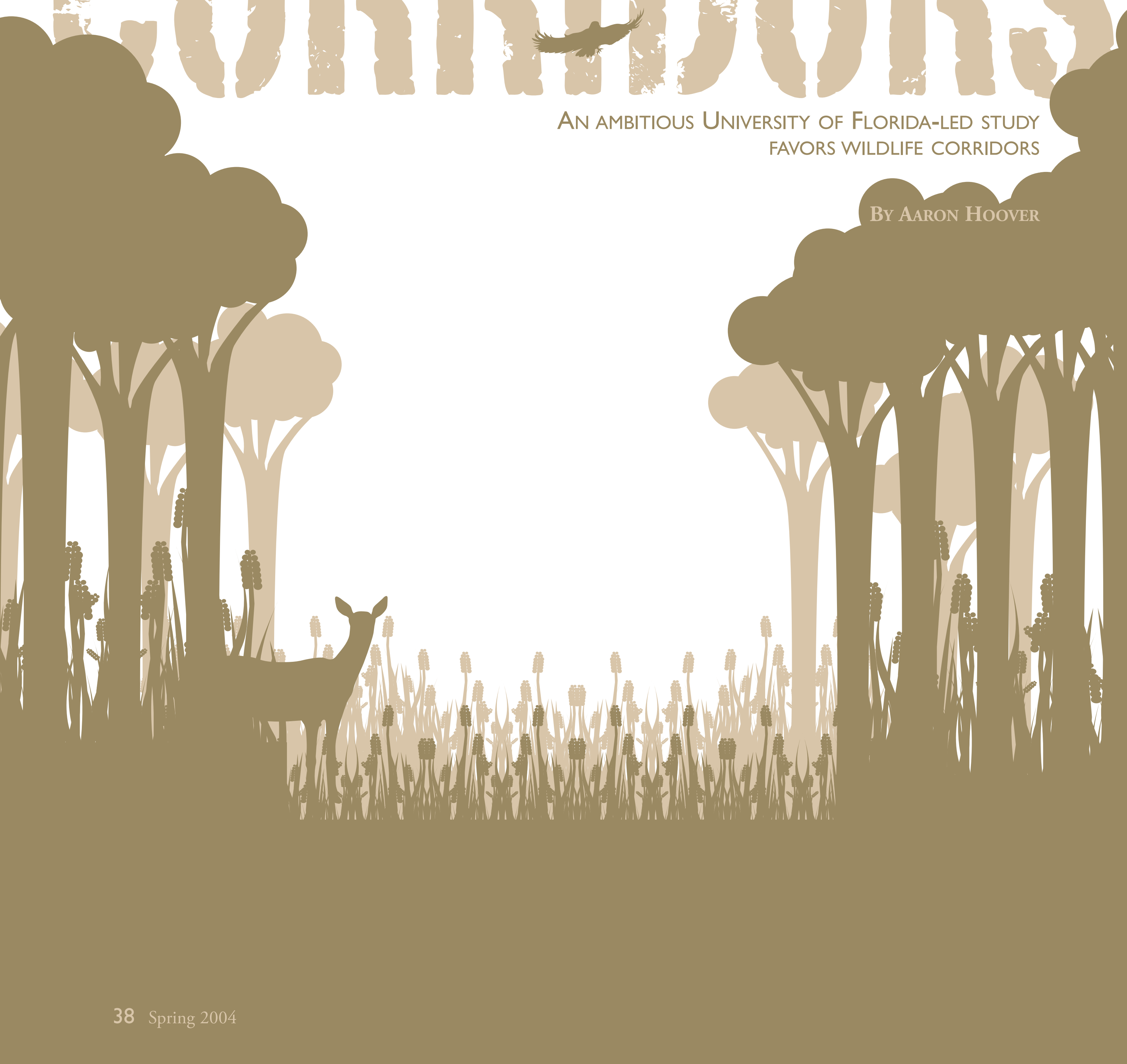
CONFIRMING CORRIDORS

An ambitious University of Florida-led study favors wildlife corridors

By Aaron Hoover



A few years ago, a researcher was examining satellite pictures of federal forest in South Carolina when she noticed something odd — Large patches of rectangular clearings arranged in patterns but unconnected by roads.

Rachel Clement and her colleagues at the U.S. Geological Survey, who were doing a national survey of land cover change, were mystified. Because the forest is part of a major Cold War-era nuclear weapons production site, they let their imaginations run wild. Were the 40-odd clearings waste disposal sites? Perhaps UFO landing pads?

"They really gave us a time, figuring out what in the heck these forest openings were used for," Clements recalled.

