HOW IMPORTANT IS HABITAT?

By Virleen Bailey

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How important is habitat? The average person in recent years has been hearing a lot about habitat. Wildlife biologists, in their commendable efforts to publicize the threatened and endangered plight of many of our wildlife species, have indicated that much of this endangered status is due directly to the destruction of habitat. Obviously, therefore, habitat is of great importance.

Wildlife workers define habitat as the place or type of site where a plant or animal naturally or normally lives and grows. For a clear understanding of the specific nature of an organism's habitat, it is essential that we view habitat from the organism's perspective.

Each species' habitat is unique. Habitats can be constant over time, seasonal (regular alternation of favorable and unfavorable periods), unpredictable (favorable periods of variable duration), or ephemeral (brief favorable period followed by unfavorable period of indefinite duration). Habitats relative to space are continuous (favorable habitat larger than the organism can reasonably use), patchy (favorable and marginal areas are intermixed but the organism is easily able to disperse from one favorable "patch" to another), or isolated (islands of favorable habitat too distant from each other to allow dispersal except by chance).

Another term frequently heard—and often misused—in connection with habitat is niche, and a knowledge of the difference between niche and habitat is essential. Niche can be described as the role of an organism in the ecological community. Perhaps the dictionary definition of niche will make this concept clear: "the place, employment, or activity for which a person is best fitted." By substituting "role in the ecological community" for "employment" and "organism" (animal or plant) for "person," the meaning of niche begins to take shape.

Conditions in which an animal or plant can exist define the dimensions of a niche. For example, consider temperature and relative humidity limits, degree of salinity, time, etc.

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Niche is more than two dimensional (length and width, or area). A third dimension, volume, must be taken into account. Sometimes, ecologists may occasionally consider additional dimensions, but more than three are virtually impossible to realize. The point we are aiming at here is a workable idea of niche so that the difference between niche and habitat may be easily realized. As you can see, the two terms are not interchangeable.

Habitat is visible; niche is not. A habitat may include several niches, but nature allots only one species to a niche. For example, a small bit of woodland will have niches for oak trees, warblers, woodpeckers, bark beetles, poison ivy, white-foot mice, mushrooms, and so on; each of these species dwelling in this small woodland habitat fills its own niche and no other. A species' niche indicates one role in the overall daily drama of existence in the ecological community, and those species-specific conditions mentioned earlier, when we were defining niche, determine the success of that role.

At this point, the difference between habitat and niche should be fairly clear. Just remember, before you read on, that only habitat is visible and concerns the actual living place of a plant or animal.

Observant persons, walking or driving through a park or the countryside, will notice that several kinds of organisms manage to live in a grassland habitat, or a pond (aquatic) habitat, or a woodland habitat similar to the bit of woods mentioned earlier. Obviously, this grassland (or any of the other habitat types) is divided or "compartmentalized" among the different inhabitant species. Equally apparent is the fact that while a snake and a meadowlark both live in the grassland, the two species do not live in exactly the same "compartment" of that grassland. While their respective niches serve as the compartmentalizing mechanism, both species are ground dwellers. What draws each of these types of animal to living among and interacting with ground-level organisms in this particular grassland community?

Ecologists have come to terms with this question by further characterizing habitat as macrohabitat or microhabitat.

One illustration of a macrohabitat is a grassy pasture. For the different...
species living in this pasture, several kinds of homesites are available. The voles, cottontail rabbits, meadowlarks, shrews, grasshoppers, big bluestem, switch grass, daisies—each requires a particular set of criteria necessary for life and growth, and while these criteria must meet the individual species' need, collectively they are all to be found in this single pasture macrohabitat.

The blocky, furry voles (called field mice by country folk) are herbivores, which means that vegetation comprises their main food resource. Voles are "picky" eaters in that they prefer the succulent inch or two of stem just above the root line of the pasture grasses. And foot supply is not the only factor in the vole's choice of habitat—it's entire life's business of eating, mating, rearing young, and keeping away from predators is carried on in a maze of runways chewed through the matted litter of dead pasture grasses. Food, home, shelter—all the necessities of life—if one is a vole—are supplied by one small segment of the pasture habitat. This small, limited vole-world is designated by ecologists as microhabitat.

