Tropicalization of Temperate Ecosystems: How Climate Change Can Influence

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Coastal ecosystems are being threatened by increased anthropogenic activity and large-scale changes in ocean systems due to climate change. Tropicalization, the increase in the ratio of tropical to temperate taxa in a region, is a significant consequence of climate change. This is particularly important in foundation species, like seagrasses, which impact ecosystem resilience, function, and stability. In North Carolina, temperate seagrass meadows once dominated by Zostera marina are being invaded by the tropical species, Ruppia maritima and Halodule wrightii. Currently it is unknown if increases in species diversity will provide the same level of resilience and ecological functioning as is currently seen in genetically diverse, monospecific temperate seagrasses. To evaluate the impacts of tropicalization I first quantified spatiotemporal patterns of genetic and species diversity between temperate and tropicalized multispecies meadows. I found that tropicalized meadows had significantly lower genetic diversity than temperate meadows. This pattern was maintained both within and between years, with monospecific seagrasses displaying significant shifts in genetic diversity likely as a response to environmental changes. Tropicalized meadows also had significantly reduced aboveground biomass. I show that even superficially similar seagrass species can differ in characteristics that affect their vulnerability to perturbations and reduce their ecological functions. Therefore, the loss or altered composition of temperate seagrass meadows as a result of climate change can have important consequences for the current capacity for resilience of nearshore coastal environments.

Awards Won:

Second Award of $2,000

Susie and Gideon Yu Awards for Innovation in Sustainability: First Award of $25,000