A few phone calls and a search through scientific literature revealed that rather than indications of other-worldly visitors, the clearings were part of a huge experiment on Earth's creatures. Headed by the University of Florida, the experiment, which began in 1999 and continued through last year, was perhaps the most ambitious attempt ever to answer a question that has bedeviled biologists for decades. The question — whether wildlife corridors really help wildlife and plants — is all the more intriguing because most people outside the ecology community take the answer for granted.

Flawed History

Many communities in Florida and elsewhere have set aside undeveloped land for wildlife corridors, or greenways, linking one natural area to another. First envisioned as early as the 1960s, these greenways are touted as ways not only to reduce urban sprawl but also to allow wildlife and plants spread across natural landscapes cut into pieces by roads, development or logging.

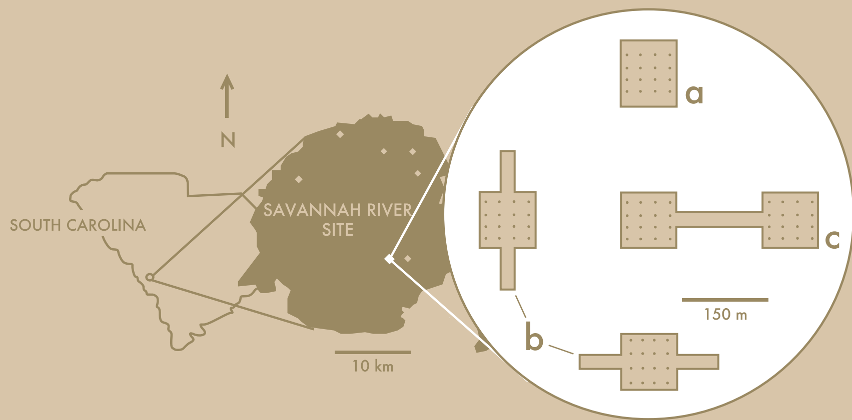
The idea is that corridors not only allow animals to find new resources, but also prevent the isolation of species — isolation that can even lead to extinction if the habitat fragments are not accessible for reproduction or re-colonization.

Intuitively, corridors make wonderful sense. But finding scientific support for their apparent benefits has been remarkably tough, says Doug Levey, a UF professor of zoology and one of the lead investigators on the UF study.

Previous studies showed that wild areas connected by corridors have more wildlife or greater biodiversity than disconnected areas. But these studies often failed to account for other influences, Levey says. For example, corridors in urban areas often lie along rivers because these flood-prone

Ray Carson

Doug Levey, a UF zoology professor and one of the leading investigators on the corridor study, says finding scientific proof for the benefits of wildlife corridors has been challenging.



Researchers mapped out eight similar sites, each about 158 acres, in the Savannah River Site National Environmental Research Park near the South Carolina-Georgia state line. The U.S. Forest Service arranged for loggers to remove trees and burn the remaining groundcover, creating one central clearing and four peripheral clearings on each site. The experiment included three kinds of clearings;

a) ISOLATED CLEARINGS
b) "WINGED" CLEARINGS
c) CONNECTED CLEARINGS

areas tend to go undeveloped. But waterways represent one type of habitat that may benefit wildlife and plants more than the corridors themselves, he says. Other studies purporting to show the benefits of corridors compared rural and more urban areas, leaving unclear whether the corridors or simply the areas' remoteness accounted for the observed differences.

Experiments on corridors, meanwhile, are difficult to pull off because the areas needed to test and repeat them are so large, at least for the big animals that people like to think corridors help protect. An experiment exploring whether corridors benefit black bears, for example, would require an undeveloped area equal to the bears' range of hundreds of miles. And other similarly huge natural areas would be needed to repeat the experiment to test its conclusions. As a result, most scientifically rigorous corridor experiments have taken place on much smaller scales. One noted experiment, for instance, focused on insects on 20-by-20-square-inch plots of moss, some isolated and some connected by pencil-thin corridors.

The UF-led team sought to increase that scale, and then some.

Unique Laboratory

The researchers mapped out eight similar sites, each about 158 acres, in the Savannah River Site National Environmental Research Park near the South Carolina-Georgia state line. The park is a 482-square-mile federally protected research area set aside early in the Cold War to purify plutonium for nuclear weapons. When carving it out in the 1940s, government officials relocated two entire towns and closed off the land to civilian activity. Because only a small part of the park served as home to the reactors and research facilities, most of the land remained undeveloped, gradually returning to its natural state. The U.S. Forest Service, which now manages much of the park, allows logging in some areas but has set aside others for ecological and biological research.

Levey says the ghosts of the site's top-secret activities remain. "You can be driving down the road and there's a sign that says 'Starve a spy, feed a shredder.' And there's another sign that says, 'What's at the heart of security? UR.'"

