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Lead Scientist's Report

Summary: This report includes four items: (1) summary of one article from *Agricultural and Forest Meteorology* on the effects of land cover type and structure on evapotranspiration in wetland and agricultural sites in the Delta; (2) summary of one article from *Estuaries and Coasts* on the relationship between habitat features and fish communities in the Delta; (3) summary of a brown bag seminar on the open data movement; and (4) By the Numbers Report.

Articles

The Effect of Land Cover Type and Structure on Evapotranspiration from Agricultural and Wetland Sites in the Sacramento–San Joaquin River Delta, California. Eichelmann, Elke; Hemes, Kyle S.; Knox, Sara H.; et al. *Agricultural and Forest Meteorology*. June 2018.

With growing interest in pursuing wetland restoration efforts in the Delta, there are questions about how these changes in land use will effect water loss through evapotranspiration. Evapotranspiration is the process of water moving into the atmosphere from the land; it occurs through a combination of direct evaporation from various surfaces (e.g., soil and water bodies) and transpiration (water movement through plants into the atmosphere). Past research suggests that the extent of open water surfaces and the amount of vegetation within a wetland (referred to as wetland structure) play a significant role in wetland evapotranspiration. However, there is a lack of data for evapotranspiration estimates across wetlands of varying structure in the Delta. A better understanding of the effect of wetland structure on evapotranspiration in the Delta is needed to improve the design of restored wetlands in the region.

To investigate this issue, researchers from the University of California, Berkeley, California State University, East Bay, the National Ecological Observatory Network (Boulder, CO), and Stanford University measured evapotranspiration at six sites in the Delta: three restored wetland sites differing in structure (i.e., the ratio of open water to closed vegetation surfaces), a flooded rice field, an alfalfa field, and a grazed cattle pasture. They found that evapotranspiration was highest in the two wetlands with the most open water, followed by the 'closed' wetland (with little open water), the flooded rice site, and the drained agriculture sites (alfalfa field and cattle pasture). The scientists concluded that greater areas of open water at wetland sites, in part due to high surface water temperatures, likely led to increased evaporation and overall evapotranspiration. They emphasized that, with respect to water conservation, design of restored wetlands should incorporate as little open water as possible. However, researchers recognized that wetland restoration projects have many additional objectives (e.g., wildlife habitat, greenhouse gas emission reduction) that may require open water surfaces and stressed that resource managers should consider all benefits for optimal restoration results.

Fish-Habitat Relationships Along the Estuarine Gradient of the Sacramento–San Joaquin Delta, California: Implications for Habitat Restoration. Young, Matthew J.; Feyrer, Frederick V.; Colombano, Denise D.; et al. *Biological Conservation*. January 2018.

Estuaries inherently have gradients and variability in environmental conditions, including salinity (salt content of water), turbidity (cloudiness of water), bathymetry (topography/elevation of the estuary sediment surface), and the presence and type of vegetation. These habitat elements, in turn, affect estuarine fish distribution. Humans have highly modified the Bay-Delta, moderating its natural estuarine variability. For example, scheduled dam releases lead to unchanging gradients in salinity and turbidity, and land use modifications have resulted in altered geomorphic features (e.g., loss of complex tidal marsh habitat). Further, the Delta has been highly impacted by non-native species, including multiple species of submersed aquatic vegetation (SAV). These non-native species have altered the Delta's physical structure and water quality, and are associated with the decline of native fish populations. Given all of these impacts, it is important to develop an understanding of how intended (e.g., wetland restoration) or unintended (e.g., levee failure, sea-level rise) habitat alterations in such a system may affect species distributions.

Researchers from University of California, Davis, the United States Geological Survey, and California Department of Water Resources studied how fish communities and environmental conditions differ in various Delta regions, as well as what fine-scale habitat elements (e.g., SAV) contribute to these differences. They used observations from four tidal lakes (more commonly known as "flooded islands") to make general predictions about how fish populations vary throughout the system. Study sites included Sherman Lake, Big Break, Franks Tract, and Mildred Island. Scientists found that native fish species were often associated with higher salinity and turbidity, and deeper water, while non-native fish were more variable in their distributions. At the finer scale, non-native species that prey on and compete with native species exhibited a positive relationship with invasive SAV. This suggests that the decline of native fishes in areas with invasive SAV may not be attributable to the presence of SAV alone but rather to the non-native fish species that associate with SAV.

This study offers insight into how future habitat modifications in the Delta, either through planned restoration or unplanned alterations, might affect fish communities. The authors conclude that habitat restoration is a feasible way to enhance fish populations in the Delta, so long as it is incorporates details of habitat effects, such as the findings in this paper.

Brown Bag Seminar

***Open Data: Making Connections for Better Science, Synthesis, and Service* – Dr. Vanessa Tobias, Senior Environmental Scientist, California Department of Fish and Wildlife.**

The Delta Science Program is hosting a three-part seminar series focusing on how research and monitoring performed by the Interagency Ecological Program (IEP) is relevant to decision-making in the Delta. Dr. Vanessa Tobias' brown bag, the first in this series, addressed the open data movement. Dr. Tobias is a member of both the IEP Synthesis Team and Science Management Team, as well as the chair of the IEP Data Utilization Workgroup (DUWG).

In order for data to be "open," Dr. Tobias stated that it must be available, discoverable, understandable, and reusable. If data is available, others are able to access it. If it is discoverable, it is searchable online or elsewhere. If it is understandable, it has some kind of supporting metadata (documentation) so others can understand what it includes and how it was collected. Finally, if it is reusable, others have permission to use it for synthesis or other purposes. The distinction between "open" and "closed" data, however, is not black and white; rather, there is a wide spectrum between fully open and closed data. For instance, some data is available by request only, some is reusable but with restrictions, and some is readable by humans but not by computers.

Dr. Tobias, a strong proponent of open science (an umbrella term that includes open data, open methods, open peer review, etc.), listed several benefits of publishing data openly. First, others might come up with new and innovative ways to use open data. Scientific journal articles that include open data receive greater attention (i.e., citations) than those that do not—likely a result of increased credibility and trustworthiness. In addition, making data publicly available is more efficient for the owner (rather than spending hours sending data to those who request it). Finally, open data is a foundation for robust scientific synthesis, enabling better decision-making.

A key focus of the DUWG is to encourage data sharing in the Delta and to make the process easier. This involves providing support and guidance to IEP and others to manage and document their data and to identify resources for storing and sharing data. Dr. Tobias shared four valuable lessons from the DUWG's initial two years. First, it is helpful to build a community to create support for scientists and other data users and to address fears or worries that are often associated with sharing data. Second, it is helpful to have an open mind about open data, as there are many potential unseen benefits of open data, including increased citations to independent datasets. There also are many different routes one can take to open science—a person can choose whichever way works for them. Lastly, open science is a process achieved in steps. Dr. Tobias emphasized that, while embracing open data may be daunting, it can beachieved with the support of a community. She encouraged her audience to remember that, "open data is really about the people...We're doing this to help each other out, and we're doing it together."

A recording of the seminar along with Dr. Tobias' slides are available here: http://deltacouncil.ca.gov/event-detail/15679

By the Numbers

Delta Science Program staff will give a summary of current numbers related to Delta water and environmental management. The summary (Attachment 1) will inform the Council of recent counts, measurements, and monitoring figures driving water and environmental management issues.

List of Attachments

Attachment 1: By the Numbers Summary (report will be provided at the Council Meeting)

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