

Climate change may spell demise of key salt marsh constituent

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This is an aerial view of Nag Creek marsh, Prudence Island. Credit: Brown University

Global warming may exact a toll on salt marshes in New England, but new research shows that one key constituent of marshes may be especially endangered.

Pannes are waterlogged, low-oxygen zones of salt marshes. Despite the stresses associated with global warming, pannes are "plant diversity hotspots," according to Keryn Gedan, a graduate student and salt marsh expert at Brown University. At least a dozen species of plants known as forbs inhabit these natural depressions, Gedan said. The species include the purple flower-tipped plants *Limonium nashii* (sea lavender), the edible plant *Salicornia europaea* (pickleweed) and *Triglochin maritima*, a

popular food for Brent and Canada geese as well as ducks and other migratory waterfowl.

Gedan and her adviser, Mark Bertness, chair of the Ecology and Evolutionary Biology Department at Brown, decided to find out how global warming may affect pannes. In a series of experiments published in [Ecology Letters](#), the pair subjected plots of forb pannes to air as much as 3.3 degrees Celsius (about 6 degrees Fahrenheit) warmer than the surrounding area.

They found that the plants in the test plots responded initially by growing more but then began a rapid die-off. As they died, they were replaced by a salt marsh grass, *Spartina patens*. At two sites — Nag Creek (Prudence Island, Rhode Island), and Little River (Maine) — the forbs covered less than 10 percent of the plot, from 50 percent originally, in tests that spanned the summer from 2004 to 2006. At the third site, Drakes Island (Maine), the forb pannes cover decreased from 50 percent of the plot to 44 percent (a 12-percent decline) in just the summer of 2007.



Sections of salt marshes called pannes may be in grave danger from global warming, according to a new study from researchers at Brown University. Credit: Brown University

The researchers believe the forbs disappeared due to changes in the plant-

water balance in the zone. What that means, Gedan explained, is the warmer air causes the forbs to take in more water, thus making the area less waterlogged and more hospitable to an invasion by *Spartina patens*, which prefers less water-soaked conditions.

"The forbs basically engineer themselves out of their habitat by making it more favorable for their competitor," said Gedan, the paper's lead author.

In New England, pannes range from Connecticut, where they make up less than 10 percent of a salt marsh's area, to Maine, where they can comprise some 40 percent of the salt marsh ecosystem, according to Gedan.

The Brown experiments "demonstrate that New England salt marsh pannes are extremely sensitive to temperature increases and will be driven to local and regional extinction with the temperature increases expected to occur in New England over the next century," Bertness said.

The scientists are unsure how other variables associated with climate change, such as sea-level rise, may affect pannes. Gedan said higher sea levels would help pannes, because forbs fare well in areas inundated by water. On the other hand, she added, the higher concentrations of carbon dioxide also expected to occur would accelerate forbs' use of water, which may open them up to competition from other plant species.

"How all these things interact, we don't really know," Gedan said. "But we know that with [higher] temperatures, these changes happen rapidly."

Source: Brown University ([news](#) : [web](#))

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