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## Rewetting Peat Soils in the Delta

Delta Independent Science Board

Draft Prospectus

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### Motivation

Drainage of land in the Sacramento-San Joaquin Delta has caused extensive oxidation of peat soils, lowering approximately 386 sq mi of land from 10 ft to as much as 29 ft below sea level. Current rates of subsidence – loss of land elevation due to oxidation of peat soils – in the Delta currently range from 0.2 to more than 0.8 in yr<sup>-1</sup> (Deverel et al., 2020). This ongoing subsidence increases costs to drain soils and decreases arability for agricultural production (Deverel et al., 2010; Deverel et al., 2020), degrades water quality (Deverel et al., 2010; Deverel et al., 2016; Deverel et al., 2017a), increases vulnerability to levee failure and flooding (Bates and Lund 2013; Deverel et al., 2016; Deverel et al., 2020), and emits significant amounts of greenhouse gases (Deverel et al., 2017b; Hemes et al., 2019). The severity and impact of subsidence have prompted re-evaluation of potential incentives for subsidence management by the Delta Stewardship Council for the Delta Plan (Delta Stewardship Council, 2022).

A broad cross section of stakeholders, including both public agencies and private sector parties, are developing approaches to mitigate subsidence by rewetting the underlying peat soils. These approaches include efforts that encourage carbon sequestration in exchange for carbon credits (HydroFocus Inc., 2017; Deverel et al., 2020; Windham-Myers et al., 2023), reversal or arresting of land subsidence by managing water tables, and practicing agriculture under wet soil conditions (paludiculture) (Deverel et al., 2017b, Deverel et al., 2020). Actions that reduce subsidence also contribute to decreasing pressures on levees, improve their stability, and reduce vulnerability to sea level rise (Bates and Lund 2013; Deverel et al., 2016; Deverel et al., 2020). Efforts in the Delta to rewet peat soils to slow, arrest, or reverse subsidence, however, are fragmented. This reduces opportunities to share critical insights that could support managing subsidence on a Delta-wide scale.

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Approximately 25,000 acres of wetland restoration is in progress with 5,000 to 10,000 acres of restoration funded by state programs (Delta Stewardship Council, 2022). This is in addition to private agricultural efforts currently underway to rewet peat soils in the Delta. The most widespread effort that slows oxidation is by farmers who raise the water table above the peat layer when fields are fallow to control soil salinity. Oxidation of course resumes when water tables are lowered to return fields to cultivation. Other farmers have converted fields to allow the cultivation of water tolerant crops like rice, which require a high-water table to grow. Total cessation of oxidation has been achieved by some public agency landowners who have permanently submerged their land (Valach et al., 2021). Finally, land elevations have been increased, i.e., subsidence has been reversed, at rates of 1.0-1.4 in yr<sup>-1</sup> (Miller et al., 2008; Deverel et al. 2020), by maintaining shallow water levels that promote the growth and subsequent accumulation of local wetland vegetation.

The Delta Plan recognizes the importance of halting or slowing subsidence in a manner that balances agricultural and ecosystem functions that support the coequal goals in the Delta Reform Act (Delta Stewardship Council, 2022). The purpose of this review by the Delta ISB is to inform ongoing and future subsidence management efforts by summarizing existing or planned programs, identifying barriers and opportunities, and document scientific understanding in four interconnected aspects of Delta subsidence:

1. Land stabilization practices and experiments including rewetting and subsidence reversal
2. Greenhouse gas emissions, carbon sequestration effectiveness, and existing incentives to manage carbon emissions through soil rewetting
3. Economic trade-offs between agricultural practices, integration of rewetting approaches to farming operations, and the adoption of paludiculture
4. Known and future economic benefits and costs of soil rewetting for farm productivity, climate risk mitigation, levee stability, water quality, and flooding impacts.

In addition to summarizing current efforts in the Delta to rewet peat soils and the state of the science, the review will assess economic and community trade-offs associated with different management actions and economic incentives. Rewetting is potentially compatible with some types of farm operations but may require conversion from current crops (Deverel et al., 2017b). In addition, incentives

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provided by some carbon credit markets may not support optimal management of farm operations (Windham-Myers et al., 2023).

## Audience

Subsidence and efforts to slow or reverse subsidence directly impacts agricultural production, water quality, carbon fluxes, and the future economic and cultural value of the Delta landscape. Accordingly, this review will serve a diverse audience that includes stakeholders and decision-makers from state and federal agencies, public water agencies, local agencies, public and private agricultural entities, non-governmental organizations, community-based organizations, and academic and research institutions. This review aims to reach parties involved in wetland restoration, carbon sequestration, and agricultural interests interested in practices that reduce oxidation of peat soils.

## Input

This review will be based on a two-day workshop consisting of panel presentations of invited experts and public discussions. Panelists will be asked to provide their perspective on existing programs, barriers and opportunities, state of scientific understanding, scientific gaps and deficiencies, and the economic considerations of managing subsidence within the four topical areas:

1. State of knowledge on subsidence reversal and land stabilization practices through soil rewetting;
2. Greenhouse gas emissions, carbon sequestration effectiveness, and existing incentives to sequester carbon through soil rewetting;
3. Economic incentives to motivate shifts in agricultural practices and adoption of paludiculture crops; and
4. Known and future economic benefits and costs of soil rewetting for farm productivity, climate risk mitigation, levee stability, water quality, and flooding impacts.

The first panel will discuss the state of the science on various rewetting approaches, water-table controls, and floating peats to reverse subsidence and stabilize land. The second panel will discuss the geochemistry of greenhouse gasses and peat soils to reveal areas where additional science could improve carbon sequestration effectiveness and quantification. The third panel will discuss the opportunities and

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barriers for paludiculture in the Delta and compare trade-offs in agricultural practices to examine their implications for subsidence management. The fourth panel will discuss economic considerations of managing subsidence to better understand if demonstrated benefits have meaningful economic benefits and whether there are adequate economic incentives to meet desired objectives.

## Timeframe

Target Date	Benchmark
May 2023	Prospectus finalized
June 2023	Finalize workshop agenda and invite speakers
August 2023	Open registration for workshop
October 2023	Host workshop
January 2024	Release draft workshop summary report for public comments
Spring 2024	Finalize summary report and findings

## Related Reviews

Although the Delta ISB has reviewed documents that include consideration of subsidence, it has not engaged in reviews that focused on subsidence *per se* or rewetting of Delta soils to mitigate subsidence. Relevant Delta ISB reviews include the following:

- [2016 Delta ISB Workshop Report on Earthquakes and High Water as Levee Hazards in the Sacramento-San Joaquin Delta](#)
- [Delta Plan Ecosystem Amendment Performance Measures](#)

## Expected Products and Outcomes

The primary product of this review will be a report of the workshop that synthesizes the presentations and research recommendations from the panelists and summarizes subsequent discussions. The report will review current rewetting efforts in the Delta and identify both barriers to and opportunities for future progress. It will summarize current scientific understanding behind existing rewetting efforts. Based on the discussions at the workshop, the Delta ISB will identify research, expertise, and tools, including modeling, that are needed to support adaptive management of a wetter Delta.

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