INFORMATION ITEM

Lead Scientist Report

Summary

In the presented article, the research team uses a model to investigate the sustainability of Delta marshes under sea-level rise. They find that for marshes at average elevation, conditions at the end of 100 years will not be sustainable for their persistence, but that increased frequency of atmospheric rivers will deliver sediment and double the area of Delta marshes in a self-sustainable state. Results underscore the importance of near-term marsh restoration in suitable locations, where marshes have sufficient elevation capital to become self-sustaining or have corridors that permit their migration inland.

An assessment of future tidal marsh resilience in the San Francisco Estuary through modeling and quantifiable metrics of sustainability

James T. Morris, Judith Z. Drexler, Lydia J. S. Vaughn, and April H. Robinson. Frontiers in Environmental Science (2022) https://doi.org/10.3389/fenvs.2022.1039143.

In recognition of wetlands' value in estuarine food supply, habitat, flood control, climate change adaptation, and recreation, the state of California has made wetland restoration a major priority. However, planning restoration is complex, and sites vary in their suitability. One key consideration in selecting wetland restoration sites is whether the wetland could persist under future rates of sea-level rise (SLR) or succumb to drowning. A "drowned" marsh is one in which all vegetation is inundated, and depths are too great for vegetation reestablishment.

Wetlands, unlike many terrestrial ecosystems, possess natural defenses to combat SLR. As a wetland's elevation relative to sea level decreases, wetland plants become more productive—to a point—and decomposition slows, so more organic matter is converted to wetland soil. Because of this process, wetlands exposed to a slow, steady rate of SLR can achieve an equilibrium, in which the wetland elevation

relative to sea level remains constant over time. However, when SLR proceeds more rapidly, rising seas can overtake the ability for plants to "keep up," and further increases in sea level result in a decrease in plant productivity, pushing the wetland toward inevitable drowning. Scientists thus consider the wetland elevation at which plant productivity switches from increasing with further SLR to decreasing a "tipping point," which indicates a lack of resilience.

For decades scientists have been modeling the interplay between sea level, plant productivity, and decomposition to estimate future wetland elevations. The Delta Stewardship Council used one of these models in the Delta Adapts Vulnerability Assessment. In the spotlighted paper, a new and improved version of the model is applied to the Delta. The newer model is informed by a wider range of wetland soil datasets acquired from throughout the Delta, improving the realism of site-specific conditions and processes. Another new element of the study is its examination of the effects of large (category 3-5) atmospheric rivers, which can mobilize large pulses of sediment from the Delta's watershed that are ultimately deposited on wetlands.

The results show that wetland resilience to SLR is variable across the Delta—due to the variability in starting elevations and vegetation communities—and with the future pace of SLR. The baseline results (i.e., without major atmospheric rivers) were similar to those of the Delta Adapts Vulnerability Assessment, which found that all marshes would drown at the end of a century under six feet of SLR. As with the model used in Delta Adapts, the newer model indicated that most wetlands will be in an unsustainable condition (below the tipping-point elevation) by the end of 100 years, but that seven percent of marshes currently in a resilient state would still be resilient at the end of the century. With six feet of centennial SLR, the survival time of the average Delta wetland is 89 years, and the time to reach the tipping point is just 41 years.

Large atmospheric rivers improve these outcomes for wetlands. Namely, they approximately double the proportion of wetlands in the resilient state at the end of 100 years. However, the atmospheric river results are based on assumptions that require further investigation in the Delta.

The findings of this article have relevance to EcoRestore, Delta Adapts, and the work of the DPIIC Restoration Subcommittee. They underscore the urgency of restoring wetlands now, well before the tipping point is approached, to ensure more time to build elevation. They also highlight the need to locate wetland restoration projects where the wetland has room to migrate inland, as inundation is inevitable for many wetlands under the most probable rates of SLR. Finally, the authors suggest that metrics generated by the model (e.g., time to the tipping point) may inform decisions about where and when to supplement wetland elevation with sediment brought in from elsewhere—a costly intervention, but one that may preserve the resilience of wetlands in critical locations.

