DELTA SCIENCE FELLOW 2016

Delta Stewardship Council
Delta Science Program

Sea Grant California

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WHY THIS RESEARCH MATTERS

A growing number of restoration projects are undertaken in the Delta to compensate for habitat loss and depleted ecosystem functions, yet post-restoration monitoring efforts have been sparse. Successful monitoring can help project managers learn effective restoration strategies, improve design, and better target future efforts for increased ecological gain. This study uses a low cost, large scale, and high temporal frequency method to assess wetland recovery, which will assist project managers with limited access to monitoring resources.

Phenological indices of wetland recovery in working landscapes in the Sacramento-San Joaquin Delta

Undergraduate students Erin Voss and Shennaz Mannan measure vegetation growth in the field. Observations of phenology and plant physiology (specific leaf area, leaf area index, and leaf water content) were conducted in the field sites. *Sophie Taddeo*

PROJECT

As a Delta Science Fellow, Taddeo worked to develop a methodological framework—an assessment of plant canopy phenology (key events in a plant life cycle) and greenness—using public remote sensing data to track the progress of wetland restoration across two decades of restoration in the Sacramento-San Joaquin Delta. After reviewing and testing a variety of currently used methods, she settled on a methodological approach that combined time series analysis and land cover classifications to incorporate remote sensing data (satellite imagery) in the monitoring of wetland restoration progress. Using this method, Taddeo generated landscape metrics to relate fluctuations in site greenness to changes in the geometry and spatial distribution of vegetated patches.

RESULTS

The fellow produced land cover classifications for 21 restored sites and five reference wetlands using medium-high resolution images captured in 2005, 2009, 2010, 2012, 2014, and 2016. From the resulting land cover maps, she generated a series of landscape metrics describing annual changes in the

RESULTS (continued)

geometry and distribution of vegetated patches throughout this sample of restored and reference sites. Next, she used 16 years of Landsat data (2000-2016) to generate annual growing season curves for 25 restored wetland sites and five reference wetlands in the region. Lastly, the resulting dataset was applied to identify phases in post-restoration development and to select phenological metrics most responsive to restoration treatments and time.

MANAGEMENT APPLICATIONS

The project results highlight the potential of remote sensing data for the long-term monitoring of sites and detection of factors impacting vegetation dynamics. The study also shows that conditions can be dynamic in the Delta, which further stresses the importance of maintaining long-term monitoring in both reference and restored wetlands. The methodological framework produced by this study could help measure how wetland restoration promotes the provision of ecosystem services in the Delta for a better planning and design of future efforts.

Sophie Taddeo measures patterns of vegetation development in a restored wetland of the Delta. *Geneviève Corbeil St-Jacques*

PUBLICATIONS AND PRESENTATIONS

Taddeo S, Dronova I. (2018) Indicators of vegetation development in restored wetlands. *Ecological Indicators* 94:454–467.

Taddeo S & I Dronova. 2018. Spatial Indicators of Post-Restoration Recovery in Wetland Ecosystems. Oral Presentation. *2018 Annual Meeting of the American Association of American Geographers*. New Orleans, Louisiana.

Taddeo S & I Dronova. 2017. Leveraging Public Datasets to Characterize Vegetation Dynamics in Restored Wetlands. Oral Presentation. *102th Annual Meeting of the Ecology Society of America.* Portland, Oregon.

Taddeo S & I Dronova. 2017. Phenological Indicators of Vegetation Recovery in Wetland Ecosystems. Poster Presentation. *2017 Annual Meeting of the American Geophysical Union.* New Orleans, Louisiana.

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