Several factors are considered in defining a microhabitat, and each factor is evaluated from the organism's "point of view." Climate and ambient temperature, by way of example, influence the type and amount of vegetation present. Think about the pasture again. Let us say that it slopes gently from a hedgerow on the north down toward a wooded streambank on the south. In the spring and summer, along and under the north hedge, the earth will probably feel damp and cool to your fingers, particularly if a layer of decaying leaves protects the soil from the drying effects of the wind. Shade from the hedge's glossy green foliage will encourage the presence of shade-loving vegetation, while plants needing full sunlight may be absent entirely, and only animal species that have adapted to these kinds of conditions will be found in this microhabitat (which, incidentally, can be separated into even smaller "microchips": the chunk of rotted log under the hedge which is home to a wood ant population, for example. Food, nest-sites, shelter—all there for the ants).

Following the fall- or drip-line—where rainwater runoff from the tree canopy falls to the ground—there usually grows a strip of grasses and weeds taller than the adjacent pasture.
vegetation because of the concentration of added moisture. This strip represents another microhabitat which provides nesting and cover for those species needing the shelter of the tall grass but also requiring the more open space out in the adjacent pasture for visibility and mobility. This type of microhabitat, called edge-effect, or merely "edge," is necessary for such species as quail, cottontails, and other small, visual foragers.

Hedge rows (Osage Orange trees) form important protective and nesting sites for birds, small mammals, and reptiles.

The open, sunny slope with its diversity of grasses and herbs, a part of the whole-pasture macrohabitat — provides spaces for plants and animals not found near or under the hedge row, and each of these species must deal with life within the narrower confines of its own microcosm (literally, "little world"). As many as five or six myomorph (mouse-like) species may live among the vegetation on our slope, yet for the most part, each type of small rodent orders its existence within the parameters of definite habitat characteristics. Nature assists them neatly, mainly by allotting a slightly different food preference to each species.

"Wait a minute!" Someone is thinking! "That's easy to understand — each mouse-like species utilizing a different kind of food so that they all can exist successfully together on the pasture slope. But what about the members of just one species? What happens if there are many deer mice to share the deer-mouse food supply?

Nature has the amazing answer to this question, also. Through a strategy designed to ensure species fitness (survival, essentially, although the term fitness includes a great many factors, all of which contribute to survival — success — of a species), the strongest and most reproductively successful individuals occupy the best, or optimal, deer mouse microhabitat on the slope. Those not so successful, in order to survive, must of course remain in deer-mouse preferred surroundings, but they have subsequently been pushed out of optimum into "marginal" habitat (not the best neighborhood for deer mice, but with luck, a mouse with quick reflexes can make it). A population control mechanism which ecologists term "dispersal" enables marginal habitat to support a certain number (density) of deer mice by forcing certain of the population's components (usually, juvenile males) to disperse or "hit the road." These dispersing individuals may have to make do with even less desirable (sub-marginal) habitat where food is quite scarce, nesting and reproductive opportunities are virtually nil, and
where they are fair game for any passing raptor (hawk or owl).

Bearing in mind that while we are concerned with deer mice, numbers of other species are continuing their lives in their own pasture compartments, and we remark how vegetation changes as we descend toward the bottom of the slope because of such factors as increased available moisture from runoff, difference in exposure angle to sun, and altered wind current pathways (with resulting changes in temperature). All down the slope, the diversity in animal species responds similarly to the related changes in microhabitat. Finally, we reach the streambank, a complexity of microhabitats apart from those of the meadow slope. By this time, we are aware that any macrohabitat consists of many, many micro-environments.

