MEETING BRIEFS

Predators, Prey, and Natural Disasters Attract Ecologists

Some 2200 ecologists turned out for the 78th annual meeting of the Ecological Society of America (ESA), held in Madison, Wisconsin, 31 July to 4 August. Among the offerings: reports on the effect of dams and levees on large river ecology, predator-prey interactions, how parasites might control evolution, and the impact of clearcutting on soil organisms.

Isle Royale: End of an Era?

In the hard winter of 1949, a couple of Canadian wolves padded across frozen Lake Superior and hit pay dirt off Ontario's shore: Michigan's Isle Royale, a wild, 45-mile-long island overrun with moose, which had discovered the predator-free haven early in the century. In 1958 wildlife biologist Durward Allen of Purdue University began tracking the changing population numbers, as the wolves tracked the moose in a classical predator-prey pas de deux. Thirty-five years later, Isle Royale is the longest studied system of natural predator-prey dynamics in existence and has been a fount of information on wolf behavior. The notion, for example, that wolves are selective in their predation, taking primarily young and old individuals, grew out of the Isle Royale studies.

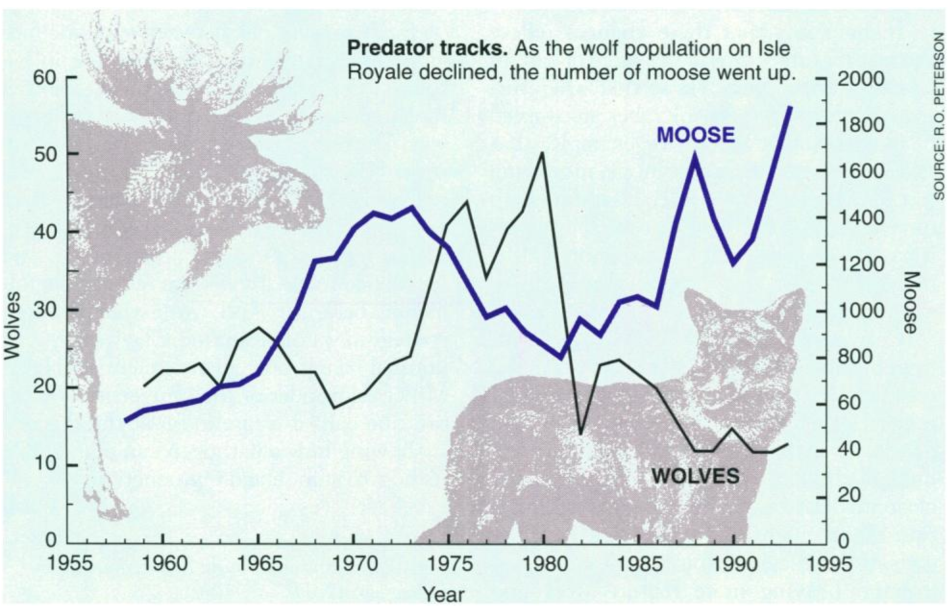
But the time course on this natural experiment may be running out. The wolf population, which at its peak in 1980 numbered 50 animals, took a nosedive in the early 1980s from which it still has not recovered, wildlife ecologist Rolf O. Peterson of Michigan Technological University reported at the ecology meeting. Only four pups have been born in the past 2 years, all to the same female in one wolf pack. The two other packs on the island are down to just a pair of wolves each. The total wolf population is now 13, and, by most accounts, is on its way to extinction. With fewer wolves, the moose population has, predictably, reached a record high of about 1900 this year.

The wolves seem to have been dealt a one-two punch: a narrow genetic base to begin with, followed, in all probability, by an encounter with a deadly canine virus in 1981. After the wolves started dying, the animals were captured in 1988 for blood testing to determine what was doing them in. Restriction enzyme analysis of the wolves' mitochondrial DNA turned up a single pattern, indicating the wolves were all descended from a single female, and they had only about half the genetic variability of mainland wolves.

