



News Release

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USGS Research Upsets Conventional Wisdom on Invasive Species Invasions

Invasive plant species are able to make themselves at home in habitats far from their native ranges. But is there ever simply no more room at the inn? Many ecologists have long accepted the view that a "no vacancy" rule applies to habitats rich in native species diversity. Areas with more native species are often presumed to use available resources more completely, leaving nothing left over for wandering weeds.

This and several other pieces of conventional ecological wisdom are challenged in a recent series of publications by USGS ecologist Thomas Stohlgren, of the Midcontinent Ecological Science Center, and colleagues at the Natural Resource Ecology Laboratory at Colorado State University. In the current issue of the journal *Ecological Monographs*, the team reports that across a broad array of Central Grassland and Rocky Mountain habitats, from Colorado to Minnesota, areas with the most native species are exactly where invasives tend to take up residence.

The findings suggest that wherever resource levels are high, invasives are able to grab a share. This means that invasibility depends more on the presence of basic resources, such as sunlight, water and soil nutrients, than on an absence of competitors. Conversely, in less favorable habitats, a small number of native plants may monopolize existing resources, making the community more resistant to invasion.



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Stohlgren says that previous studies, suggesting that low-diversity communities are more invasion-prone, may have simply not cast a wide enough net. In his Central Grasslands study sites, for example, data from small, one-meter square plots did support the classical view that high native species richness deters invasives. But this changed as the scale of vegetation sampling expanded to ten, one hundred, and one thousand meter-square plots.

"The pattern reversed itself at larger scales because resources are patchily distributed in the landscape,"

says Stohlgren. "Nitrogen, light and water are present in some areas but not in others. At large spatial scales, it's those hot spots of resources that are being invaded."



Just as human immigrants may find more opportunities in an already-overcrowded city than a small town, invasive plants take advantage of the constant turnover and jockeying for position that characterizes species-rich ecological communities. The classical dictum that "diversity begets stability," Stohlgren says, is simply not true in some ecosystems. Communities with high diversity tend to be in constant flux, creating openings for invasives.

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Stohlgren's team also carried out an extensive investigation of the effects of grazing on native and invasive species richness. One branch of ecological theory predicts that regular disturbance, such as that caused by grazing, allows a greater number of plant species to co-exist. Such disturbances may also set the stage for fast-growing invasive species to colonize new areas.

As reported in the current issue of the journal *Ecological Applications*, the researchers measured vegetation at multiple scales on 26 long-term grazing exclosures and surrounding rangeland in Colorado, Wyoming, Montana and South Dakota. Surprisingly, the researchers discovered that numbers of native and invasive species were virtually identical for the fenced exclosures and adjacent grazed areas.

"In some habitats, grazing isn't quite the disturbance we thought it was in terms of invasive species," says Stohlgren. He notes that shortgrass steppe in Colorado has been grazed heavily by bison for thousands of years and, more recently, by cattle. "And yet the shortgrass steppe is a low-diversity site with a few dominant species and not very many weeds," he says. However, adds Stohlgren, the effects of grazing clearly differ according to climate; in more arid regions, studies have shown an association between soil disturbance by large grazers and the spread of invasive plants.

From a conservation perspective, the results of these multi-site, multi-scale studies are disturbing. "It's an alarming pattern," says Stohlgren. "In the Central Grasslands and the Rockies, the high diversity habitats are already becoming rarer and rarer because of both natural succession and human influences. And these are the places where invasive species are most heavily invading." The invasions may threaten some of the last strongholds of certain biologically rich habitats, such as tallgrass prairie, aspen woodlands, and moist riparian zones.

In a recent paper in the journal *Plant Ecology*, Stohlgren and his co-workers also document the proclivity of invasive plants for streamside, or riparian, areas. Many plant and animal species depend on streamside habitat for all or part of their life cycle, and conservationists have long stressed the importance of streamside corridors as biological lifelines for species migrations and dispersal. Unfortunately, the researchers found, streamside corridors also act as havens for invasive species, as well as networks for the spread of invasives from one pristine area to another.



The transformation of rich riparian zones into communities dominated by invasives may accelerate the loss of native plant species and may also greatly affect some animals, such as birds and butterflies, that rely on the natives for food or habitat, Stohlgren says. The invasions may also disrupt the relationships of plants and pollinators that evolved together. "This is really troubling,

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because it means that all along their migratory routes, butterflies are running into more and more non-native plants that they may not benefit from as much," says Stohlgren.

One consistent message from these studies, Stohlgren says, is that ecologists should avoid making sweeping generalizations based on work done at a small spatial scale or a single study site. Conservationists and land managers should be aware of the potential for invasives to move into biologically rich areas, but conservation strategies need to be dictated by the particular characteristics of the habitats and species involved.

"We ought to turn our attention to finding out which weeds may be the biggest problem in our highest diversity areas, so we can work at saving native species while controlling invasives," Stohlgren says. "But we need to be smart about it. That means selecting priorities based on landscape-scale science, instead of relying solely on smaller scale studies that may be misleading."

Being smart also means realizing that simply protecting an area from human disturbances may not be enough, Stohlgren says. "We had this comforting feeling that if we can maintain diversity everything will be stable. I don't think we can be that comfortable any more."

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