**HABITAT SELECTION:**

Once we have acquired an understanding of just what is an animal's or plant's habitat, the question that logically follows asks, "How does a species choose a habitat?" Why, for instance, do orioles nest high in the canopy while a robin builds its nest in the fork of branches growing much lower on the trees? Why do bluebirds prefer cavities shoulder-height from the ground and meadowlarks hide their nests in grass clumps scattered over the open pasture? What makes a deer mouse nest in the open meadow, while her congenitor (same genus, *Peromyscus*) the white-footed mouse, is most often found among woodland vegetation?

More than one answer to these questions is necessary to formulate a satisfactory habitat selection theory. Scientists have given much thought to why a species chooses one type of habitat over another. One biologist believes that habitat selection may be a form of imprinting. Imprinting is the rapid establishment of a perceptual preference for another individual or an object. Mary's little lamb may be an example of imprinting. If the lamb, at the right stage in its development (usually, shortly after birth—the exact time to elapse between birth and the "right stage" for imprinting depends on the species), was rejected by its natural mother—as lambs often are—was visited by Mary with a bottle of warm milk, the lamb rapidly learned to associate Mary as a source of food, and, thereafter, followed her, as is well known. In effect, the lamb regarded Mary as its mother. In other words, the lamb imprinted on Mary.

Fence rows composed of wood or stone, with weedy growth, offer permanent habitat and passageways for a variety of wildlife.
According to the imprinting theory mentioned above, very young animals may become imprinted on their specific habitat type, and will select the same habitat type when they establish their own nests or dens. However, other scientists have produced evidence that indicate that birds and mice are not influenced by early habitat experience. Moreover, there is belief that habitat choice is associated with competition and natural selection. Remember, we defined natural selection earlier—and briefly—when we spoke of how the less fit deer mice are forced into sub-marginal habitat where they are more readily susceptible to capture, parasite infestation, and disease. By contributing their "fit" genes to their young and subsequently to the population "gene pool," healthy deer mice occupying optimal habitat are simultaneously influencing their offspring's choice of proper deer mouse habitat!

Robert MacArthur, a biologist who has studied the matter intensively, suggests that habitat selection for animals could even be partly psychological. Birds, for example, may recognize their specific habitat by conspicuous structural features, and choose nesting sites on the basis of leaf density at different elevations above the ground.

The important overall aspect appears to be the type of terrain: whether rolling or level, open (like our pasture slope), or wooded (the hedgerow and the stream bank), or homogeneous (vegetation of even growth—again, the pasture), or patchy ("islands" of shrubs, such as plum or sumac thickets dotted about open prairie). For plants, moisture or the lack of it can have a major influence on the distribution of plants. Cattails, which are a marsh species, will not be found growing on a prairie hillside. Plants, as well as animals, have become adapted to specific climate and geographical zones over time.

In central and western Kansas and along certain rivers, sand dunes form a hostile environment to most plants and animals; however, there are those types that not only tolerate it, but are found nowhere else.

Nearly all scientists concerned with habitat selection agree that there may be some relationship between habitat choice and food availability. A former Kansas biologist, Stephen Fretwell, devised a method for determining how well an animal and its habitat suited
each other. He believed that each individual would select optimum habitat (remember the deer mice, back in our pasture), where its chances of survival and reproductive success would be the best possible. For those mice not settled, all the habitat looks pretty good. So, when the best habitat is filled, these roamers settle in the next most suitable habitat, and when that is filled, the marginal habitat becomes most suitable to the individuals still unsettled. In other words, as density (the total number of animals in a given population), increases, the suitability of the habitat decreases. According to Fretwell, it is the behavior of the settled animals that indicated to the unsettled animals that an area is completely populated and they had better look elsewhere for a place to call home!

Actually, the rules for habitat selection are not "set in concrete." Most species appear to choose home sites with some flexibility. The fact that animals will spread into atypical habitats (as pointed out by Dr. Fretwell) supports this statement. The bottom line seems to be that the type of habitat in which a species has become successful over the long haul dictates present selection. Factors governing the choice appear to exist on both learned-behavior and inherent levels.

