a dinosaur. Well informed professionals are attempting to manage land through anticipation/prevention. Another name for this anticipation/prevention is risk management.

The objective of risk management is to efficiently conserve the assets and financial resources of the organization and to achieve financial stability by reducing the potential for financial loss.

Risk management will not eliminate all risks and liabilities. Personal injuries cannot be totally eliminated from recreational activities. Where there are water sports, there will be drownings. Where there are campgrounds and playgrounds there will be broken bones. Where there are federal and state regulations, there will be infractions. Where there are contracts, there will be disputes. Lawsuits are part of normal business operations in land management.

The land manager must be prepared to face lawsuits and to recognize differences between them. Some lawsuits state valid claims, some seek to define gray areas and some are frivolous. Nearly 1/2 million civil cases per year are being filed in U.S. Federal Courts alone.

In *Galloway v. McDonald's Restaurants of Nevada*, 728 p.2d 826 (Nov. 1986), a child had been badly burned on the buttocks, calf and thigh. The child's parents alleged that the burns resulted from the child's play on a merry-go-around at a McDonald's

playground. Apparently, the burns were of the type one would receive from sitting on a hotplate. McDonald's received a defendant's verdict from the jury, but they had to defend this spurious suit nonetheless. Land owners with "Deep Pockets," simply have to expect to see this type of suit from time to time, and no amount of risk management will prevent a suit like this. But risk management can and will serve you well.

There are four phases involved in risk management:

- (i) Risk Identification
- (ii) Risk Evaluation
- (iii) Risk Treatment
- (iv) Risk Implementation

In this issue we will discuss risk identification. We hope that this discussion will serve as a timely review of what land managers already know.

I. Effective Risk Identification requires that the manager understand the state's "Recreational Property Act."

Does your state have a "Recreational Property Act?" Have you read the Act within the past twelve months? Have you read actual cases litigated which deal with your Act?

Forty-six states have enacted statutes providing a degree of legal protection to private and public landowners who allow their property to be used for public recreation proposes.

Alaska, Mississippi, Rhode Island and Utah have not enacted statutes.

These statues are the result of a perceived need for public access to private lands coupled with a willingness on the part of users to forego a recovery for injuries for the opportunity to use the land. Most of these acts were patterned after a 1965 Council of

State Governments Model Act, and share many of the same features:

If a landowner allows use of property

- (i) By anyone
 - (ii) Without Charge
 - (iii) For recreation purposes
- O.C.G.A. Section 51-3-23

Then the landowner does not incur any liability for injury.
O.C.G.A. 51-3-20.

So long as there is no willful or malicious failure to guard or warn against a dangerous condition, use, structure, or activity. O.C.G.A. Section 51-3-25.

The backbone of a Recreational Property Act may look rather simple and straightforward, but it is not. In a review of case law from the past several years, I was impressed with the number of cases litigated which involved as a central issue whether or not an act was applicable. Under various circumstances, different state courts reach different results.

In 1986 the Supreme Court of Pennsylvania in the case of *Commonwealth Department of Environmental Resources v. Auresto*, 511 a.2d 815 (Pa. 1986) held that the Pennsylvania Recreational Use Statutes applied to lands held by the Commonwealth as well as other landowners.

However, also in 1986, the Court of Appeals of New York (the highest Court of Appeals) in the case of *Ferres v. City of New Rochelle*, 502 N.E. 2D 972 (1986) found that the New York Recreational Use Statute did not apply to a supervised public park.

For the Recreational Property Act to be applicable, the land area must be open to anyone. If only portions of the property are open, then the act will apply only to the open portion. For example, Georgia Power Company operates a hydroelectric plant on Lake Jackson. Although the lake itself was open to the public, the company posted warning signs at the power plant and dam which read:

"Danger. For your own safety please keep out. Rough waters. Gates at dam operate automatically."

A ten-year-old boy drowned in a pool of water located below the dam. In the case of *Georgia Power Company v. McGruder*, 229 Ga. 811 (1972), the Georgia Supreme Court held that the posting of "keep out" signs at the Dam area removed the dam site waters from liability protection under the Recreational Property Act.

A further consideration of the Act in general is that the lands must be available free of charge to the public. This does not mean, however, that some charge may not be made, and you would be well advised to understand what charges you may or may not levy in your parks.

