

Questions 19-28 are based on the following passage and supplementary material.

This passage is adapted from Bettina Boxall, "Yellowstone Wolves Boost Berry Diet for Grizzlies, Study Says." ©2013 by Los Angeles Times.

In another example of how the return of a top predator can have far-reaching ecological effects, researchers have found that the reintroduction of the gray wolf to Yellowstone National Park has boosted an important food source for the threatened grizzly bear. A study published in the *Journal of Animal Ecology* is essentially a tale of who eats what.

When wolves were reintroduced to the park in 1995 after a 70-year absence, they preyed on elk herds that browsed trees and shrubs. The elk population, which had exploded without the wolves, dropped. The over-browsed plants began to rebound, including berry-producing shrubs that provide nutritious summer meals for grizzlies when they are fattening up for hibernation.

"The grizzly bear uses some of the same plants that the prey of the wolf uses," said William Ripple, an Oregon State University professor of forest ecosystems and lead author of the study. "The reintroduction of one top predator is potentially affecting another top predator through this food web."

Ripple and his fellow researchers at OSU and Washington State University compared the frequency of fruit found in grizzly bear scat (animal fecal droppings) to elk numbers before and after wolf introduction. Over a 19-year period, they found that the average proportion of fruit in grizzly scat rose significantly after wolves returned to Yellowstone and the elk population fell. The scientists examined and rejected other possible explanations for the smaller, pre-wolf proportion of fruit in grizzly diets—such as climate influences or the operation of open-pit garbage dumps that served as bear mess halls before the last one was closed in 1970.

Previous research by Ripple and colleagues has demonstrated other ways in which the gray wolf's return has had a cascading effect in the Greater Yellowstone Ecosystem, the wildest in the lower 48 states. Ripple's work was the first to show that aspens declined after wolves were eliminated from the park in the 1920s. When wolves returned and drove down the elk numbers, scientists saw a resurgence of aspen, cottonwood, and willows in some parts of the park that has led to an increase in beavers.

"We're in the early stages of this ecosystem recovery. This is what we call passive restoration," Ripple said. "We put the wolf back in and then we let nature take its course." In the case of the grizzly, the paper's authors said increasing berry production could help make up for the loss of another bear food threatened by climate change, whitebark pine nuts. The Yellowstone region's whitebark pines have been dying en masse, the victim of beetle kills promoted by milder winters. Wildlife biologists worry the diminishing nut crop could hurt grizzly survival.

Ripple cautioned that it will take time for berry-producing shrubs to regrow. "It may not be a panacea or a big silver bullet as a food item for the grizzlies."

The wolf-bear connection in Yellowstone offers a broader lesson, Ripple said. "We should be looking much farther and much more holistically at large mammal or predator management," he suggested. "There could be far reaching effects that we have not considered in the past. And they can be very important."