

DELTA SCIENCE FELLOW 2016



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WHY THIS RESEARCH MATTERS

The Delta ecosystem is under threat from multiple concurrent stressors, including drought, nutrient pollution, and invasion by non-native species. Pepperweed (*Lepidium latifolium*) is an invasive perennial plant that displaces native species. The species may also reduce carbon storage in tidal marshes, which has implications for projects that aim to restore marshes for the purposes of increasing carbon uptake and storage, a decarbonization method known as "blue carbon."

Effects of drought and elevated nutrients on invasion by *Lepidium latifolium* and implications for carbon storage in tidal wetlands of the San Francisco Bay-Delta



Rain exclusion shelters set up in the marsh were used to test the impact of drought on invasive *Lepidium latifolium* populations. Megan Kelso

PROJECT

Using experimental manipulation of tidal marsh plots, this project tested the impact of drought and elevated nutrients on *L. latifolium* invasion and on carbon storage in the marsh. The fellow conducted field experiments and processed plant and soil samples for elemental analysis to evaluate the effect of *L. latifolium* invasion and elevated nutrients on carbon storage in Bay-Delta tidal marshes.

RESULTS

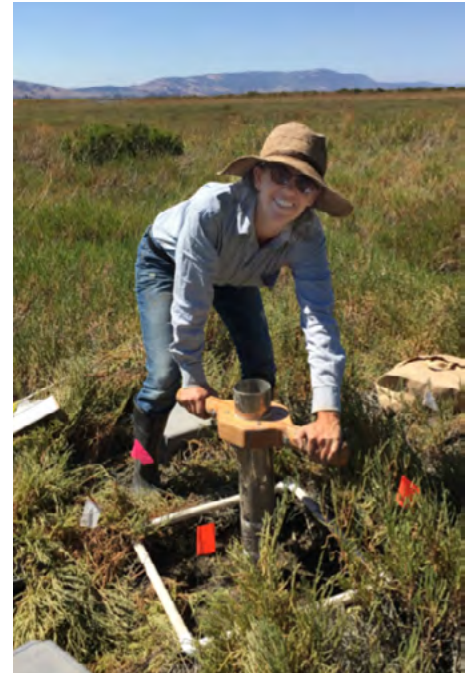
The study showed that *L. latifolium* invasion increased rates of below-ground decomposition and decreased standing stock of carbon in salt marshes. Nutrient addition trended towards increasing below-ground decomposition rates as well.

Preliminary results from the second year of the study also show that drought dramatically reduced the stem density of *L. latifolium* at all four of the field sites along the Bay-Delta salinity gradient and that elevated nutrients (N, P) largely mitigated this effect. Drought also negatively impacted native plants such as the dominant *Salicornia pacifica*, but it seems the effect was stronger on *L. latifolium*, suggesting drought might benefit native plants over *L. latifolium*.

MANAGEMENT APPLICATIONS

These results are relevant to the work of the Sacramento-San Joaquin Delta Conservancy, a state agency charged with ecosystem restoration and economic development in the Delta and Suisun Marsh. The findings on decomposition are important because the slower things decompose, the more carbon will be stored in an ecosystem. With strong interest in wetland restoration as a potential source of carbon uptake and storage, or “blue carbon,” such research provides important input for agencies interested in quantifying the carbon storage potential in marshes.

The findings on drought also suggest that extreme drought could be an opportunity to eradicate invasive *L. latifolium* when it is weakened and vulnerable. The finding that nutrient addition mitigates the effect of drought on *L. latifolium* suggests managing nutrient inputs should be a critical component of *Lepidium* eradication efforts.



Megan Kelso collects soil samples in the marsh for carbon analysis.

PRESENTATIONS

Kelso M. 2017. Blue carbon in coastal salt marshes: Impacts of plant invasion and elevated nutrients. Oral presentation.

Kelso MA. 2016. Bay Area Conservation Biology Symposium. Nonnative plant invasion in coastal salt marshes impacted by drought. Presentation. Stanford, CA. May 7, 2016.

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