As early as 1969, in the case of *Stone Mountain Memorial Association v. Herrington*, 225 Ga. 746 (1969), it was held that a parking fee charged for any vehicle entering the Stone Mountain Park was *not* a charge for park use and did not thwart applicability of the Recreational Property Act.

In 1986, the Court of Appeals in Michigan ruled that a park permit fee was not a fee as anticipated under the Michigan Recreational Use Statute. *Schuller v. Muskegon State Park*, 395 N.W. 2d 75 (Mich. App. 1986).

The largest threshold question for a land manager, in approaching to risk management is the covenant found in all statutes concerning "willful or malicious failure to guard or warn against a dangerous condition, use, structure, or activity."

"In order to characterize an injury as having been willfully or wantonly inflicted, it is necessary to show knowledge of a situation requiring the exercise of ordinary care and diligence to avert injury to another; ability to avoid resulting harm by ordinary care and diligence in the use of the means at hand; and the omission of such care and diligence to avert threatened danger when to an ordinary person, it must be apparent that the result likely would prove disastrous to another."

The three key elements are:

- (i) Knowledge
- (ii) Ability to avoid harm
- (iii) Omission of care

What could be a "willful failure" on the part of land management? The possibilities may only be limited by the fertile imaginations of plaintiffs' attorneys. Two recent examples in the case law are:

Umpleby v. United States, 806 F.2d 802 (8th Cir. 1986). In a U.S. Park in North Dakota an individual was injured in a one car accident on a road constructed by the army corps of engineers. The accident occurred at a 90 degree curve on the road and no warning signs were provided warning of this dangerous turn. The Eighth Circuit Court of Appeals ruled that this omission may well have been willful misconduct.

Merlerine v. State, 505 S.2d 79 (La. App. & Cir. 1987). A tree house used by children was illegally built on State of Louisiana property. State school officials knew that the tree house was on the property and was being used by children, but did nothing to remove the tree house. When a ten year old boy fell while swinging from a rope in the tree house, his mother successfully sued the State by alleging willful misconduct.

This is a very general discussion of recreational property acts, but it gives some flavor of the areas in state acts which require attention in order for the manager to identify risks requiring management skills.

II. Effective risk identification requires an understanding of negligence law that applies to your particular jurisdiction.

Liability for negligence varies greatly from state to state. In some areas, liability is limited by statutes which allow a lesser duty of care by the landowner to individuals on premises where no fee is charged for usage of the land. In other states, a person must be completely free of any contributory negligence in order to recover for damages. In still other states, the wrong doings of both parties are taken into consideration and a negligent person can still recover for damages if his or her actions are judged to be less negligent than those of the defendant.

But in every lawsuit based on negligence of landowner, plaintiff must establish four elements:

- (i) Defendant must have been under a duty to conform to a specific standard of conduct for the protection of the plaintiff against an unreasonable risk of injury.
- (ii) Defendant must have breached the duty of care.
- (iii) Breach of duty must have been the direct cause of plaintiff's injury.
- (iv) Plaintiff must have suffered some injury or other damages.

The existence of a duty and a breach of that duty are the important benchmarks for risk identification.

We have already defined duty. If the land manager has knowledge of a situation, and has some ability to avoid harm, but omits taking action, a breach of duty has occurred.

Duty will vary depending on whether you are dealing with natural or non-natural conditions and whether the condition is obvious or hidden.

Duty obligations are less in natural areas than they are in improved campgrounds. Your duty obligations are less concerning bridges over lakes than they are when hidden rocks lurk beneath riverbanks where you know swimmers regularly dive.

In *Roberts v. Town of Colchester*, 5009 N.Y.S. 2d 975 (Sup. 1986), a man was made paraplegic on diving from a bridge into shallow water. The court said:

"There is no duty to warn against a condition that can be readily observed by a reasonable use of one's senses."

In *Durham v. Forest Preserve District of Cook County*, 504 N.E. 2d 899 (Ill. App. 1 Dist. 1987), a 16 year old boy drowned in a flood pond after throwing a picnic table into the pond to use it as a raft. The court said:

"A duty will be imposed under ordinary negligence where an owner or occupier knows or should know that children frequent the premises and if the cause of the child's injury was a dangerous condition

on the premises . . . There are many dangers, such as fire and water which under ordinary conditions may be reasonably be expected to be fully understood and appreciated by any child of any age to be allowed at large . . . we find that the pond presented an obvious and open danger of which decedent Durham should have been aware of and avoided."

