# Blood is thicker than water for the common reed—At least that's what the soil tells us

September 5 2017

URI Professor Laura Meyerson investigates Phragmites at a marsh on Block Island as part of her research. Credit: Laura Meyerson

In a paper published in *Nature Communications*, Northeastern University Professor Jennifer Bowen and University of Rhode Island Professor Laura Meyerson reveal that a native type of the common reed (*Phragmites australis*) has more in common with other native populations of the plant growing elsewhere across the country than they have in common with invasive types occupying the same ecosystem. The results from their study will aid in understanding how plant invasions succeed and the conditions necessary for their success.

The common reed, *P. australis*, stands between five and fourteen feet tall with a purplish or tan tuft at the top. As a native species, the native lineage of *P. australis* has inhabited North American wetlands for thousands of years but an introduced invasive *P. australis* lineage from Europe is taking over many North American marshes.

"I work in salt marshes and I'm interested in bacteria within salt marshes, but I've never thought about these particular plant microbe interactions and how microbes in the soil work to both facilitate plant success and inhibit their growth," said Bowen. "But it turns out that the evolutionary signatures of the different plant lineages are so strong that it results in similar microbial communities in related plants that are found across the country, that's incredible."

In their new paper, Bowen and Meyerson examined microbial communities in the native, invasive, and Gulf lineages of *P. australis* to understand the lineage-specific controls on the bacterial communities in the sediments of these plants. Research was conducted using both field surveys and controlled common garden experiments and results from both concurred. Both studies found that the bacterial communities in the soil, which are influenced by the plant's root secretions, are primarily structured by plant lineage rather than by environmental factors as was previously thought.

## PHASE 1 - In the greenhouse

The first part of the experiment took place in Meyerson's greenhouse at the University of Rhode Island. Using native and invasive populations of common reed, Meyerson and Bowen cloned, sterilized, and planted juvenile propagules of each lineage in isolated cones in identical potting soil. This ensured that each plant started with the same soil microbial community. After growing them for four months under identical conditions, they analyzed the microbes at the roots of the plants.

"We saw a really dramatic effect according to which plant genotype was growing in the soil, which I did not expect to find at all," Bowen said.

"I was hoping for a difference between the native and invasive types," Meyerson said. "I have been working with this plant for nearly 25 years and have documented how the native and the invasive types differ in many traits. However, the strength and clarity of the distinct signals we found in the native, introduced and Gulf microbial communities was a surprise."

Their results indicated that the invasive plant, which is taking over many wetlands in the U.S., had distinct microbial communities that were entirely different from the native lineages.

## PHASE 2 - Take to the field

The experiment was then taken out into the field. Bowen, Meyerson, and their colleagues collected and analyzed sediments from around the country from native, invasive, and Gulf varieties of *P. australis*. The microbial patterns they found matched the greenhouse experiment. In fact, the soil microbial communities showed that native *P. australis* from Massachusetts was more similar to native *P. australis* growing in

California than to an invasive variety growing right next to it in Massachusetts.

These results are important for understanding more about the success and fitness of invasive species. The enemy release hypothesis states that when a plant lives in its native range, it dedicates some of its resources to defending itself from pathogens and animals that prey on it. However, if a native plant escapes its native range and becomes invasive elsewhere, its usual enemies are left behind and the plant no longer has to dedicate resources to fending them off, freeing resources for growth and reproduction, and increasing the overall fitness.

"One of the things we noticed was that the bacteria associated with the native plants had more kinds of bacteria that are used in antimicrobial defense in order to help them fight off enemy attackers compared to invasive plants. The invasive plants didn't need to cultivate these defense mechanisms among their microbial communities. So what our research shows is that these plants are successful as invaders, in part, because they are freed from the need to cultivate a microbial defense shield," said Bowen.

## PHASE 3 - Into the future

Bowen and Meyerson are currently developing proposals to study *P. australis* on a global level, including in the native range of the invasive lineage that is invading wetlands all over North America. Studying the invasive lineage in its native range, and determining if it dedicates more resources to a microbial defense shield, would support these results and help us to better understand why invasive species are so successful.

**More information:** Jennifer L. Bowen et al. Lineage overwhelms environmental conditions in determining rhizosphere bacterial community structure in a cosmopolitan invasive plant, *Nature*

*Communications* (2017). DOI: 10.1038/s41467-017-00626-0 ,
www.nature.com/articles/s41467-017-00626-0

Provided by Northeastern University College of Science