Genome size affects whether plants become invasive

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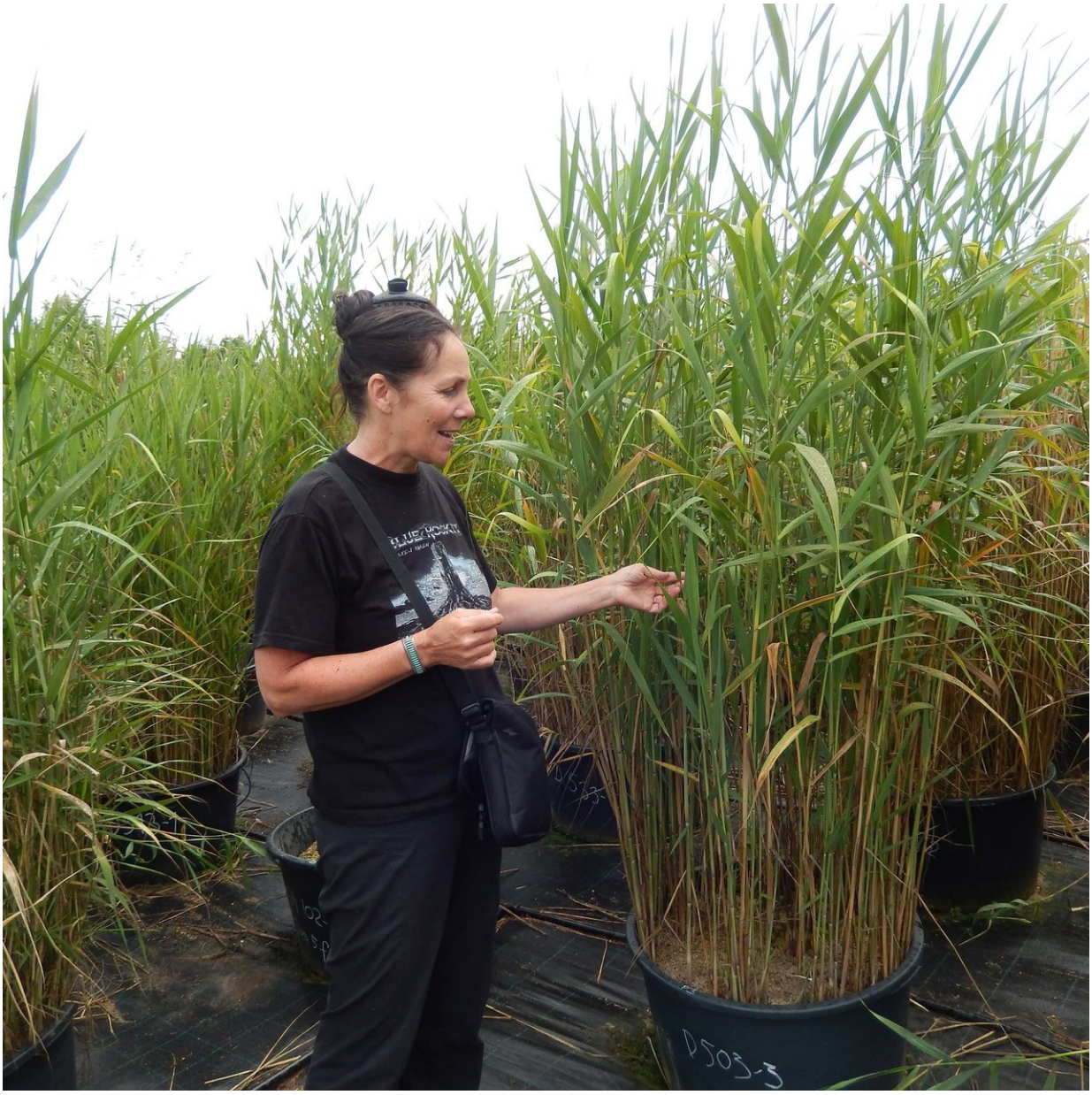

URI Professor Laura Meyerson discusses her Phragmites research in a common garden in the Czech Republic. Credit: Laura Meyerson

A University of Rhode Island scientist who studies the invasive plant Phragmites was part of an international research team that found that the most significant factor in determining whether a plant will become invasive is the size of its genome.

Laura Meyerson, URI professor of natural resources science, said "our results are crystal clear. Small genomes are the most important factor in determining invasiveness, at least for Phragmites but likely for many other species as well."

The results of this research were published this week in the journal *Ecology*.

Working with her colleagues Petr Pyšek and the late Jan Suda from the Institute of Botany at The Czech Academy of Sciences and their team, they screened 900 populations of Phragmites from around the world and chose 100 to evaluate. The researchers grew those plants in a common garden in the Czech Republic where they exposed them to the same environmental conditions and regularly measured a wide variety of traits, from nutrient content and leaf toughness to plant chemistry and susceptibility to herbivores.

While all of the plants studied were of the same species, Phragmites australis, their genome size varied from population to population.

According to Meyerson, the senior author on the paper, their results suggest that plants with large genomes can only grow in limited locations. The Gulf of Mexico lineage of Phragmites, for instance,

which has a large genome, has been unable to move out of the Gulf region, whereas the Phragmites native to Europe, which has a small genome, is highly invasive throughout North America.

"Smaller genomes are more nimble," she said. "They can grow in variable environments and at almost all latitudes."

The findings of the research team raise the question of why plants with small genomes are more likely to become invasive. She thinks they have the answer.

"The main theoretical reason has to do with minimum generation time," she explained. "The idea is that a smaller genome can be replicated more quickly than a larger genome. So if a plant is in a stressful environment, it can be replicated more quickly than if it had a larger genome. It needs fewer resources and can use its resources quickly to reproduce before its luck runs out.

"On the other hand, a smaller genome also means that it may lose genes that are potentially beneficial," added Pyšek, the first author of the paper. "So there may be a trade-off."

Scientists use flow cytometry, a simple and inexpensive technology, to measure the size of a plant's genome, and the speed and simplicity of the process provides numerous applications for the results of the research. Border security officers could quickly screen plants for genome size before they are brought across the border or imported into the country, for example.

"It gives us a cheap tool to measure their invasive potential," said Meyerson.

She also believes it could be used to prioritize the management of

existing invasive populations of common reed and other plants with the same genome size characteristics.

"Land managers could screen invasive populations for genome size so they can allocate their resources more effectively to manage the most invasive species," she said. "By determining whether a population has a particularly small genome size, they will know that a particular plant might be more aggressive and should be targeted for removal."

Meyerson's next studies, in ongoing close cooperation with researchers from the Czech Republic, will build on these results. She is conducting experiments at URI to determine how environmental variables like salinity and temperature interact with plants of different genome sizes and how plant chemistry is affected by genome size. Preliminary results of those studies are expected next year.

More information: Small genome separates native and invasive populations in an ecologically important cosmopolitan grass. *Ecology*. DOI: 10.1002/ecy.2068

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