INFORMATION ITEM

Lead Scientist Report

Summary

While restoring wetlands can remove atmospheric carbon and store it in vegetation and soils, methane emissions associated with rewetting can cancel out these climate mitigation benefits for at least the first few decades. Delwiche et al. (2025) analyzed 14 years of greenhouse gas exchange data following rewetting of the Mayberry wetland in the Delta. They predicted that the wetland would achieve a net climate mitigation benefit about 50 years after restoration. This study highlights the importance of long-term monitoring, and identifies data gaps for understanding what controls methane emissions in restored wetlands. The study also reinforces how careful consideration and research coordination are essential to ensure that management activities such as wetland restoration deliver on their climate mitigation promises.

Methane emissions in a restored Delta wetland highlight the value of long-term data

Delwiche, K., Matthes, J. H., Arias-Ortiz, A., Knox, S. H., Oikawa, P., Sturtevant, C., Verfaillie, J., Szutu, D., Keenan, T. F., & Baldocchi, D. (2025). Dynamic methane emissions in a restored wetland: Decadal insights into uncertain climate outcomes and critical science needs. *Agricultural and Forest Meteorology*, *373*, 110735. https://doi.org/10.1016/j.agrformet.2025.110735

When wetlands are drained, their rich peat soils are exposed to oxygen in the air and the soil organic matter is broken down by microbes. This releases large amounts of the greenhouse gas carbon dioxide into the atmosphere and causes the land to subside. This is a huge problem in the Delta, where peat soils are

estimated to release more than 1 million metric tons of carbon dioxide per year, and where some parts of the Delta are as much as nine meters below sea level. As well as releasing greenhouse gases, this subsidence puts increased pressure on Delta levees (increasing flood risk and potentially threatening California water supplies) and reduces available farmland.

Restoring these wetlands by rewetting the peat soil presents an opportunity to reduce carbon dioxide emissions and to halt or even reverse land subsidence. (Wetland restoration can also provide important habitat for wildlife, help to reduce flooding, and offer opportunities for recreation, among other benefits.) However, while reflooding can slow the release of carbon dioxide from wetland soils and allow carbon accumulation in the soil again, it can also lead to significant emissions of methane—a greenhouse gas that is much more potent than carbon dioxide over the short term. Such methane emissions can offset the climate benefits of reduced carbon dioxide emissions. Thus, long-term and large-scale studies on the effects of wetland restoration on greenhouse gas fluxes are critical to understanding the climate implications of pursuing wetland restoration as a management strategy.

In this article, Delwiche et al. (2025) studied greenhouse gas exchanges on the restored Mayberry wetland, a 300-acre area of Sherman Island in the Sacramento-San Joaquin Delta that was reflooded in 2010. During restoration, a flux tower was installed, which is a special monitoring system that measures and analyzes the exchange of energy, water vapor, carbon dioxide, and methane between the ecosystem and the atmosphere.

The authors used 14 years of flux tower data and field measurements alongside advanced statistical modeling to explore how and why methane emissions changed after restoration, and to calculate the potential climate impact. They found that methane emissions were highest in the first six years following rewetting and subsequently declined. This trend of high and then declining methane emissions was key to determining how long it would take the wetland to shift from a carbon source with a net warming effect to a carbon sink with a net cooling effect (i.e. the time it would take until the cooling effect of the reduced carbon dioxide emissions outweighs the warming effect of the increased methane emissions). Using the full

14-year dataset, the authors estimated that it would take less than 50 years to achieve net carbon neutrality at Mayberry.

Despite the robust methods and extensive data used in this study, the reasons for the decline in methane emissions after restoration remained unclear. The decline is likely related to a mix of factors, including vegetation type and coverage, water chemistry within the soil matrix (e.g. salty water generally reduces methane generation), and water table depth (waterlogged conditions promote methane generation). This suggests that managing the water table and soil salinity in restored wetlands may be a way to inhibit methane production while also reducing carbon dioxide emissions, building soil carbon, and reversing subsidence.

Given the increasing interest in wetland restoration and rice conversion projects in the Delta to mitigate climate emissions and subsidence, it is critical to advance research on methane emission dynamics in restored wetlands. And as demonstrated by this study, long-term monitoring data is key to this effort: Without the full 14-year time series to show the drop in methane emissions following the post-restoration spike, the estimated timeframe to achieve net carbon neutrality would be much less accurate. To help build capacity for carbon sequestration initiatives in the region, the Council, through its Delta Science Program, is funding research into subsidence and greenhouse gas emissions, organizing a blue carbon symposium in March 2026 with the Coastal and Marine Sciences Institute at UC Davis, and participating in an interagency carbon collaboration convened by the Delta Conservancy and The Nature Conservancy. Furthermore, the Delta Independent Science Board is undertaking a subsidence review to better understand the science needed to inform how subsidence in the Delta can be managed in ways that balance ecosystem health, greenhouse gas emissions, agriculture, and community needs.

Delta Science Program Activities

2025 Delta Research Awards Kick-Off Meeting

On August 27, the Delta Science Program and California Sea Grant hosted the kick-off meeting for the 2025 Delta Research Awards. The meeting brought together principal investigators and their research teams from the funded projects, providing an opportunity to introduce their work through brief presentations. The purpose was to make introductions, learn more about each project, set expectations, and discuss logistics. Researchers connected with staff who will track and support their research progress throughout the duration of their projects. The Delta Science Program will provide more updates as the projects progress.

