INFORMATION ITEM

Lead Scientist's Report

Summary: This month, we continue to highlight articles by previous Delta Science Fellowship recipients and discuss their research results and management implications. The articles highlighted in this report feature findings from two Delta Science fellows investigating greenhouse gas emissions and carbon budgets of two estuary settings: agricultural peatlands and coastal wetlands. Their findings will help inform methods to sequester carbon while minimizing other greenhouse gas emissions and establish the potential role of Delta peatlands in statewide carbon markets. These studies are related to action area 1 of the 2017-2021 Science Action Agenda (Invest in assessing the human dimensions of natural resource management decisions) specifically, action A1B.

HOT MOMENTS DRIVE EXTREME NITROUS OXIDE AND METHANE EMISSIONS FROM AGRICULTURAL PEATLANDS. ANTHONY & SILVER, GLOBAL CHANGE BIOLOGY, 2021.

Delta agricultural lands are predominantly drained peatlands characterized by carbon-rich soils that accumulated in former wetlands. Upon drainage, carbon sequestered in those soils is readily converted to carbon dioxide (CO_2). These soils can also be sources of other, more potent greenhouse gases such as nitrous oxide (N_2O) and methane (CH_4), though these emissions have remained poorly characterized. Though drained peatlands make up only one percent of agricultural land globally, they are estimated to be responsible for up to one-third of greenhouse gas emissions from croplands. However, emissions of greenhouse gases other than CO_2 have been poorly characterized in agricultural peatlands, and questions remain about whether the application of nitrogen-rich fertilizer might enhance N_2O emissions. These lands are also often flooded in winter to encourage waterfowl use, and questions remain about how this practice impacts greenhouse gas emissions.

In this study, Tyler Anthony and Whendee Silver addressed this knowledge gap using recent technology to take continuous, automated measurements of N_2O, CO_2, and CH_4 over a three-year period at a drained peatland used to grow corn in the Sacramento-San Joaquin Delta. They found that CH_4 emissions were high after several weeks of flooding and when soil temperatures were above 10˚C. They also found that the primary driver for N_2O emissions was winter flooding and not

fertilization, as originally hypothesized. Remarkably, the N_2O emission average over this three-year period also exceeded the highest IPCC estimates for temperate organic cropland soils. Regionally, the researchers estimated that N_2O emissions alone could make up to 26% of cornfield peatland emissions for this region. Based on these findings, this study reaffirms that agricultural peatlands are significant sources of GHG emissions and demonstrates how altered management of winter flooding (e.g., altered timing and duration) could help reduce greenhouse gas emissions. Lastly, the study provides a more rigorous accounting for the role of drained peatlands in local greenhouse gas budgets, which could inform the assignment of carbon credits associated with land-use conversion (e.g., conversion of agricultural land to restored wetland) in a carbon market.

HYDROLOGIC EXPORT IS A MAJOR COMPONENT OF COASTAL WETLAND CARBON BUDGETS. BOGARD ET AL., GLOBAL BIOGEOCHEMICAL CYCLES, 2020.

Unlike drained agricultural peatlands, coastal wetlands are widely regarded for their role as a sink for greenhouse gases through their ability to sequester carbon in their soils. However, there is an important gap in understanding their role in the global carbon cycle. Namely, wetland plants take up carbon (through photosynthesis) faster than it accumulates in the soil. Where does the missing carbon go, and is it likely to return to the atmosphere over short (human) timescales? Addressing this question could be important in determining how to assign carbon credits to wetland restoration actions and properly account for wetlands in global carbon budgets.

Matthew Bogard's team worked to address this question and tested the hypothesis that transport of carbon away from the marsh via flow is the missing carbon sink. To do so, they produced a comprehensive tidal marsh carbon budget (i.e., by tracking and quantifying all exchanges of carbon between the marsh, atmosphere, soils, and waterways), based on existing data, new measurements acquired over a year for a site in the Suisun Marsh, and models.

The team found that the export of carbon by flow is a significant piece of the Suisun Marsh carbon budget. Their direct measurements showed that only 59 percent of carbon dioxide uptake by plants remains stored in soils, and the rest is lost to waterways. Importantly, carbon that is transported away by flow is dominantly (91percent) inorganic is likely to become sequestered in the ocean, where it is not likely to return to the atmosphere over human timescales. Thus, even though this carbon is lost from the marsh, it is still removed from the short-term carbon cycle and therefore helps mitigate global warming. The remaining 9 percent, meanwhile, would likely supplement Delta food webs.

DELTA SCIENCE PROGRAM ACTIVITIES

2022-2026 Science Action Agenda

The public review period for the draft 2022-2026 Science Action Agenda (SAA) closed in late January 2022. Over a dozen letters were submitted, including one from the Delta Independent Science Board, with specific and general suggestions for the Delta Science Program staff to consider in developing the final 2022-2026 SAA. Many of the comments highlighted the need to better connect the prioritized Science Actions to relevant legislation, regulations, and existing efforts and suggested some minor revisions to the Science Actions themselves. Staff is currently revising the SAA in response to the comments received, and the final SAA is anticipated for Council endorsement by Spring 2022.

Social Science Community of Practice Meeting Report-out

Central to continuing our social science integration efforts (https://deltacouncil.ca.gov/social-science), the Delta Science Program continues to support the building of a social science community of practice (CoP; https://deltacouncil.ca.gov/bay-delta-social-science-community-of-practice), which aims to bring together social science scholars, practitioners, and allies who are committed to advancing applicable and relevant research on the human dimensions of the Bay-Delta.

This community aims to:

- Facilitate collaborative social science research and interdisciplinary investigation,
- Provide opportunities for the social sciences to inform management and policy, and

- Advance our understandings of the estuary as a complex social-ecological system.

