Invasive species can dramatically alter landscapes

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Invasive plant and animal species can cause dramatic and enduring changes to the geography and ecology of landscapes, a study from Purdue University and the University of Kentucky shows.

A review of studies on how life forms interact with and influence their surroundings concluded that invasive species can alter landscapes in myriad ways and with varying degrees of severity. These changes can be quick, large-scale and "extremely difficult" to reverse, said study author Songlin Fei, a Purdue associate professor of quantitative ecology.

"Invaders can change a landscape in long-lasting ways," Fei said. "If we do not keep an eye on them, they could cause serious problems that can have impacts for decades or centuries."

The impact of invasive species - defined by Fei as non-native species that cause economic and ecological damage - on other organisms and the overall species composition of an area has long been recognized. But little work has focused on how invasive species can transform the land they colonize.

Invasive plants, for example, can alter sedimentation rates and change stream channels; insects can modify a landscape by building mounds and burrowing; and animals can accelerate erosion by digging and trampling vegetation.

"This is a subject area that merits more attention," Fei said, noting that

the review examines the "geomorphic" effects of invasive species in a neutral way. "We're not saying these changes are positive or negative, but rather, this is what invasive species are doing to the system."

The review showed that areas where land and water systems overlap - such as wetlands, salt marshes, coastal beaches and dunes - are particularly vulnerable to invasive species. The dynamic nature of these areas contribute to the speed and scale with which non-native species can transform the landscape and ecology. Fei pointed to the example of Spartina grass, also known as cordgrass, which was intentionally introduced into coastal mudflats to prevent erosion. In China, the grass quickly transformed about 432 square miles of coastline into salt marshes.

"You basically lose your beach in about a decade," Fei said.

In contrast, forests are often slower to show signs of the impacts of invasive species because of the longer life spans of forest organisms and the slow ecosystem turnover.

The review also established trends in the types of changes that invasive species can cause. Invasive plants primarily construct new structures in a landscape, such as peat bogs or layers of leaf litter, or protect an area from wind or erosion. Invasive animal species also create new structures - examples being beaver dams and termite mounds. In addition, animals move materials and contribute to erosion and sedimentation. Reworking of soil and sediment by earthworms, for example, changes the soil structure up to nearly 7 feet below the surface.

Fei recommended that natural resource managers identify high-risk areas, which could be determined by the type of landscape or the invasive species to which the area is most prone. Whether to restore an area that has already been altered by invasive species can be a difficult

decision, he said.

One of the challenges of studying the changes invasive species have on a landscape is the lack of a standard unit for measuring these effects, he said. More research is also needed to better understand the impacts of invasive microbial organisms.

"This is a new frontier in science," he said. "Biogeographers and experts on invasive species need to work together to help quantify these changes."

More information: "Biogeomorphic Impacts of Invasive Species Annual Review of Ecology, Evolution, and Systematics" DOI: 10.1146/annurev-ecolsys-120213-091928

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