The 2025 Delta Research Awards include eight high-priority projects that address critical knowledge gaps identified in the 2022–2026 Science Action Agenda and total $5.9 million in funding. More information about the Delta Research Awards can be found on the Council's website: https://deltacouncil.ca.gov/delta-science-program/research-awards

California Sea Grant Matching Workshop

At the start of September staff from the Council's Delta Science Program (DSP) and Planning and Performance Division participated in the annual matching workshop for the California Sea Grant State Policy Fellowship Program. State Policy Fellows are recent post-graduates interested in exploring a career path in the public sector at the science-policy interface. Fellows are matched with municipal, state, or federal agencies for 12-month fellowship periods to gain experience with marine, coastal, and/or watershed resources and the decisions affecting those resources in California. The Council has hosted a total of 49 fellows through this program for the past 13 years. Previous work performed by fellows includes working with the Delta Lead Scientist on monthly Lead Scientist Reports to the Council; supporting the Delta Independent Science Board; participating in the Delta Science Plan and Science Action Agenda updates; and assisting in Delta Plan amendments and updates.

On Your Radar

Advancing Restoration - DPIIC Restoration Subcommittee Meeting

The Delta Plan Interagency Implementation Committee (DPIIC) Restoration Subcommittee met on August 7. Chaired by Delta Conservancy Executive Officer Campbell Ingram, the focus of the meeting was information sharing to help the DPIIC agencies get up to speed on several current and planned habitat and restoration projects. The Nature Conservancy and Conservation Farms and Ranches described the multiple benefits of implementing a mosaic of rice and wetlands, with a focus on their work on Staten Island. Three presenters described how the upcoming Webb Tract Wetland Restoration Project (which Council staff toured in June) may improve carbon sequestration and provide a space for ecocultural restoration. Point Blue Conservation Science also discussed their research to estimate how tidal wetland restoration is helping Delta bird populations. The next Restoration Subcommittee meeting is tentatively scheduled for early 2026.

Adaptive Management Forum Update

The Delta Science Program hosts the Adaptive Management Forum every two years to increase capacity for more effective adaptive management in the Sacramento-San Joaquin Delta. The 2025 forum will be held on October 14–15.

The forum's first day runs from 9:00 a.m. to 5:30 p.m. as a hybrid event: in person at the California Natural Resources Agency Headquarters in Sacramento, California, and online via Zoom. It will feature oral presentations, panel discussions, and a poster session. The forum's second day is an in-person half-day field trip to the Lookout Slough Tidal Habitat Restoration and Flood Improvement Project. During this trip, forum attendees will hear from project representatives about what adaptive management looks like on the ground.

Visit the Council’s adaptive management webpage to see a detailed forum agenda: https://deltacouncil.ca.gov/delta-science-program/adaptive-management

Register to attend the forum here: https://www.eventbrite.com/e/2025-delta-adaptive-management-forum-tickets-1520571332789

Additionally, if you have a research, management, or implementation project to share, submit your poster abstract by September 26 via the registration link.

Questions? Please email adaptivemanagement@deltacouncil.ca.gov.

California Natural Resources Agency Secretary Speaker Series Panel Discussion on Climate Change and Extreme Events

On October 27 Council staff and other partners will participate in a Secretary Speaker Series panel discussion hosted by California Natural Resources Agency Secretary Wade Crowfoot (https://resources.ca.gov/About-Us/Secretary-Speaker-Series). The purpose of these public, live-streamed events is to discuss emerging natural resources issues and management solutions with leaders and thinkers from across California. The upcoming panel will highlight the latest climate research and how it relates to Delta management, building off the Delta Science Program's State of the Bay-Delta Science (SBDS) special edition focusing on extreme events, the Delta Independent Science Board's September climate symposium, and the Council's recent adoption of the Delta Adapts climate initiative. Alongside Secretary Crowfoot as moderator, the speakers include:

- Jessica Pearson (Delta Stewardship Council Executive Officer)
- Dr. Lisamarie Windham-Myers (Delta Lead Scientist)
- Dr. Tanya Heikkila (Delta Independent Science Board)
- Dr. Clifford Dahm (Former Delta Lead Scientist, lead author of SBDS chapter on wildfires and their water quality effects)
- Dr. Alexander Gershunov (Scripps Institute of Oceanography, lead author of SBDS chapter on atmospheric rivers)

Registration Open for State of the San Francisco Estuary Conference

Registration is now open for the 2025 State of the Estuary Conference. Two-day, one-day, and student options are available. Register here: https://www.sfestuary.org/registration/. The next biennial State of the Estuary Conference will be held October 28–29, 2025 at the Henry J. Kaiser Center for the Arts in Oakland, CA. The San Francisco Estuary Partnership organizes this event every two years to highlight the current management and ecological health of the San Francisco Bay-Delta Estuary. More information is available here: https://www.sfestuary.org/state-of-the-estuary-conference/.

By the Numbers

Science Program staff will summarize current numbers related to Delta water and environmental management. The summary (Attachment 2) will inform the Council of recent counts, measurements, and monitoring figures driving water and environmental management issues.

List of Attachments

Attachment 1: Visual Summary of Article

Attachment 2: By the Numbers

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