Such an isolated and inbred population would have a tough enough time hanging on during the best of times. But antibodies in the blood samples indicated the wolves had also been exposed to parvovirus, a common killer of unvaccinated dogs that emerged in the late 1970s. Though only circumstantial evidence indicts the virus as the killer, the start of the wolves' decline coincides with a 1981 parvovirus outbreak in nearby Houghton, Michigan, and it could have been carried to Isle Royale on the hiking boots of visitors to the U.S. National Park on the island.

Virus or no, the wolves seem to be on their last legs, although not everyone believes they are going extinct. "It's too early to conclude that," says wolf expert L. David Mech of the Fish and Wildlife Service. He points out that the wolves rebounded after other periods of low reproduction in the 1960s, despite their inbreeding. Peterson does concede that the outcome isn't certain, but he's not optimistic. "More likely the population will continue to dwindle with progressively poorer reproductive success until ...they run out of one sex," he says. If that happens, the famed predator-prey study could become a study of extinction.

–Christine Mlot



Predator tracks. As the wolf population on Isle Royale declined, the number of moose went up.

Dams, Levees, and River Health

Civil engineers have long known that constructing dams and levees along major rivers changes their physical characteristics in ways that can have unfortunate results. That lesson was brought home this summer when the mighty Mississippi and some other rivers of the U.S. heartland surged out of their banks in what by all accounts is the flood of the century in North America. The many dams and levees constructed to hold the rivers back apparently contributed to the havoc wreaked by the floods. But while dams' and levees' effects on water flow have long been studied, the impacts of flood control engineering on the biological health of major rivers have barely been explored. One reason: Ecologists have concentrated most of their efforts on smaller rivers and streams because they are much easier to study.

That's now beginning to change as ecologists and other biological researchers are forming equal partnerships with the physical scientists to develop models that describe how the physical alterations brought about by dams or levees in turn affect the biology of large rivers. Judy Meyer, a University of Georgia stream ecologist and president-elect of the ESA, describes this new cooperative effort as "the wave of the future. You need teams of geologists, hydrologists, chemists, and biologists to understand rivers. One researcher can't encompass it all."

A talk given at the ESA meeting by aquatic ecologist Frank Ligon of EA Engineering in Lafayette, California, exemplifies this new approach. With geomorphologist William Dietrich of the University of California, Berkeley, and aquatic scientist William Trush of Humboldt State University in Arcata, California, Ligon measured the rates of the movements of gravel, sand, and cobblestone-sized rocks on both sides of dams on various rivers in California, Georgia, and New Zealand, and related the changes to alterations in the rivers' depth, width, and velocity downstream.

The analysis suggested, Ligon says, that many of dams' harmful effects on river hydrology may come about because they don't permit sediments to pass. As a result, a river will cut into the riverbed, deepening the channel. This can prevent rivers from spilling into their floodplains, thus depriving them of the nutrients they would normally pick up there. Dams that withhold sediments can also simplify riverflows, changing braided rivers into single thread rivers and limiting fish-spawning and rearing grounds as a result. Ligon notes, for example, that dams are gradually changing the McKenzie River in Oregon from a river with many islands to a single thread river, putting the McKenzie's salmon population in jeopardy. When dams are built, Ligon suggests, more attention should be given to keeping sediments moving downstream.

Recent modeling work by stream ecologist Mary Power of the University of California, Berkeley, and civil engineer Gary Parker of the University of Minnesota in Minneapolis and their colleagues also points up the importance of maintaining sediment flows for life in the river. Power's group is collecting data to determine how levees affect a river's hydrology and how that in turn affects feeding relations among species and the abundance of plants, insects, and fish. Preliminary results show, Power says, that riverbeds must be renewed periodically with fresh sediments to provide habitats for weedy plants and the animal species, such as insects, which provide food for fish, that dwell among them.

While a great deal more remains to be learned about the effects of dams or levees on river ecology, the researchers say that even now the work can help guide the management and restoration of large rivers. Such efforts, says Power, "will be critical in maintaining better conditions for biological life within, and human life alongside, the large rivers of our land."