III. Effective Risk Identification requires that the manager recognize patterns in case law within and outside your particular jurisdiction.

It may seem incongruous, but if you are going to be effective risk managers able to identify risks on property sites, then you would be well advised to stay abreast of any current recreation and parks case law. One way you can do this is by reading current publications such as *Recreation and Parks Law Reporter*.

Certainly, few cases will be directly applicable to your particular situations. However, there undoubtedly will be several cases each year which will prompt you to think about risk situations in your own land areas that merit attention.

Second, after reading cases over a period of time, the manager should begin to distinguish patterns which recur in recreation tort litigation. This will be so because six types of recreation facilities generate more than 70% of recreation tort litigation:

- (i) Beaches
- (ii) Swimming Pools
- (iii) Recreation Centers
- (iv) Playgrounds
- (v) Ball Diamonds
- (vi) Campgrounds

A nearly infinite number of conditions exist at most swimming facilities that are or may be hazardous to the user. The bulk of dangerous condition cases concern water depth or submerged objects. Reading about cases dealing with water depth and submerged objects should assist in identifying risks in your water property areas *prior* to the time they are pointed out in a tort claim against your company.

Reading a case about diseased trees falling in campgrounds should prompt you to assess trees in your supervised campgrounds, etc.

Finally, reading current case law may alert you to developing tort liability patterns to which you may not normally be attuned.

In *Leone v. City of Utica*, 414 N.Y.S. 412, *aff'd* 49 N.Y.2d 811, 426 N.Y.S. 2d 980, 403 N.E.2d 964 (1979), a child playing by railroad tracks six hundred yards from park area lost his leg when he stumbled while running beside a train. The court said:

"Since there was no barrier or apparent line of demarcation between the park land and the contiguous property, it could reasonable have been anticipated that an infant, attracted by a train whistle, might take a path leading from the park and across that property to the tracks. The jury permissibly could have found that a fence along the boundary between the park and the private property would have prevented this accident."

In *Dumas v. Pike County, Mississippi*, 642 F. Supp. 131 (S.D. Miss. 1986), a man was injured in a dive off a clay embankment on property adjacent to a park. The court said that the county's duty of reasonable care may extend beyond the premises to areas consistent with the scope of invitations extended to plaintiff.

"The duty of an occupier or owner of a premises to an invitee can extend to the entrance of the property, to a safe exit after the purpose of the visit is concluded, and to all parts of the premises to which the purpose may reasonably be expected to take him . . . The court would not imply that there is, in the usual case, a duty imposed on landowners who invite the public onto their property to inspect their neighbor's property for dangerous conditions. Here, however, the property around the falls, including the clay embankment was being used in a manner entirely consistent with the purpose of the invitation. . . . The park officials were aware of the use of the land around the falls, yet apparently, did not warn of any dangers. Additionally, the county was in the best position to inform or warn patrons of dangers not otherwise apparent to the reasonably cautious person."

The reading of these two cases in conjunction raises the spectre of your liability on properties adjacent to those managed by you. That's a concept that raises your risk management consciousness.

IV. Effective risk management requires an appreciation that liabilities lurk in your daily paper chase.

Much "of the mission" of managers in land management involves much more paper shuffling than actual field effort. Land managers have backgrounds in forestry, agriculture, engineering, business, archaeology, and the sciences rather than law. Many have the habit of transacting business on a handshake or a simple two page contract, and hate to see an attorney darken their doors.

Obvious and hidden liabilities lurk in all of commerce with other individuals and entities. You need to identify these potential liabilities, either on your own, or with the assistance of an attorney.

- Hunting leases may negate your liability protection under recreational purposes act.
- A carelessly entered contract for garbage pickup may cost thousands of dollars.
- An agreement to let a Chamber of Commerce use a park facility may require an indemnification clause.
- Riversand mining leases may be fraught with liability possibilities.
- Lakefront easements need to be written with federal regulations in mind to prevent millions of dollars in future liability.

The four simple risk identification exercises we have discussed here are:

- Understand local recreational property acts
- Understand negligence law as it applies to your jurisdiction
- Be familiar with case law concerning recreation and parks litigation
- Monitor the daily paper chase for lurking liabilities

These exercises will not insulate you from lawsuits, but they will enable you to better risk manage, to efficiently conserve the assets and financial resources of your organization and to achieve financial stability by reducing the potential for financial loss.