Climate Change's Impact On Invasive Plants In Western US May Create Restoration Opportunities

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A new study by researchers at Princeton University's Woodrow Wilson School of Public and International Affairs has found that global climate change may lead to the retreat of some invasive plant species in the western United States, which could create unprecedented ecological restoration opportunities across millions of acres throughout America. At the same time, global warming may enable other invasive plants to spread more widely.

The researchers assessed the relationship between climate change and the distribution of five prominent invasive plants in the western United States – known colloquially as the "kudzus of the West" – cheatgrass; spotted knapweed; yellow starthistle; tamarisk; and leafy spurge. Such plants are defined as invasive because they were brought into this country from other lands and now dominate and alter ecosystems in ways that threaten native wildlife, agriculture, and ranching. All have greatly expanded their ranges in recent decades in the western U.S., causing millions of dollars in damage to farmlands and rangelands. Invasive plants are increasingly expensive to control, and it is widely believed that global warming will make the problem worse.

But Bradley and her co-authors find that global warming may also reduce the competitiveness of some invasive plants if conditions become climatically unsuitable to the weeds, "creating opportunities for restoration in areas currently dominated by intractable invasive species," according to the study.

The five species were selected in part because they represent the most problematic plants in the western U.S. The study authors created "bioclimatic envelope models," wherein the authors identified where the invasive plant species occurred, and identified critical climate variables such as precipitation patterns and temperature patterns that are associated with the presence of the invasive plants under investigation. The authors then determined what combined set of climate variables best described the distribution of these weeds, and mapped all of the places in the U.S. where these climate conditions occur.

Developing such models is important because scientists can use them to assess how changing climate conditions might affect the distributions of invasive plants. Maps of how invasion risk is likely to change with global warming are also important for land managers designing long-term protocols for fighting invasive plants.

The researchers employed 10 atmosphere-ocean general circulation models (AOGCMs) that predict what climatic conditions in the West are likely to be in 2100 if emissions are not limited, and matched those predicted conditions to the climate conditions associated with each of the invasive plant species. The projected invasive species distributions for each of the models were added together to create a map of invasion risk under future climate conditions.

"Just as native species are expected to shift in range and relative competiveness with climate change," the authors wrote, "the same should be expected of invasive species."

Specifically, the researchers concluded that climate change is likely to expand invasion risk from yellow starthistle in California and Nevada – and lands currently occupied by invasive populations of the weed in California, Oregon and Washington are unlikely to become unsuitable for the species; hence, they have low potential for restoration. Tamarisk distribution, they found, is unlikely to be affected by climate change.

Cheatgrass, however, is likely to be affected by climate change, potentially moving northwards into parts of Idaho, Montana and Wyoming, but retreating in southern Nevada and Utah. And, according to Bradley and her co-authors, the impacts of climate change will likely shift spotted knapweed, currently distributed throughout the foothills of the Rocky Mountains and the Colorado Plateau, to higher elevations, leading to both expanded risk and restoration opportunities in part of Montana, Wyoming, Utah, and Colorado.

Leafy spurge, abundant in northern states west of the Mississippi River and some rangeland west of the Rockies, will likely retreat from some places in the face of climate change, creating restoration possibilities in Colorado, Nebraska, Iowa, and Minnesota – but potentially expanding into parts of Canada not included in the researchers' study. In addition, the researchers found that leafy spurge is likely to retreat from Nebraska and parts of Oregon and Iowa, creating strong potential for restoration in these areas.

To better address the impacts of invasive species, the authors note, further modeling and experimental work is needed to determine which species will be able to occupy these sites if the invasive species are reduced or eliminated by climate change. Local native plants (the ones that were there prior to the arrival of the invasive species) may be unable to reoccupy these areas as a result of global warming. If local native plants cannot reoccupy the areas, then native plants from elsewhere in the West will need to be considered for restoration to prevent new invasive species from quickly invading these sites.

"The restoration opportunities associated with the retreat of currently intractable invasive species are vast in the western United States," the authors wrote. "The uncertainties associated with these changes, as well as the unknown makeup of viable future vegetation… highlight a pressing need for integrated modeling, monitoring, and experimental work to better address the ecological consequences of climate change."

"The question for policy makers and land managers is, 'What do we want these lands to be?'" said Wilcove. "These lands will change, and we must decide now – before the window of opportunity closes - whether we do nothing or whether we intervene."

"Governments need to reduce emissions quickly to avoid a variety of dangerous climate changes, Oppenheimer warned. "At the same time, it will be necessary to adapt to the inevitability of some warming. Proper management of ecosystems to minimize the damages is a key part of any effective adaptation strategy."

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