Attractive tree ISO lemur to start a family

K. Dausmann

Brown lemurs feed on fruits of a Strychnos *tree in western Madagascar.*

A much discussed, rarely demonstrated kind of relationship between plants and animals has turned up between certain trees and the lemurs of Madagascar, report German researchers.

Twenty tree species in the island's dry forests depend largely on lemurs to eat their fruit and disperse their seeds, according to Jörg U. Ganzhorn of the Institute of Zoology in Hamburg and his colleagues. In the August CONSERVATION BIOLOGY, they warn that the new generation of these dependent species looks sparse in forest fragments where lemurs are disappearing.

Conservationists have fretted for years about the possibility that the loss of fruit-eating animals could wipe out the plant species that they disperse. Fruit that plops to the ground under maternal branches rarely gets a good start in life. It faces such menaces as deep shade and seed-damaging grazers that know where to find a good thing. Seeds in fruit eaten by the right animal, however, can hitchhike in its gut to more promising spots.

Demonstrating ecological effects of fruit eaters has been difficult, Ganzhorn explains, because so many diets overlap. In parts of Africa, a fruit that doesn't get gobbled by monkeys could still be spread by antelopes, bats, birds, or elephants. Some New World floodplain trees even get dispersed by fish.

Also, a tree can live so long that ephemeral creatures like people might not notice that the loss of seed dispersers is changing a forest. "It looks all bright and sunny," Ganzhorn says, yet the nonreproducing trees are just "living dead."

One famous proposed example of a disperser affecting a plant turns out to be less than clear, Ganzhorn notes. In the 1970s, scientists reported that no new generation of *Calvaria* trees had sprouted in Mauritius in the last couple of centuries. They speculated that without the dodo, the tree seeds no longer germinate. More recent work, however, has located some postdodo saplings.

Madagascar appears to be the perfect place to look for a new example of disperser dependence because the island has few fruit-eating mammals and birds, Ganzhorn notes. He has watched animals and collected droppings year-round. Lemurs seem to be major dispersers, especially the brown lemur. With the possible exception of the bush pig, it was the only animal that eats and disperses seeds greater than 11 millimeters long.

Madagascar's booming human population is wiping out wild habitat. The researchers compared sapling numbers at plots in extended forests with plots in forest fragments where much of the largest wildlife had disappeared. In the fragments without the brown lemur, many fewer saplings of the 20 tree species dependent on lemurs were sprouting than in the larger areas. Saplings from trees dispersed by other animals thrived in both locations.

"It's the first place we've been able to make the connection," Ganzhorn says.

Kent H. Redford of the Wildlife Conservation Society in New York welcomes the study as "amongst the best we've got" on disperser dependence. For a bulletproof case, Redford would require studies that add and remove animals from plots. He says that he also wants to know more about other forest interactions, such as what rodents and ants do to the seeds that lemurs leave behind.

Despite his questions, Redford finds value in correlational studies such as this one. "There's a tension between our work as scientists and our work as conservationists," he says. "If we wait for proof that convinces us as scientists, the chances are there will be no work for us as conservationists." —*S. Milius*

Tiny earthquakes hint at larger shocks

By recording thousands of puny earthquakes, a pair of seismologists has discovered a way to track the subtle mood swings of California's San Andreas fault. The technique may provide some warning when tensions along the infamous quake-maker reach the breaking point.

The study, reported in the July 30 SCIENCE, looked at 6,000 small earthquakes recorded near Parkfield, Calif., about halfway between San Francisco and Los Angeles. The segment of the San Andreas running through Parkfield has become one of the best-studied faults in the world because it appears to snap regularly every few decades, producing strong earthquakes.

In the late 1980s, Thomas V. McEvilly of the University of California, Berkeley and his colleagues installed seismometers at the bottoms of deep boreholes, 250 meters below the ground at Parkfield. This network of 10 instruments records quakes as small as magnitude –1, far too weak for people to feel.

Robert M. Nadeau and McEvilly discovered that many spots along the San Andreas produce characteristic microquakes months to years apart. By measuring the time between these carbon-copy quakes, the two researchers could detect surges of underground stress. "We're using these sequences of repeating earthquakes like instruments, essentially like strainmeters on the fault," says Nadeau.

Geophysicists have outfitted the San Andreas near Parkfield with several types of surface instruments that can monitor stress along the fault and the movement of rocks on either side of the fracture. The microquakes, however, provide a direct look at the kinds of changes going on deep underground. Taken together, the information from surface instruments and boreholes offers a more complete picture of the fault's behavior, say Nadeau and McEvilly.

Using the pattern of repeating quakes, the scientists deduced that a pulse of stress had migrated from the northwest to the southeast along the Parkfield stretch of the San Andreas fault starting in the late 1980s. The passage of this pulse preceded and overlapped a series of four moderate earthquakes between 1992 and 1994.

Nadeau and McEvilly surmise that the fault may display similar behavior before a major quake at Parkfield. The city has suffered five strong shakes since 1881, and seismologists in 1985 predicted that another one would happen by 1993 (SN: 7/5/97, p. 8). The expected jolt did not strike, but researchers continue to collect data in hopes of capturing any warning signals when it does happen.

The microquake technique could have uses elsewhere. A network of 20 borehole seismometers has already enabled Nadeau and McEvilly to detect repeating sequences of quakes along the Hayward fault, which runs along the east side of San Francisco Bay. "I could envision putting these [borehole seismometers] along any fault that has a seismic hazard potential," says Nadeau.

He and others caution, however, that nobody yet knows what kinds of deep signals will precede a large quake.

William L. Ellsworth of the U.S. Geological Survey in Menlo Park, Calif., has doubts about applying this technique elsewhere. Parkfield, he says, is a unique place, where the San Andreas produces many similar tremors. "It's hard to turn the results from Parkfield into a general method for looking at faults," he says. —*R. Monastersky*