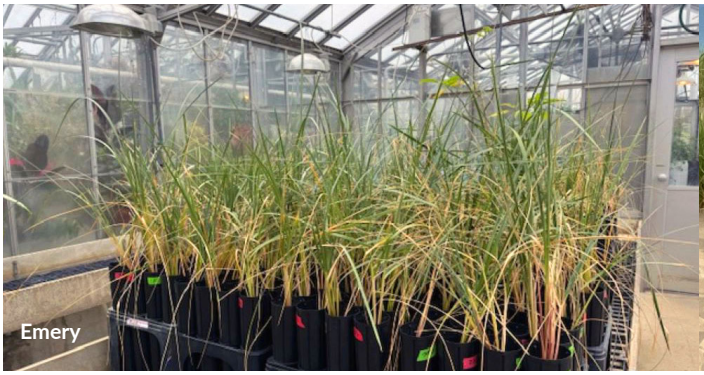
Assessing resilience of ecosystem-engineering plants for Great Lakes sand dune restoration and stabilization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Core Question: How does environmental variation affect beachgrass resilience, and how can we use this to plan for future dune restorations?

Michigan's coastal sand dunes represent the largest collection of freshwater dunes in the world, covering nearly 1,000 square kilometers. These landscapes serve as vital green infrastructure that protects neighboring land from erosion, purifies drinking water, and stores carbon. They also provide essential habitats for rare species and act as a major draw for tourism and recreation. Because of their immense ecological and economic value, the state of Michigan has designated about one-third of these dunes as critical habitats.

Despite their importance, these ecosystems are facing increasingly complex pressures from human activity and environmental changes. A central figure in the health of these dunes is American beachgrass (*Ammophila breviligulata*). This plant acts as an ecosystem engineer by trapping blowing sand with its leaves and anchoring it with an extensive network of roots. This process not only builds the physical structure of the dunes but also creates a stable environment where other plant species can eventually settle.

Current conservation and restoration strategies in Michigan rely heavily on planting beachgrass to stabilize shorelines. However, scientists are concerned that these efforts may be vulnerable to shifting environmental conditions. Climate models for the Great Lakes region predict significant increases in average temperatures and more frequent heavy rainfall events. Additionally, nutrient runoff from agricultural and industrial sources is changing the soil chemistry of these naturally nutrient-poor habitats.

Researchers are now working to understand how these combined stressors affect the ability of beachgrass to function. By studying the relationship between the plants and their changing environment, decision makers can develop better management practices. This ongoing scientific work is essential for ensuring that Michigan's shorelines remain resilient and that the public continues to have access to these unique natural wonders in the future.

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