For anyone on his or her morning walk across a field or park, another question demands an answer. Every animal or plant seems to match-up with its habitat, like a puzzle piece fitting into its allotted place. The organism obviously is adapted to the type of surroundings selected. Almost always, the animal or plant appears to have done the adapting (although there are instances of mutual adaptation which we will not examine here). For example, a

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Flowing aquatic habitats are provided by streams with slow, deep pools and faster, shallow riffles.
fish is very well adapted to its home in the water. But fish are certainly not all of the same species. Every fisherman knows that catfish are bottom feeders and that bass will eagerly strike a surface lure. Each of these species has adapted to a specific type of microhabitat within the macrohabitat of the water. Each can be identified as a fish by its appearance and its lifestyle. So what determines the depth at which each kind of fish can usually be found?

In the case of these two fishes, preferred food is probably the major adaptive force. Next time your fishing line brings in a channel cat or a bullhead, take a close look at its head, particularly the set of its mouth. It is relatively easy to imagine a catfish swimming in the darker, cooler depths, scooping the bottom-dwelling water organisms which comprise catfish food. There are other contributing factors, certainly, which bracket the catfish family to inhabit a particular depth, but feeding habit is a prime example.

Thoughtful consideration of the manner in which other animal species secure their food will enable the observer to discern a possible relationship between the animal's means of getting food and the selection of its home-site.

Wildlife biologists, long aware that habitat availability holds the key to species survival, have done much in recent years to inform the public about the importance of providing permanent nest sites, cover, and food sources. These programs have proven fairly successful, particularly when the public's attention is focused on providing for locally native species. Moreover, some success has been achieved in transplanting species from one geographical region to another when the transplanted animal or plant is settled into the type of habitat to which it has always been adapted. This type of wildlife relocation is nearly always carried out by Fish and Game personnel or other wildlife biologists working for a governmental agency. But whether the project entails a small landowner attempting to ensure survival of local wildlife or a tax-funded, large scale relocation project, quality of habitat is crucial to the success of either route.

Families in rural areas frequently establish wildlife areas on their lands. A large acreage is not necessary. In fact, the Kansas Fish and Game Commission's nongame wildlife project (supported by the "Chickadee Checkoff" funds designated by friends

Marshes are unique habitats for many aquatic and semi-aquatic creatures. The water is shallow and vegetation is characteristic.
of wildlife on their Kansas income tax forms) encourages the development of backyard habitat to attract and maintain small animal species. In cooperation with the State and Extension Forestry at Kansas State University, they offer to interested landowners inexpensive bundles of shrub varieties preferred by small animals and birds. The kinds of plants in the wildlife bundles have been carefully chosen to provide a nucleus planting of 50 feet (small bundle) or 100 feet (large bundle). While neither of these bundles will meet all the needs of the nongame wildlife in an area, they will, when grown, create small islands of cover and supplemental food for attracting wild neighbors during the fall and winter months. Table 1 lists some plants appreciated by nongame wildlife. The nongame wildlife project will also provide help in forming a planting plan and assist, if necessary, in carrying the plan through. The procedure will go something like this:

The first step is not to order the wildlife bundles right away, but to survey the available yard space—or, if you are a farm family, to survey your farm for the most logical—from an animal's perspective—area for contiguous habitat, and to realistically visualize the area's habitat potential. The next step is to determine the presence of a constant water source, which, together with a survey of locally resident animals and birds, will suggest type and placement of shrub, tree, and perennial plantings. Townfolk must also take into account the attitude of near neighbors. While a nearby farm family may not mind the close proximity of raccoons or an occasional skunk, the town gardener with limited space for a garden, whose sweet corn falls prey to the furry little rogues from the backyard wildlife refuge next door, may be difficult to appease!

Food, water, cover, and nest and dens sites must be readily—and constantly—available. A suggestion usually made is to draw a scale map of the allotted area, and include any natural areas that seem to you to provide these

Mature forests occur only along the eastern edge of the state, with pines shown here scarce, but deciduous trees form large stands in the northeast, along the Missouri border, and follow major rivers into the east-central part of the state.
necessities. This map will serve to highlight those habitat factors already "on hand" as well as the components your plan must provide.

