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Warming Alters Predator-Prey Balance

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ISLE ROYALE, Mich. -- For six decades since they loped across frozen [Lake Superior](#) to reach this rocky island, wolves have roamed 45-mile-long Isle Royale, the nation's least-visited national park.

The wolves survived the extermination efforts by the island's few inhabitants, who in the 1950s and '60s saw them as mortal enemies. And they survived an outbreak of deadly canine parvovirus in the 1980s. Now, scientists tracking the wolves in the world's longest-running "single predator-single prey" study fear that the Isle Royale wolves could become extinct because of global warming.

Next weekend, scientists and [National Park Service](#) officials from around the country will celebrate the 50th anniversary of the Isle Royale Wolf/Moose Study, which has helped reveal how predator-prey interactions can affect entire ecosystems. Because the two species live in geographic isolation here in the largest of the Great Lakes, with no other predators or prey and minimal interference from humans, it is an ideal laboratory in which to study how their fates are intertwined.

But the anniversary may not be a happy one, as both populations are close to their lowest-ever levels and have been feeling the effects of Earth's rising temperatures.

When moose are plentiful, the wolves also thrive, hunting as a pack and often tracking moose for days before making a kill. If the moose population drops -- from disease, starvation or tick infestation -- the wolves also suffer. When the wolf population plummeted from a high of 50 to a low of 14 in the early 1980s because of parvovirus, moose numbers rose. And when the severe winter of 1996 caused moose to starve, the wolves gorged on the carcasses and easily picked off weak, underfed moose.

Since the study was begun by [Purdue University](#) professor Durward Allen in 1958, it has tracked many such ups and downs. But scientists fear that the forces that drove those fluctuations are paling, compared with the impact of climate change on the island's ecology.

Researchers monitor both populations by plane overflights early in the year. This spring, they counted 23 wolves and about 650 moose, down sharply from the highs of 50 wolves in 1980 and almost 2,500 moose in 1995. In 2006, moose numbers hit a record low of 385.

With the exception so far of this year, summers over the last decade have been unseasonably warm on Isle Royale. Moose thrive in frigid boreal climates, but when the mercury rises above 60 degrees Fahrenheit, their heart and respiration rates increase, and every step is an effort. They spend warm days resting or submerged in water rather than eating the 40 pounds of vegetation a day they need to fatten up for the winter, when the only food sources are twigs and fir trees.

A hot summer means weaker and older moose may die from heat stress. Come next winter and spring, many others will starve because they ate too little during summer. Or they will be so weak, they will be easy prey for the wolves.

"It all started in 1998," said study director Rolf Peterson, a research professor at Michigan Technological University. "Moose were dropping dead of starvation right in front of park visitors."

The heat also encourages ticks that make moose miserable. Later onset of winter means more time for the blood-sucking ticks to latch onto a moose, and earlier springs mean more success for tick eggs.

Over the winter, a tick-infested moose may need to replace 100 percent of its blood. They also rub, bite and scratch off their hair in an effort to rid themselves of the insects. This spring, said study co-director John Vucetich, the average moose had lost 75 percent of its hair, and one in four had lost 95 percent.

"There were bare-naked moose running around," he said.

No one thinks the moose, which arrived on Isle Royale about 100 years ago by swimming from the mainland, will disappear. But with fewer moose, the wolves could be doomed. Desperate wolves have been seen chomping on old moose bones and even eating green apples from trees.

Peterson, who lives with his wife in a fishing cabin on Isle Royale surrounded by hundreds of antlered moose skulls, said the wolves are still suffering from the moose crash of 1996.

"Now wolves are living on moose born in the early 1990s, before the collapse," he said. "It's like they're feeding on a baby boom generation that's not backed up."

Vucetich noted that climate change can have contradictory effects. Milder winters and earlier springs mean more food for moose, while winters with deep, crusty snow benefit the predators, which can walk atop the snow while the moose crash through. Less snow gives the moose an advantage.

But ultimately, Vucetich said, "moose are creatures of the north country who like it cold. If it gets warmer, they won't fare well."

It's worse for the wolves. "Wolves will go extinct before moose do, and their extinction could definitely be caused by climate change," Vucetich said.

In 1978, gray wolves of the type found on Isle Royale were listed as an endangered species in all the Lower 48 states except Minnesota, where they were labeled threatened. Wolf-recovery programs around the country had solid success over the next few decades, and in 2007, the western Great Lakes wolves were delisted, although legal wrangling over their status continues. There has also been debate over the years about the fate of the wolf-moose study, which is financed by the National Park Service, the [National Science Foundation](#) and others.

Vucetich conceded that the survival of about 20 wolves on an isolated island visited by relatively few people may seem like a less-than-urgent issue. But he sees larger symbolism to the project, since it illustrates the intricate interdependence of species.

"It is an opportunity to appreciate how complicated this is, to generate a sense of wonder about nature," he said. "That's why we should care."

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