Climate change puts invasive plants on the move

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Garlic mustard (Alliaria petiolata), which thrives in cooler temperatures, may disappear from the southern part of New England and crop up in Canada, as a result of climate change. Credit: Getty Images/University of Connecticut

Climate change may force one of New England's invasive plant species

to retreat north, while another will likely stay put and take over an even greater area, according to a new study by UConn faculty and former doctoral candidates.

Garlic mustard may disappear from the southern part of New England only to crop up in Canada, while Japanese barberry takes hold of the region.

The study of the two pervasive, widespread, and problematic invasive species was published in the *Proceedings of the National Academy of Sciences*, and provides evidence that climate change can both inhibit and facilitate invasive species growth. Few studies have linked plant demographics to climate change to understand invasive species.

Invasive species and climate change are two of the primary factors that alter ecological systems, but their interaction requires a greater understanding to improve the efficiency of management plans, according to the ecological and evolutionary biology team from the University of Connecticut, Yale University, the University at Buffalo, University of New Hampshire, and the Linda Loring Nature Foundation on Nantucket.

By tracking individual plants across environmental variations in temperature and precipitation, the researchers were able to predict their survival success under temperature changes predicted for 2041-2050. They compared those to the predictions for the species under current conditions.

Japanese barberry is a woody shrub common in New England, where it is often found in dense populations in forests. Current models predict that Japanese barberry can establish in all but coastal Maine and the northernmost parts of Maine, New Hampshire, and Vermont.

But based on Japanese barberry's positive response to warm

temperatures, it is apparent that these northern habitats will only become more suitable under climate change, allowing prolific population growth throughout the region, the researchers said.

On the other hand, their findings indicate that garlic mustard may decline considerably in southern New England but instead appear in force in northern region and southern Canada. Better performance in cooler climates suggests that warmer temperatures resulting from climate change may render southern New England uninhabitable for this species, which produces copious seeds and dominates the forest floors where it invades.

"We have not dodged the invasion, only shifted the focus," noted the authors. "Furthermore, if a robust herb such as garlic mustard responds poorly to warming, native competitors could respond similarly."

The study included 21 experimental study sites encompassing climate and land use differences in five regions across New England. Seeds were collected from multiple wild populations and germinated in the greenhouse.

Seedlings were planted in the late spring of 2009 in natural conditions, with minimal disturbance that spanned regional environmental differences.

The demographic approach to predicting species distributions provides a number of improvements over existing approaches to forecasting invasions, according to the researchers. It offers practical links to understand the drivers of invasion, forecast potential distributions, and evaluate management strategies.

Current management techniques for Japanese barberry have focused on developing cultivars – variations of the species with more desirable

characteristics – with lower seed production. But demographic models show that this alone is not sufficient to keep the species from spreading elsewhere.

More information: Cory Merow et al. Climate change both facilitates and inhibits invasive plant ranges in New England, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1609633114

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