

Cape Cod saltmarsh recovery looks good, falls short

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Cape Cod's saltmarshes may appear to be recovering, and they are, but the ecosystem service of coastal protection is not at full strength even in marshes that look back to normal. Credit: Mark Bertness/Brown University

After decades of decline, grasses have returned to some once-denuded patches of Cape Cod's saltmarshes. To the eye, the marsh in those places seems healthy again, but a new study makes clear that a key service of the marsh – coastal protection – remains diminished.

"We've got the aesthetics back but the ecosystem function hasn't come back," said ecologist Mark Bertness, professor of biology at Brown and senior author of the study in the journal *Biological Conservation*. "The metric of a recovered habitat should not be 'Does it look like a recovered habitat?' but 'Does it restore the ecosystem services?', which is really what should be important to us."

Bertness and his lab members have been studying the marshes for years. In particular they have tracked the fate of the grass *Spartina alterniflora*, which their research has found to be the victim of herbivorous *Sesarma* purple marsh crabs run amok. Recreational fishing has depleted the crab's predators, Bertness said, resulting in die-off where recreational fishing is prominent.

But in some places the grasses have been growing back in, in part thanks to the invasion of a new predator of *Sesarma*. Given that positive development, Bertness and co-authors and former students Caitlin Brisson and Tyler Coverdale set out in the summer of 2013 to determine whether the recovering marshes were again providing the essential service of buffering the Cape's coast against the Atlantic Ocean's waves.

The answer is that the recovering ecosystems were not back to performing like healthy ones. In the team's measures of wave exposure, wave force, and changes in sediment height, recovering marsh creek banks did better than ones that still had extensive die-off, but were notably worse than marshes that have always remained healthy.

Measuring Marshes

To make their measurements, the team visited marshes in all three stages of health. Because of their extensive research in the area, they had already set posts in many marshes in 2009 to measure sediment heights. Last summer they also measured the amount of grass, both in terms of

the density of stalks, as well as above- and below-ground biomass of samples. They also set standard-sized chalk blocks at equal elevations at all sites and deployed instruments that measure wave speed.

Always-healthy marshes, they found, had the highest grass stem density of 637 per square meter, while recovering marshes had 448 and dying marshes had only 156. Biomass was also higher in healthy marshes than recovering ones and much higher than in dying ones.

The purpose of the chalk is to slowly dissolve upon exposure to the waves, thereby showing which marshes are most successful in dampening incoming water. In recovering marshes the chalk blocks dissolved 48.4 percent more than in always healthy ones. The wave speed sensors showed the same pattern. The healthy marshes slowed the waves the most. Recovering marshes slowed them somewhat less and dying marshes held them back the least.

Finally, while healthy marshes experienced a slight increase in sediment height between 2009 and 2013, sediments continued to decline somewhat in recovering marshes. Sediments declined more dramatically in dying marshes, the data show.

Prevention and Real Restoration

Among the many services that saltmarshes provide, [coastal protection](#) is of particular importance as sea levels rise due to climate change, Bertness said. Based on this study's findings, he said he is concerned that people just eyeballing the marshes may become complacent about the pace of this service's recovery.

Ecological restoration is a complicated and expensive endeavor that sometimes fails because of the subtle and intricate nature of ecosystems, Bertness noted. In the case of Cape Cod's marshes, among the key

species that may have been set back are the slow-growing mussels that transfer nitrogen from the water to the sediment, promoting grass growth.

"One of the things that happens when you have one of these predator-depletion-triggered die-offs is that you lose a lot of the positive feedbacks, which is really going to slow the recovery," Bertness said. "If you slow the recovery you basically leave room for all kinds of things to intervene so that the recovery never gets completed."

The study is a reminder, therefore, that ecosystem management cannot be judged as successful based merely on how the marshes look. In the best case, he said, the remaining healthy marshes would never die-off at all.

"We need to prevent the die-off or understand the recovery enough to do management conservation tasks, such as fertilization, that would enhance the recovery," Bertness said.

Provided by Brown University

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