Forests of 50-year-old pine trees dominated all eight of the UF research plots. At the researchers' request, the U.S. Forest Service arranged for loggers to remove trees and burn the remaining groundcover, creating one central clearing and four peripheral clearings on each site. The loggers also logged corridors connecting each central clearing to one of the peripheral clearings, leaving the others separated by the forests. Each clearing measured about two acres.

Levey says such complicated arrangements probably couldn't have happened anywhere else.

"The way that loggers usually operate is they come in and they clear cut and they build roads into places — well, if you built a road into our sites you would be creating a corridor," he says. "We had to specify that they could not cut any trees to get the trees out of the patches they created, which was a pain for them."

Carved out in 1999, the clearings quickly grew into fields. The habitat in these "patches" was radically different from that of the surrounding woods — plants and animals found in the patches would never thrive in the woods, or vice versa. Research on the sites spanned 2000 to 2001.

The team — which included zoologists Nick Haddad of North Carolina State University, Brent Danielson of Iowa State University, Sarah Sargent of Allegheny College in Pennsylvania and numerous graduate students — did two major experiments.

In one, researchers planted male holly bushes in the central patch and female hollies in the four peripheral patches. They chose holly because it is not naturally present in the forest and the females cannot bear fruit unless pollinated by males. The researchers waited until the hollies flowered and then measured the fruit set, or the percentage of flowers that turned into berries, in each of the clearings.

The result: The hollies in the connected patches were consistently more fruitful than in the unconnected ones. This indicated that more wasps, butterflies and other insect pollinators made it from each central patch through the corridor than through the forest.

When birds or other animals eat fruits, they often distribute the seeds to new locations in their droppings, an important way that plants spread. To gauge the effects the corridors had on this process, the researchers marked thousands of seeds of wax myrtle and holly in the central patch with a sticky powder that can be seen only with a florescent light. The researchers then placed seed traps under 16 bird perches built in each of the connected and unconnected peripheral patches. Over several months, they collected and analyzed the resulting bird droppings in a lab.

Given the grand scale of the experiment, the work was not without difficulties. For one thing, many of the first hollies that were planted died because of a drought at the time. As a result, the researchers had to spend thousands of dollars on an extensive irrigation system. And they also had to sort a lot of bird poop.

"We collected thousands and thousands of defecations from birds, and it takes a lot of time to go through them all," says Josh Tewksbury, a UF postdoctoral researcher at the time of the study and now an assistant professor at the University of Washington.

The resulting data revealed that significantly more droppings containing wax myrtle and holly seeds were carried from the central patches to the connected patches than to the unconnected patches. This indicated that more birds were flying between the connected patches than the unconnected ones.

"There were almost double the center patch's droppings in the connected receiver patches versus the unconnected patches," Levey says.

View of a corridor connecting two clearings.

The findings probably go well beyond just pollination and seed dispersal. When plants have more pollen, they produce more fruit, attracting more birds, which distribute more seeds, which attract more birds and seed-eating animals, and so on. So, although the experiment tested only two processes, it suggests that corridors can be beneficial in the much larger biological community.

"Our study suggests that these corridors do help in connecting populations, and theoretically they should help sustain networks of populations existing in increasingly fragmented landscapes," Tewksbury says

Toward A More Complete Picture

The scale of the UF experiment was not the only thing that made it rigorous. Scientists reduced the size of the patches with corridors to make sure the area of the connected patches matched the area of the isolated patches. This addressed a common criticism of previous studies: that the added natural area that comes with corridors might itself account for their benefits, as opposed to the corridors themselves.

Another long-standing theory was that the beneficial effects of corridors are not related to the corridors themselves — but rather to the so-called "drift net" effect. This held that birds and animals migrating through an area are more likely to run into the corridor than smaller unconnected patches, which would increase their numbers. With this in mind, the UF team elongated some patches with "wings." The resulting data showed no significant differences between these longer patches and the regular ones.

As complete as it was, the study hardly put an end to the corridors controversy. Levey says that although the first experiment demonstrated corridors positively affected pollinators and seed disbursers — which help plants — it did not examine whether they could also help seed-eaters and herbivores — which hurt plants. Grasshoppers, mice and deer might use corridors to eat more plant seed and plants. "Who knows? Corridors may benefit those 'bad guys' in terms of plant animal interactions more than the 'good guys' — and if they do, then corridors may be bad news for plants," Levey says.

The researchers hope to get at that question with a major follow-up study examining these variables. Although their initial proposal to the National Science Foundation did not get funded last summer, they plan to apply again in the fall.

Ultimately, the value of the corridor study, and other studies like it, may be that they bolster conservationists' arguments that corridors and greenways are worth preserving. As Levey says, "The balance of evidence thus far is certainly that corridors are beneficial."

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