Even in the dry prairie there are springs that flow most of the year, creating a habitat for aquatic plants, such as Watercress, and a host of insects.

To ensure adequate water, the planner may need to install some type of water line with a hydrant located conveniently for supplying birds baths, artificial pools, and other animal-watering devices. Artificial pools provide more in the way of aesthetic rather than practical value and some management is required, which should be reviewed while considering installation. Small pools can be lethal traps for young birds and small mammals. Bird baths (with winter heating, if possible), and/or pans of water placed on the ground are better water sources in most instances for the backyard refuge. However, if it is decided to include a pool in the plans, there are ways to make it safe as well as attractive. One end should be shallow enough to allow small birds to stand and bathe safely—an inch is about the right depth. Flat rocks used as islands provide perching space beyond the reach of cats (rock islands also supply additional perches in large bird baths). Gently sloping sides enable small animals to climb out, and pools, water basins, and bird baths should all be placed in the shade so that the water stays cool. A hand dipped in a bird bath that has been exposed all day to the Kansas summer sun is a convincing argument for shade! As you blow gently on your reddened fingers, imagine yourself as a robin.

Shrubs, trees, and perennials should be planted with an eye to providing not only food, but cover from predators and shelter (home sites) as well. A list of varieties adapted to a given area of the state can be obtained from district Fish and Game offices, county extension agents, and from nursery and seed catalogs. Agencies other than the above-mentioned nongame project also may furnish advice on habitat planning and—in season—offer "backyard wildlife bundles" at reasonable prices.

By trial and error, much study, and through long hours of field observation, wildlife experts have learned to evaluate habitat with an "organism's eye view." Over time, data from these observations have been collected, and analyzed, and the results formulated into various systems for evaluation. Usually, such a system is tailored to the species or group of species whose habitat is under con-
consideration for improvement. Managers of the state and federal wildlife areas across Kansas utilize these formulas to determine specific food-crop and shelter plantings, water levels, predator control, etc. for the wildlife species most likely to be found in their management areas. Many other management factors are involved, of course, but—as for the backyard or farm habitat management plan, the crucial factors are food source, cover, and home sites.

Table 1. Some plants attractive to nongame wildlife.*

<table>
<thead>
<tr>
<th>Category</th>
<th>Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper level trees</td>
<td>Hackberry, Pin oak, Pines, Mulberry, Bur oak, Eastern red cedar</td>
</tr>
<tr>
<td>(over 25 ft.)</td>
<td></td>
</tr>
<tr>
<td>Mid-level trees and shrubs</td>
<td>Autumn olive, Cherry, Pear, Hawthorn, Russian olive, Firethorn (Pyrocantha)</td>
</tr>
<tr>
<td>(10-25 ft.)</td>
<td></td>
</tr>
<tr>
<td>Lower level shrubs</td>
<td>Coralberry, Honeysuckle, Fragrant sumac, Cotoneaster, Dogwood</td>
</tr>
<tr>
<td>(2-10 ft.)</td>
<td></td>
</tr>
<tr>
<td>Vines</td>
<td>American bittersweet, Honeysuckle, Grape</td>
</tr>
<tr>
<td>Grasses and flowers</td>
<td>Asters, Columbine, Indiangrass, Gayfeather, Butterfly milkweed, Little bluestem, Sunflowers, Impatiens, Marigolds, Salvia, Cosmos, Big bluestem</td>
</tr>
</tbody>
</table>

*After the Soil and Extension Forestry, Kansas State University.
Table 2 is an adaptation of a simple habitat evaluation form devised by a college ecology class. Evaluations such as this give landowners a rule-of-thumb appraisal of the potential of the proposed wildlife area. A low overall rating would point to a need for extensive improvement to attract desirable wildlife, while a good-to-excellent rating would indicate a habitat area already well-used—one whose weak points are few and need only minimal correction. This system works well for analyzing small areas such as backyards, woodlots, “odd-areas” around the farmstead, and so on.

