Subsidence Reversal and Carbon Sequester Using Re-establishing Wetlands

An Engineering and Science Partnership

CA Department of Water Resources and the U.S. Geological Survey

USGS

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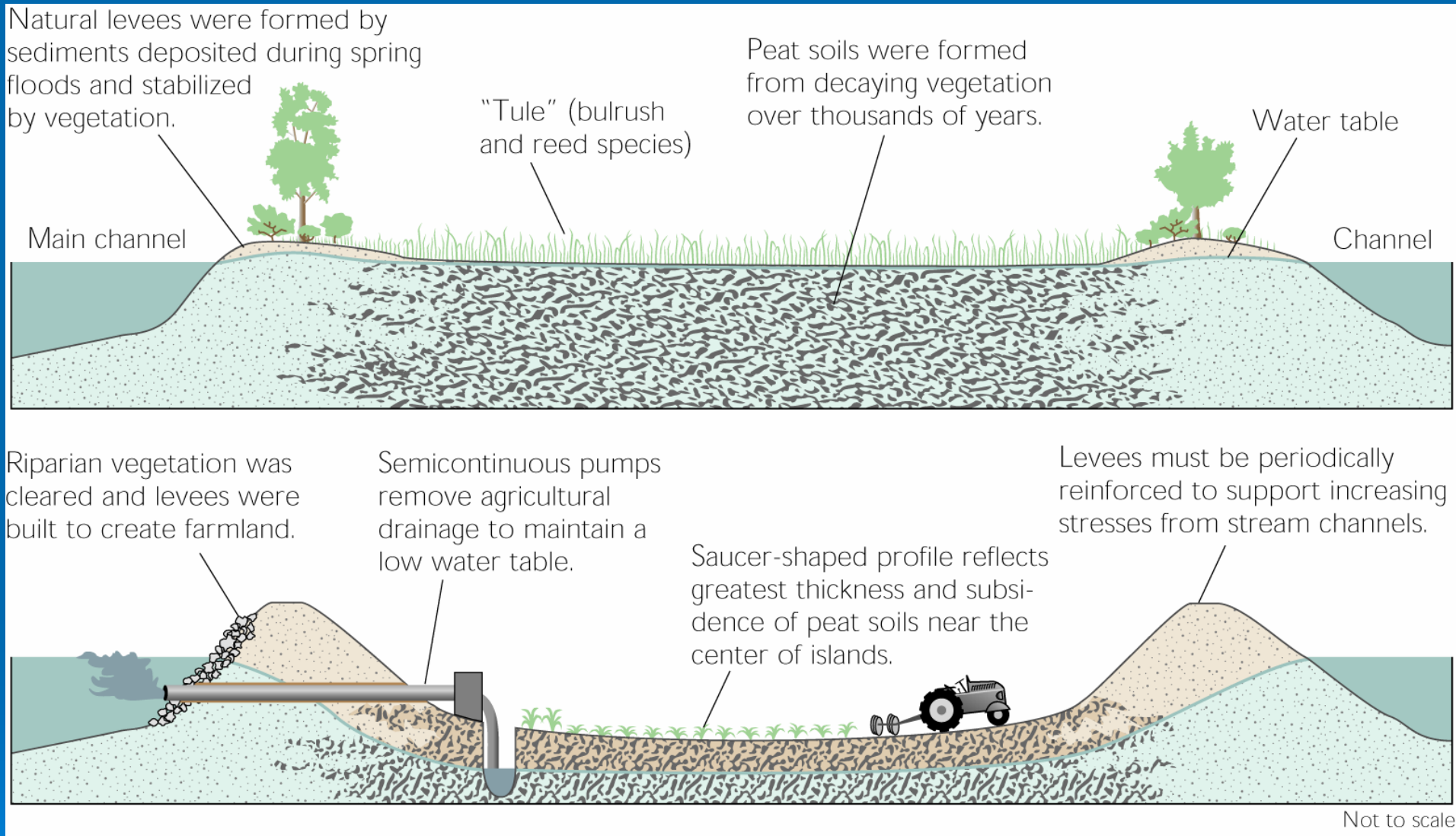
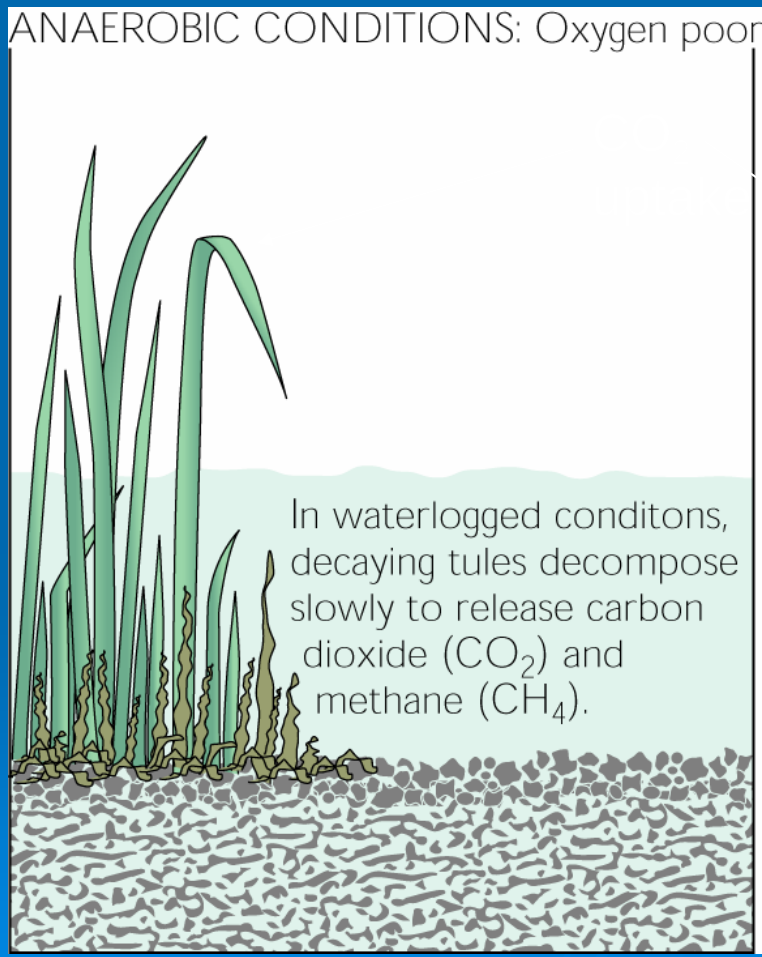