Delta Science Program Activities

Integrated Modeling Framework (IEP) Workshop

The Delta Science Program convened a 2-day Integrated Modeling Framework Workshop on February 28 and March 1 to initiate discussions regarding developing a modeling framework and collaborative modeling center. The workshop theme was “One Delta, One Science, One Modeling Framework.” Attendees heard presentations and several panel discussions on a variety of topics that included learning from other systems that have developed similar resources and centers, and identifying current management challenges in the Delta (“use cases” or “case studies”) that could benefit from enhanced collaborative modeling resources and infrastructure. The Delta Science Program is currently developing a management summary of the proceedings that will distill key points and identify the next steps toward achieving the goals of developing a modeling framework and collaborative center to better serve the Delta modeling community and further the vision of “One Delta, One Science.”

Interagency Ecological Program (IEP) Workshop

The Interagency Ecological Program’s mission is to provide and integrate relevant and timely ecological information for management of the Bay-Delta ecosystem and the water that flows through it. This is accomplished through collaborative and scientifically sound monitoring, research, modeling, and synthesis efforts for various aspects of the aquatic ecosystem via multidisciplinary teams of agencies, academic, non-governmental, and other scientists. The IEP addresses high-priority

management and policy science needs to meet the purposes and fulfill responsibilities under State and Federal regulatory requirements. The IEP relies upon multidisciplinary teams of agency, academic, non-governmental agencies, and other scientists to accomplish its mission.

The IEP Workshop is an informal event held each spring to share new research results that advance science important to IEP and the larger Delta science community. The workshop features invited speakers, interactive sessions, poster sessions, training events, and a mentoring luncheon. The 2023 workshop will be held on March 21-24 in a hybrid format, with the in-person component at CNRA Headquarters. The theme for this year is Community Collaboration, and the workshop will highlight the research being completed by collaborative, community-based IEP Project Work Teams.

DSP Legislative Briefing

On February 16, the Delta Lead Scientist and Deputy Executive Officer for Science joined Executive Officer Jessica Pearson in providing a legislative staff briefing for the Assembly's Water, Parks, and Wildlife Committee on the roles and activities of the Delta Stewardship Council and Delta Science Program. The briefing was well attended, with questions on agency-academic partnerships and the nexus between the Science Program and its ability to provide unbiased information relevant to controversial projects. A recording of the briefing and Q&A session can be viewed at bit.ly/3Fofh8y.

On Your Radar

UC Davis Coastal and Marine Sciences Institute/DSP Joint Symposium: Implications of Rising Temperatures for Coastal, Marine, and Estuarine Ecosystems

Rising temperatures, including heat waves, have the potential to profoundly influence coastal, marine, and estuarine systems. What unique considerations must be evaluated to understand these effects from both ecological and human perspectives?

This daylong symposium, on Friday, May 19, 2023, will bring together researchers from the natural and social sciences to discuss the state of research on the influence of extreme heat on organisms, communities, and socio-ecological systems. The symposium will be divided into four main sessions, with focuses on:

- **Physical environments** and how they influence biotic responses to heat waves
- **Organismal responses**, including physiological shifts associated with increased temperatures and population shifts
- **Community and ecosystem** effects, including shifts in assemblages or ecosystem function
- **Management and governance,** including the effects of heat wave events on economics and how heat wave events can be integrated into future plans

The symposium will meet in person on the UC Davis campus and will be livestreamed and recorded. It will be free and open to the public. A registration link will be distributed via the Council's listserv.

For more information, contact Carole Hom, clhom@ucdavis.edu

By the Numbers

Science Program staff will summarize 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

Attachment 2: Visual Summary of Morris et al. (2022)

Contact

Dr. Laurel Larsen

Delta Lead Scientist

Phone: (916) 445-0463