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K-Stater researches habitat changes

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The back of a camel isn't the only thing that snaps with the addition of one too many straws. Nature, too, can only take so much abuse before its ability to keep invading plants, animals and insects at bay reaches the breaking point.

That was the finding of a study that modeled the disruption of natural habitats, such as those caused by human land-use activities. Humans will continue to alter landscapes, but the study may be the beginning of the tool that helps them minimize the effects of their damage.

Kimberly With, associate professor of biology at Kansas State University, performed the study, which modeled landscapes subjected to habitat loss and fragmentation, as might occur when humans clear natural habitats for farms or housing developments.

"Habitat fragmentation is the breaking apart of a habitat into smaller, isolated islands that are surrounded by an inhospitable matrix of agriculture or other human activities," With said. "For species living in these islands, they may have trouble dispersing and maintaining viable populations."

It gets worse. When humans alter the landscape through habitat destruction and fragmentation, they often intentionally or accidentally introduce foreign insects, animals and plants. These exotic species, because their natural predators were left back home, can sometimes spread throughout the landscape and overtake the native ecosystem. They may prey upon the native species or out-compete them for the same food or habitat.

"Habitat loss, fragmentation and invasive species collectively pose the greatest threat to native species. We're trying to combine the two areas of landscape ecology and invasive species biology. If you plow the prairie to clear an area, you've created a disturbance that may allow exotic species to become established," With said.

With's computer models showed something both surprising and unsettling. The risk of invasive species spread goes up sharply at some point as the amount of habitat disturbance on the landscape increased. In other words, the landscape can keep foreign species confined to a small area until it finally reaches the breaking point. At that point, the invader can spread throughout the entire landscape.

"The chances that it will spread go up dramatically at some point. There is a threshold," With said. "The prediction of this threshold effect is what's exciting about the results of this research."

In one model, for example, a hypothetical invading species has no chance of spreading throughout the area if 30 percent of the landscape is destroyed or even if 50 percent is destroyed. But when 70 percent of the habitat is destroyed, the species has a 100 percent chance of spreading throughout the landscape. That threshold changes, however, depending on the dispersal ability of the species and the pattern of fragmentation. If habitat is destroyed in pockets, instead of one concentrated area, some species will not spread easily.

With said the next step is to use this predictive model as a tool to manage the use of land and reduce the risk of invasive spread. With said timber companies may choose to change the pattern of how they harvest forests, for example, to help keep exotic plants and insect pests from invading.

"We are concerned about preserving the natural integrity of native habitats and interactions among species. If non-native species alter the dynamics of the ecosystem, you've lost that natural integrity," With said. "We need to develop management plans that control invasive spread while maintaining the native species."

Invading species can hurt the economy, as well as the landscape. They cause billions of dollars of damage annually in the United States, especially to timber and crops, With said. Zebra mussels, a foreign species, have spread throughout the Great Lakes and waterways of the East, attaching to the hulls of boats and clogging intake pipes.

She said aquatic and terrestrial ecosystems all over the world are suffering from fragmentation and the invasion of foreign species.

"It's happening at such an alarming rate. Habitat destruction, fragmentation and the introduction of exotic species have led to the decline and sometimes extinction of certain species," With said.

With presented her findings this week at the Ecological Society of America's annual meeting in Tucson, Ariz. Her study will be published this October in the journal "Conservation Biology." Her research has been funded by the National Science Foundation and is currently funded by the Environmental Protection Agency.

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