



INFORMATION ITEM

Lead Scientist Report

Summary

Invasive floating aquatic vegetation (FAV) is a persistent and costly problem in the Delta that adversely affects fishing, boating, and wildlife. Control of FAV would be more effective if maps of its distribution could be updated frequently (weekly or better). The spotlighted study, funded by the Council, leverages advances in satellite technology and artificial intelligence to produce highly accurate maps of water primrose and water hyacinth--two prominent invaders in the Delta--at a nominal five-day interval.

Genus-Level Mapping of Invasive Floating Aquatic Vegetation Using Sentinel-2 Satellite Remote Sensing

Christiana Ade, Shruti Khanna, Mui Lay, Susan L. Ustin, and Erin L. Hestir. Remote Sensing (2022) <https://doi.org/10.3390/rs14133013>.

Research supporting the effective management of invasive species is critical for the Bay-Delta (Delta), where invasive floating aquatic vegetation (FAV) negatively impacts the system's biodiversity, hydrology, and recreational boating and fishing industries.

According to a review by Conrad et al. in the upcoming 2022 edition of *State of Bay-Delta Science*, the annual cost of FAV control in the Delta has been steadily increasing over the past decade, with a total cost of nearly \$15 million in 2018. Control is challenging and costly because rapid spread can happen in a matter of days, facilitated by water flow. Presently, the Delta lacks tools for producing updated maps of FAV coverage at a frequency commensurate with driving management decisions that would stop the spread of FAV. However, the 2022-2026 Science Action Agenda prioritizes research that could lead to the production of such tools (*Action 3E*:

Synthesize existing knowledge and conduct applied, interdisciplinary research to evaluate the costs and benefits of different strategies for minimizing the introduction

and spread of invasive species, and to inform early detection and rapid response strategies.)

Image acquisition from satellites or aircraft is standard for mapping the growth and spread of Delta plant communities, including invasives. However, both means of image acquisition have tradeoffs. Satellite imaging of the Delta occurs every five days but produces lower-resolution images. Lower resolution results in maps with less detail, leaving scientists unable to easily discriminate between multiple species in areas that are spatially or temporally complex. Conversely, imaging by aircraft can produce higher resolution images but less frequently, because flights for data collection are expensive. Recent advances in imaging have improved mapping capabilities through new satellites (including the Sentinel-2 satellite) that produce higher resolution images and new techniques that use artificial intelligence to improve the classification of image data into plant genus or species coverage.

The present study by Ade et al., funded through the Delta Science Program's 2018 PSN, involves the use of artificial intelligence to develop vegetation maps from Sentinel-2 images (acquired at a five-day interval), with particular focus on mapping two dominant FAV species: water hyacinth and water primrose. They compared the accuracy of the satellite-based maps to those of aircraft-based maps, commonly considered the gold standard. They found that the satellite-based maps were accurate up to 90%, with identification accuracies for water hyacinth and water primrose ranging between 79-91% and 85-95%, respectively. These accuracies were typically within 5% of those of aircraft-based maps and sometimes exceeded the aircraft-based map accuracy. This work represents an important step toward developing an operational tool for guiding FAV control decisions in the Delta.

Delta Science Program Activities

Delta Residents Survey

The Delta Science Program is supporting a Delta Residents Survey research project that will be launched in January 2023. Dr. Jessica Rudnick (Social Science Extension Specialist) is providing leadership for this collaborative team of researchers from CA Sea Grant, Sacramento State University Institute for Social Research, UC Davis, UC Berkeley, and Oregon State University.

The survey aims to reach a demographically and geographically representative sample of Delta residents and is focused on assessing residents' well-being, sense of place, and climate change experiences. The data collected will be helpful in establishing a baseline of understanding for what Delta residents think about Delta issues, how they connect to the Delta as a unique place, and how they are experiencing and adapting to climate changes. This aims to address a large gap in our current understanding of the social and human behavioral aspects of the Delta.

The research team aims to invite all Delta "primary zone" residents and a random sample of residents in and around the "secondary zone" to participate (~60,000 households total). Invitation letters will be sent to residents with instructions on how to access the survey online, by mobile, or by mail.

Updates and preliminary data will be made available in coming reports. Please encourage the Delta community to respond to surveys.

Advancing Interdisciplinary Research Symposium Report-Out

The Advancing Interdisciplinary Research symposium was held in October 2022 and brought together members of the **Bay-Delta Social Science [Community of Practice](#)** with representatives from multiple collaborative science venues that focus on the biophysical and ecological components of the estuary.

Day 1 focused on facilitating coordination and integration across social and natural science communities and provided context and training on why and how interdisciplinary research approaches could help advance the state of relevant and useable science in the Delta.

Day 2 provided opportunities for participants to work in interdisciplinary breakout rooms to brainstorm ideas on integrated approaches to researching some of the Delta's hardest challenges. Some of the topics discussed were drought and salinity management, carbon sequestration, land subsidence, shoreline vulnerability, and flood protection.

The Social Science Integration Team will be planning next year's activities and efforts to further conversations around themes that emerged as overlapping interests bridging the social and natural science communities. The recordings of the training and workshop are available on the Council's YouTube channel. Other

relevant resources from both the training and workshop can be found on the Council's Social Science Community of Practice webpage events tab (<https://deltacouncil.ca.gov/bay-delta-social-science-community-of-practice>).

Harmful Algal Bloom (HABs) Workshop Report-Out

The Delta Science Program hosted a hybrid in-person and virtual Harmful Algal Blooms (HABs) workshop on November 8-9 to inform the development of a community monitoring strategy. The workshop was opened by state Assemblymember Bill Quirk who authored AB 834 which directed the development of a Freshwater and Estuarine Harmful Algal Bloom Program for California.

Themes for the workshop were "Creating a coordinated partner monitoring strategy" and "Data sharing and integration". Monitoring for HABs is not consistently conducted or funded, even though HABs are a public and environmental health hazard. Key outcomes from this workshop were that participants desired standardized practices for response to an analysis of blooms, and that long-term funding for collecting data, analysis, and communication is an ongoing challenge to properly respond to blooms.

The next steps for this workshop are to develop a monitoring strategy that the community can use to conduct monitoring in a way that adds to a collective understanding for HABs. We hope to have this strategy available for monitoring practitioners by mid-2023.

On Your Radar

Science Funding Coordination

The Delta Lead Scientist and Delta Science Program staff have been leading ongoing conversations about how to promote greater coordination for science funding with partners at the California Department of Fish and Wildlife, US Geological Survey, US Bureau of Reclamation, Department of Water Resources, and the State Water Contractors. As an outcome of these conversations, we will be seeking input from a broader range of science funding entities to explore the type of coordination that is desired and that would be a worthwhile investment of time for science funding managers. Options to be explored include establishment of regular meetings to promote information sharing about planned solicitations in

order to identify partnership opportunities and avoid competing solicitations, and/or establishment of a common pre-proposal process as a mechanism to promote greater alignment of proposals with management needs and direct scientists to the most appropriate funding opportunity. The draft questionnaire to be sent to funding entities is included as Attachment 3.

By the Numbers

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

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

Attachment 3: Draft Science Funding Coordination Questionnaire

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