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Making the Best of What Remains of Shrinking Habitats

By SAM HOOPER SAMUELS

[I] OWA CITY - Why did the chicken cross the road?

The old riddle raises an issue of real importance to many animal species, and to the scientists who study them.

As human activity alters more and more of the landscape - breaking up rain forests, wetlands and prairies with highways, farms, parking lots and housing developments - some creatures retreat into ever tighter habitats, while others venture across the human obstacles to find suitable places to feed and breed. The question conservation biologists are asking is why.

Dr. John Wiens, a professor of ecology at Colorado State University, has been studying the effects of changing habitats on species as different as songbirds and sheep.

"There are various bird species, particularly in forests in the East and Northeast, that are really interior birds," he said. "They don't even go close to the edges. If you think you have a 10-acre wood lot, from the perspective of something that only uses the inner core of that, you really have two acres. As fragments get smaller and smaller, these interior species really feel the effects."

By contrast, desert bighorn sheep might be expected to stick close to the mountains where they find their water. But when Dr. Wiens's students put radio collars on the rams and tracked their movements, the results were surprising.

"Rams would get up and move 30 miles across flat burning desert to another mountain range," Dr. Wiens said. "They spend a couple of weeks over there and then come back. The scale of movement was much greater than anticipated."

Findings like this have prompted some scientists to change the way they think about habitat fragmentation. The classical model for a habitat fragment is an island. Ever since Darwin landed on the Galápagos, scientists have understood that island habitats are special.

Species in isolation tend to survive, prey, reproduce and evolve differently from species with large open territories.

Dr. Wiens says this old model is giving way to a new one. "We need to shift our thinking away from isolated areas in the midst of inhospitable human development," he said. "They're not oceanic islands." Only if biologists think of fragments in the context of the overall landscape, he went on, can they help to manage, conserve and restore these habitats.

No habitat in America is more severely fragmented than the prairie. Once there were about 25 million uninterrupted acres of northern tallgrass prairie. Now barely 1 percent of that remains, about 300,000 acres. Few prairie remnants are large enough to be measured in the thousands of acres; most are in the hundreds or tens.

Prairie fragmentation is particularly severe in Iowa, which has a high concentration of roads, and scientists studying the behavior of butterflies here have made some startling observations about the differences among species. Some butterflies - monarchs, sulfurs, red admirals - hop freely across roads and farm fields in search of the next prairie remnant. Others, like viceroys, regal fritillaries and tiger swallowtails, are "habitat sensitive," rarely venturing far from a patch of virgin prairie.

But Dr. Diane Debinski, a professor of animal ecology at Iowa State University, found that when roadsides were replanted with authentic prairie grasses and flowers, these sensitive species were found in greater abundance and variety than they were on roadsides that had not been replanted.

"It shows that these roadsides are actually creating habitat that is benefiting butterfly populations," she said.

Roadside prairies also carry danger, however. The study, by Dr. Debinski and a graduate student, Leslie Ries, found a significant risk of butterfly mortality on the windshields of passing cars. So even if butterflies use roadsides as habitat, are they surviving to breed? Or are they lured in by the easy pickings of a roadside

prairie only to die without reproducing? Dr. Debinski said her next line of research would include a more detailed study of butterfly road kill.

A roadside prairie is an imperfect corridor. Two thousand miles west of Iowa, another team of scientists has used genetic testing to determine whether a true corridor can connect isolated populations - in this case, voles in the forests of Washington.

The scientists - Dr. Stephen Mech, now a professor of biology at the University of Memphis, and Dr. James Hallett of Washington State University - worked in a logging area, where forest fragments were surrounded by clear cuts. They identified pairs of forest fragments connected by corridors of forest. They then captured voles and took genetic samples to determine how closely related the different populations were.

They found that voles living within a single patch of forest were very closely related; voles living in separate patches were not closely related; and voles living in patches connected by corridors fell in between.

"I'm still amazed that it worked as well as it did," Dr. Mech said. "This shows that corridors, yes, do maintain some gene flow."

Sometimes, the goal is not to let species pass freely between fragments but to keep them out.

Dr. Mary Cadenasso and Dr. Stewart Pickett of the Institute of Ecosystem Studies in Millbrook, N.Y., study the edges of habitats, where outside species creep in and sometimes take over. As habitats become fragmented, edges become longer. Two forests, one whole and one fragmented, may have exactly the same area, but the fragmented forest will present many more miles of vulnerable edge to the outside world.

The two scientists examined how well different kinds of forest edges kept out nonforest seeds from adjacent fields. They noticed that when a forest was cut down by people, the edge looked very different from a natural forest edge. A natural edge is dense, with side branches and foliage forming a fairly solid wall from the canopy to the ground.

A cut edge, however, tends to be thick at the top and significantly more open below that. Would that lead to a greater infiltration of nonforest plants along the edges?

To find out, Dr. Cadenasso and Dr. Pickett took two lengths of edge between a forest and a field containing goldenrod. They left one intact and thinned the other artificially. Then they set seed traps at various points along the edges and within the forest.

"What we found was that when you open an edge up, remove that sidewall of vegetation, more seeds get through, and they move further in," Dr. Cadenasso said. Surprisingly, the effect continued into late fall, even after the trees dropped their leaves.

"I suspect that the twigs and branches still function as a barrier," Dr. Cadenasso said. "They're not as good or as solid as a thick wall of leaves, but they also must have a barrier function."

The study includes a recommendation: when forest is cut down for development, seal the edges by planting thick vegetation to preserve the remaining areas.

The butterfly, vole and forest-edge studies all were published in recent issues of the journal *Conservation Biology*.

Along with these new ways of studying habitat fragments, scientists also hope to encourage practical new methods of managing fragments. The conventional methods, in which a government or nonprofit agency buys land and sets it aside, may no longer be sufficient. Instead, the management of a park may be only as successful as the management of the apartment complex next door.

"If you put a wall around a reserve, it becomes an us-and-them issue," Dr. Wiens said. "We need to look at managing the surrounding landscape. That involves working with landowners. There are a lot of uses that are compatible with conservation objectives. A meadow between two patches of forest, many species of songbird might cross. A strip mall might be a big barrier."