–Anne Simon Moffat

Clearcutting's Soil Effects

When a forest is clearcut, the environmental degradation that occurs above ground is obvious. Less obvious, but equally cataclysmic, is the damage that goes on underground —the loss of fungi, worms, bacteria, and other microbes that can nourish plants or protect them from disease. "Soils can be biologically destroyed, even if they seem physically intact, holding most minerals and topsoil," says Elaine Ingham, a soil microbiologist at Oregon State University in Corvallis who reported the results of her group's analyses of soils from a clearcut forest on the Olympic Peninsula at the ESA meeting. This loss of subterranean life-forms is important because it can impair efforts to restore forests, although the research is also suggesting ways to improve reforestation.

In their work, Ingham and her colleagues compared the soil populations of a variety of organisms in a large forest area, measuring hundreds of meters on a side, before and after it was clearcut. By 6 to 9 months after the trees were cut, the underground fungal biomass had declined to about one-tenth of what it was before logging started, Ingham says. Also lost were roundworms and some arthropods, such as springtails and mites. Microbial populations were affected as well. One indication of that came about 1 year after the clearcut when Ingham and Dennis Knight of the University of Wyoming in Laramie measured a large surge of nitrogen concentrations in groundwater, probably reflecting the death and decay of nitrogen-storing microbes. And the losses of soil organisms only get worse with time: Ingham found that soils were showing a 100-fold decrease in fungal biomass and significant loss of nitrogen 5 years after clearcutting.


KENNETH W. FINK/PHOTO RESEARCHERS

Soil despoiler. Cutting all the trees may have just as serious effects below ground as above.

Ingham says that these changes reflect the fact that trees provide a source of carbon to subterranean microbes so that when forests are clearcut, some microbes are starved of nutrients. She notes, for example, that smaller gaps in the forest canopy, measuring just tens of meters on a side, did not seem to have such a disastrous effect on soil organisms, presumably because microorganisms moving in from surrounding areas help to keep a healthy underground environment.

Conversely, soil microbes help nourish trees by providing them with water and minerals. Indeed, without a healthy microbial population, reforestation efforts may fare poorly. As many as 75% of Douglas fir seedlings died when they were planted in the clearcut areas studied by Ingham. Reforestation efforts might fare better, Ingham suggests, if they begin within 6 to 9 months of logging. Leaving more mature trees and keeping large, soil-compacting machinery out of logged areas might also aid reforestation by helping maintain underground biological systems.

–A.S.M.

Pathogens Take Charge

While many in the scientific community are currently concerned with sex as a means of disease transmission, in evolutionary terms sex has been seen as a means of disease avoidance: Sexual reproduction creates the genetic variability that gives rise to disease resistance in a population. "Sex is one way of staying one step ahead of your pathogens," says biologist Leslie Real of Indiana University, who organized the ESA's first symposium on the ecology of disease. Sometimes, however, the pathogen still wins. Indiana University plant population biologist Keith Clay reported on a strategem employed by a fungal pathogen to steer its host plant away from sexual reproduction, simultaneously securing its own future and taking control of the future of the plant.

Poverty grass (*Danthonia*) normally can reproduce in two ways: through wind-pollinated or self-fertilized flowers, as can violets and some other plants. But when a poverty grass plant is infected with the fungus *Atkinsonella hypoxolon*, the fungus engulfs the developing flower at the tip of the plant, mechanically preventing it from opening. This eliminates wind pollination and the possibility of cross-breeding with plants resistant to the fungus; that, in turn, eliminates the production of more individuals that could fight off the fungal onslaught. But the self-fertilizing flowers at the base of the plant still develop and produce seeds—seeds that genetically resemble the fungus-prone parent. The fungus even manages to infect those seeds, condemning the plant and its offspring to infection in perpetuity.

Such associations between systemic fungal parasites and plants are common in nature, according to Clay—choke, another fungal disease of grasses, operates in a similar way. The result, for the plant, is evolutionary stasis. "By suppressing sex and forcing clonal reproduction," he says, "the parasites have been able to subvert the coevolutionary response from their host populations...and [have] taken the driver's seat rather than following behind." And while the parasite's strategy may not be unique, Clay's study is an unusual one, says plant scientist Helen Miller Alexander of the University of Kansas. She calls it a rare look "at the flip side ...showing how a pathogen can manipulate its host to stop sexual reproduction."

–C.M.

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