Now you know. Habitat is important. So important that people have come to realize that habitat improvement is crucial to the very existence of a number of wildlife species, and necessary for the general well-being of many other, less-threatened species. As one biologist noted: “For man, home is where the heart is, but for many animals, home is where the cavity—or burrow—or nest—or pool is.” Providing “home” for wildlife, encouraging growth of lovely wild plants both common and rare, not only ensures their well-being in the present, but will also help to stabilize their future as a species.

Table 2. Simple form for small-area habitat appraisal.

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of vertical layers</td>
<td>1 (few) - 4 (many) (x 10)</td>
</tr>
<tr>
<td>Number of horizontal zones</td>
<td>1 (few) - 4 (many) (x 5)</td>
</tr>
<tr>
<td>Vegetation density in canopy</td>
<td>0 (open) - 4 (closed) (x 10)</td>
</tr>
<tr>
<td>Vegetation density in midstory</td>
<td>(same scale as above) (x 10)</td>
</tr>
<tr>
<td>Vegetation density in shrub layer</td>
<td>(same scale as above) (x 10)</td>
</tr>
<tr>
<td>Vegetation density in herbaceous layer</td>
<td>(same as above) (x 10)</td>
</tr>
<tr>
<td>Continuity of layers</td>
<td>0 (no connections) - 4 (foliage continuous) (x 2)</td>
</tr>
<tr>
<td>Number of tree and shrub species</td>
<td>1 (low) - 4 (high) (x 10)</td>
</tr>
<tr>
<td>Number of herbaceous species</td>
<td>1 (low) - 4 (high) (x 10)</td>
</tr>
<tr>
<td>Soil: ability to support burrows</td>
<td>1 (low) - 4 (high) (x 10)</td>
</tr>
<tr>
<td>Terrain</td>
<td>1 (smooth, even) - 4 (complex, rocky, thatched) (x 8)</td>
</tr>
<tr>
<td>Number of nest sites, cavities</td>
<td>0 (none) - 4 (many) (x 8)</td>
</tr>
<tr>
<td>Dependable water source</td>
<td>0 (none) - 4 (on site) (x 8)</td>
</tr>
<tr>
<td>Surrounding area “disturbed”</td>
<td>1 (man-made) - 4 (natural undisturbed) (x 10)</td>
</tr>
</tbody>
</table>

Farm ponds sometimes are necessary in otherwise open, arid cultivated fields, where waterfowl, amphibians, and fish find suitable aquatic habitats.
REFERENCES

The only way to learn about habitats is to get out and examine them. Here, your editor, Dr. Clarke (somewhat younger) conducts an environmental field trip — a beneficial undertaking.
NOTICE

Since 1954 we have provided The Kansas School Naturalist to all who requested it free of charge. The intent has been never to do otherwise. Financing (printing, handling, postage) has been the responsibility of the Division of Biological Sciences at Emporia State University. For a considerable period of time, the budget allocated to Biology has not been able to meet the ever-increasing costs of providing for quality education in this area. Therefore, something has had to give; we have now pared down to basic essentials, and those services not directly concerned with instruction are destined for the axe. The Kansas School Naturalist is one of these.

We can ensure continued publication only through the generosity of those who receive the journal. An endowment fund, whose annual revenue will alleviate some of the burden from the Biology budget, is planned. There is an envelope enclosed in this issue which we hope you will return with a contribution to this endowment fund. Please be generous! We will continue to publish as long as the money lasts, if an insufficient amount is not obtained to set up a fund. If any of you know of an institution, foundation, or corporation that would make a contribution or underwrite this endowment, please let me know.

Note: We will continue to send copies of future issues to everyone on the mailing list, regardless of whether or not a contribution is made. But remember, the future of the Naturalist depends upon the response to this request.

Thank you very much.

—Robert F. Clarke, Editor