Loss of Dung Beetles Puts Ecosystems in Deep Doo-Doo

Like an overengineered airplane, ecosystems are thought to have redundant functions that should prevent a single extinction from triggering more serious consequences. Many animal species disperse seeds, for example. So when one such species disappears, others face less competition and ought to become more abundant, taking up any slack.

New research suggests that may not always be true. The study examined the fate of dung beetles, which collect dung, bury it, snack on it, and lay their eggs in it. Burying the seed-laden dung also enriches the soil and helps plants regenerate. Trond Larsen, a graduate student at Princeton University, found that the beetle species best at burying dung were the first to disappear from forest fragments. Alarmingly, related species did not become more abundant. Much dung then went unburied. “It tells us that the level of resilience in ecosystems to damage or biodiversity loss could be much less than we thought,” says Richard Ostfeld of the Institute of Ecosystem Studies in Millbrook, New York.

Larsen studied 42 species of dung beetles in eastern Venezuela, where a hydroelectric dam completed in 1986 flooded 4300 square kilometers of tropical forest and created more than 100 forest islands. He found that smaller islands had fewer species of beetles and that the larger beetles were most frequently missing.

The main cause of the beetle’s decline was a bad sense of direction. Most dung beetles are used to flying in contiguous forest, where they don’t need to be expert navigators. By marking some 15,000 beetles and recapturing as many as possible, Larsen showed that beetles couldn’t find their way back if they flew off the island. “Once they hit open water, they’re done for,” he says. Big beetles fly faster and farther than small beetles, he discovered, and are more likely to go AWOL. The problem is worse on smaller islands, where there is a larger perimeter relative to the area. To retain a viable population, three of the largest dung beetle species needed at least 85 hectares—a surprisingly large amount of habitat for an insect, Larsen says.

When beetle diversity declined, much less dung was buried. The remaining species of dung beetle on the smaller islands didn’t become more abundant and dig into the surplus dung, Larsen found. The reason, he suspects, is that they too are accidentally leaving the islands, although at a lower rate. With fewer seeds being buried, forest diversity ultimately will decline.

The worrisome conclusion is that species diversity is less of a safeguard against ecosystem collapse than had been assumed, Larsen says: “Even the loss of just one or two species may have a much greater impact than we previously thought.” Like top carnivores, the large dung beetles appear to be the most sensitive to extinction and extremely important for ecosystem integrity, he adds. Moreover, it’s surprisingly hard for others to fill their shoes, Ostfeld says: “I wouldn’t have expected to see this effect with a dung beetle.”

Larsen’s discovery that the beetle’s larger body size and flying behavior make it more vulnerable to decline is an important contribution, says Ostfeld. “Finding a clear mechanism makes it more likely that ecologists can predict the systems that should behave similarly,” Ostfeld says. “That’s a big deal for environmental managers and policy specialists.”

Forest Loss Makes Monkeys Sick

It’s bad news for endangered animals when their habitats are fragmented. Populations become isolated, food supplies diminish, and hunters become more of a threat. Now add to that list a higher risk of illness.

Although it’s known that disturbed habitat can help transmit diseases between wildlife and humans, a new study shows for the first time that fragmentation of forests by humans can hasten the decline of a primate population by making common parasites more abundant and introducing new ones. “It’s a potentially devastating effect,” says Peter Daszak, director of the Consortium for Conservation Medicine in Palisades, New York.

Deforestation threatens many populations of forest-dwelling primates in Africa. Thomas Gillespie, now a postdoc at the University of Illinois, Urbana-Champaign, and his Ph.D. adviser, Colin Chapman of the University of Florida, Gainesville, studied two species of leaf-eating monkeys to understand how habitat change might affect their health. They compared groups living in undisturbed forest within Kibale National Park in western Uganda with those living in surrounding forest fragments.

In the park, overall populations of both the Red Colobus monkey (Piliocolobus tephro-

Backlog. When key dung beetle species disappear, monkey dung goes unburied.

Homesick. Red Colobus monkeys that live in fragmented forests suffer from more parasites, such as Strongyloides stercoralis (inset).