The CoP Steering Committee met for the second time in January 2022 to learn about other social science network building within the US Department of Interior and discuss goals for reconvening the full Bay-Delta social science CoP in the upcoming year. The CoP is currently brainstorming ways to best facilitate introductions between Bay-Delta natural and social science communities (perhaps through a "speed-dating" type meet and greet event). Additionally, the CoP is considering planning a Human Dimensions of the Bay-Delta Symposium as a space to share and get feedback on current research and to begin cataloging the social science research happening across the estuary. More updates will be provided as both initiatives develop.

Adapting Restoration for a Changing Climate

Adapting Restoration for a Changing Climate, a two-day symposium that explored the short- and long-term climate change considerations of current restoration projects in the San Francisco Bay-Delta and elsewhere, took place on February 2-3, 2022. A full report-out of this event, including links to symposium talks and presentations, will be available in a future Lead Scientist Report.

Delta Lead Scientist "Ask-Me-Anything" (AMA) Series

The January 31, 2022 episode of the Delta Lead Scientist Ask-Me-Anything (AMA) series focused on the Science Program's synthesis activities, including the ongoing work of the National Center for Ecological Analysis and Synthesis-Delta Science Program working group on understanding drivers of the estuarine food web. The conversation featured the Delta Science Program's Dr. Sam Bashevkin and Pascale Goertler as co-hosts and highlighted topics such as the importance of science synthesis, management-relevant topics in the Delta needing synthesis, and training for scientists in this approach to analysis. Archives of this and previous episodes are available on the @deltastewardshipcouncil's Instagram page. The next episode, focused on the upcoming launch of the Delta Science Tracker, is scheduled for Monday, February 28, 2022, at noon via Instagram Live. Co-hosts will be Maggie Christman of the Delta Science Program and Clint Alexander of ESSA Technologies.

ON YOUR RADAR

Delta Governance Brown Bag Webinar Series

The Delta Science Program is hosting a three-part brown bag webinar series on Delta governance. The series will foster discussion of the complex and multi-faceted governance of the Sacramento-San Joaquin Delta. Each webinar will feature a panel of speakers, with panelists selected to represent a wide range of perspectives from federal, State, local, and tribal government; collaborative partnerships between government and non-government entities; and academic social scientists. Examples of panelists include Councilmember Don Nottoli, Tanya Heikkila (University of Colorado, Denver), Kaylee Allen (US Fish and Wildlife Service), Matthew Moore (United Auburn Indian Community), Jessica Law (Sacramento Water Forum), and many more!

Each webinar will focus on a different social scientific framework that can be used to understand Delta governance. The first webinar (March 1, 2022) focuses on environmental governance, highlighting the structures and processes within which decision-making and action for environmental management occur. The second webinar (April 13, 2022) focuses on collaborative governance, highlighting how partnerships and decentralized structures and processes are used by government and non-government actors to influence decision-making. The third and final webinar (May 5, 2022) focuses on adaptive governance, highlighting how governance arrangements can respond to changing social and environmental conditions and support adaptive management.

These three webinars aim to increase awareness of and engagement with the social, political, and institutional dimensions of Delta science and management. In addition, the webinars seek to spark conversation about the kinds of institutional structures and processes that support effective and equitable Delta management. Attendance is free with registration (https://us06web.zoom.us/webinar/register/WN_35B-vRhyR4umt_90WQJylg).

Interagency Ecological Program Workshop

The Interagency Ecological Program (IEP) Workshop is an informal event held each spring for sharing new research results that advance science important to IEP and the larger Delta science community. The workshop features invited speakers, interactive training, poster sessions, and a mentoring luncheon.

Workshop presentations, training, and discussions are intended to help support improved IEP monitoring and science and facilitate the dissemination of news about studies, activities, and IEP-related opportunities for research among our affiliated partners and stakeholders.

This year's planning committee has chosen to emphasize early-career scientists and managers within our community. The planning committee is looking forward to discussions led by, and for those with, newer roles in our ranks and hosting poster sessions, lightning talks, and a poetry slam. This year's workshop will be an all-virtual event platform, with further details coming soon.

The 2022 IEP Workshop program can be found on the IEP website: https://iep.ca.gov/Public-Engagement/Annual-IEP-Workshop. The public may also sign up for future email workshop announcements at this site.

Please direct any questions to the Workshop Co-chairs, Steven Culberson (steve.culberson@deltacouncil.ca.gov) or Christine Joab (christine.joab@wildlife.ca.gov).

Delta Science Fellows

The Delta Science Program, in collaboration with California Sea Grant, is excited to announce the 13th round of Delta Science Fellowships for the 2022-2024 academic years. The fellowship funds research projects that advance the understanding of high-priority science issues affecting the Sacramento-San Joaquin Delta and its management as an integrated social-ecological system. Projects must be responsive to the 2022-2026 Science Action Agenda and encompass research in the biological, physical, and social sciences. In addition, fellows can receive support for their tuition and stipend. Eligible applicants include postdoctoral researchers, PhD students, and master's students. All applicants must submit a Notice of Intent by February 28th. Applications are due on April 20, 2022. The informational website for the fellowship and application materials can be accessed at https://caseagrant.ucsd.edu/fellowships/delta-science-fellowship.

Please help us spread the word about this funding opportunity. The Delta Science Program also would appreciate suggestions for community mentors to work with the fellows. A community mentor is a practitioner in the use of science for management, policy, or advocacy in the Delta. The Delta Science Program works with applicants to identify an appropriate community mentor who will work with them for the duration of their fellowship, in addition to their academic advisor.

BY THE NUMBERS

Delta Science Program staff will provide 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 (provided at the Council Meeting)

Attachment 2: Visual Abstract of Article Summary 1

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