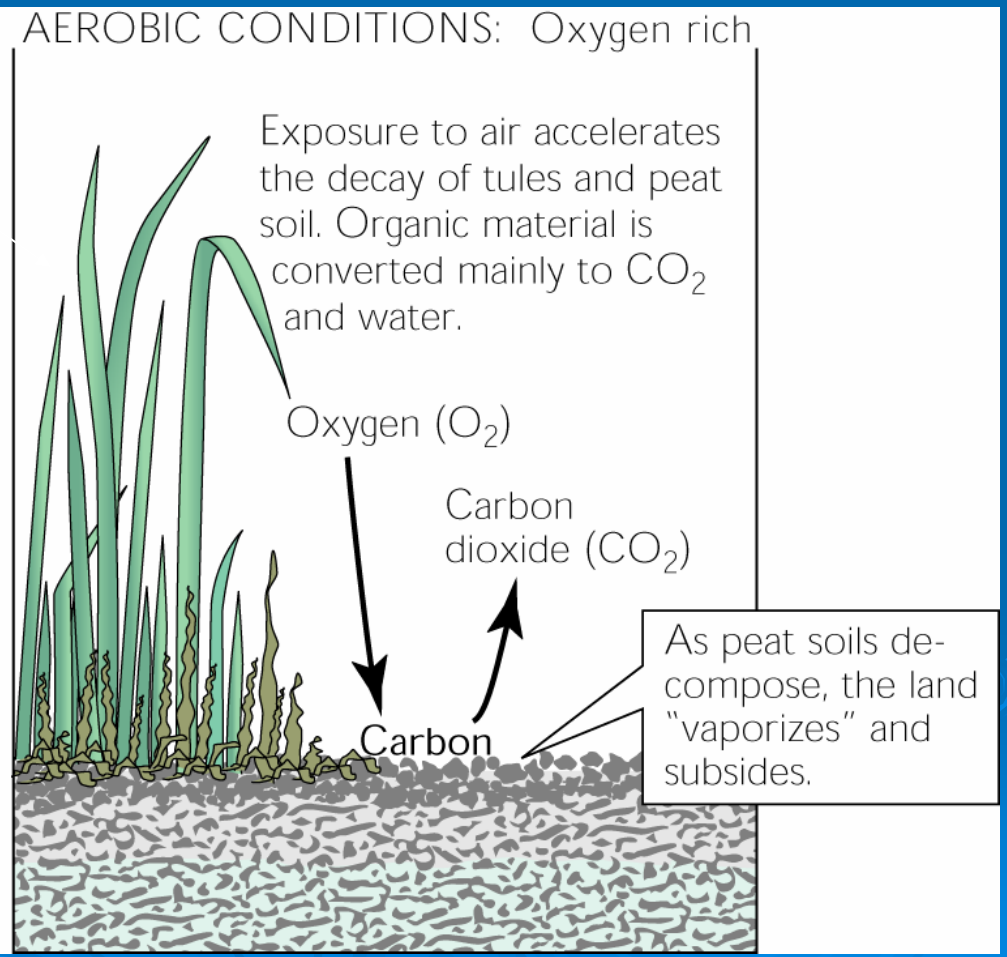
Carbon Sequestration

C input > C loss

Subsidence

(C loss > C input)





Subsidence
(land surface elevation decline)

- **Greatest subsidence in Central and Western Delta**
- **Subsidence as great as 25 ft below sea level**

How can we reverse Subsidence?

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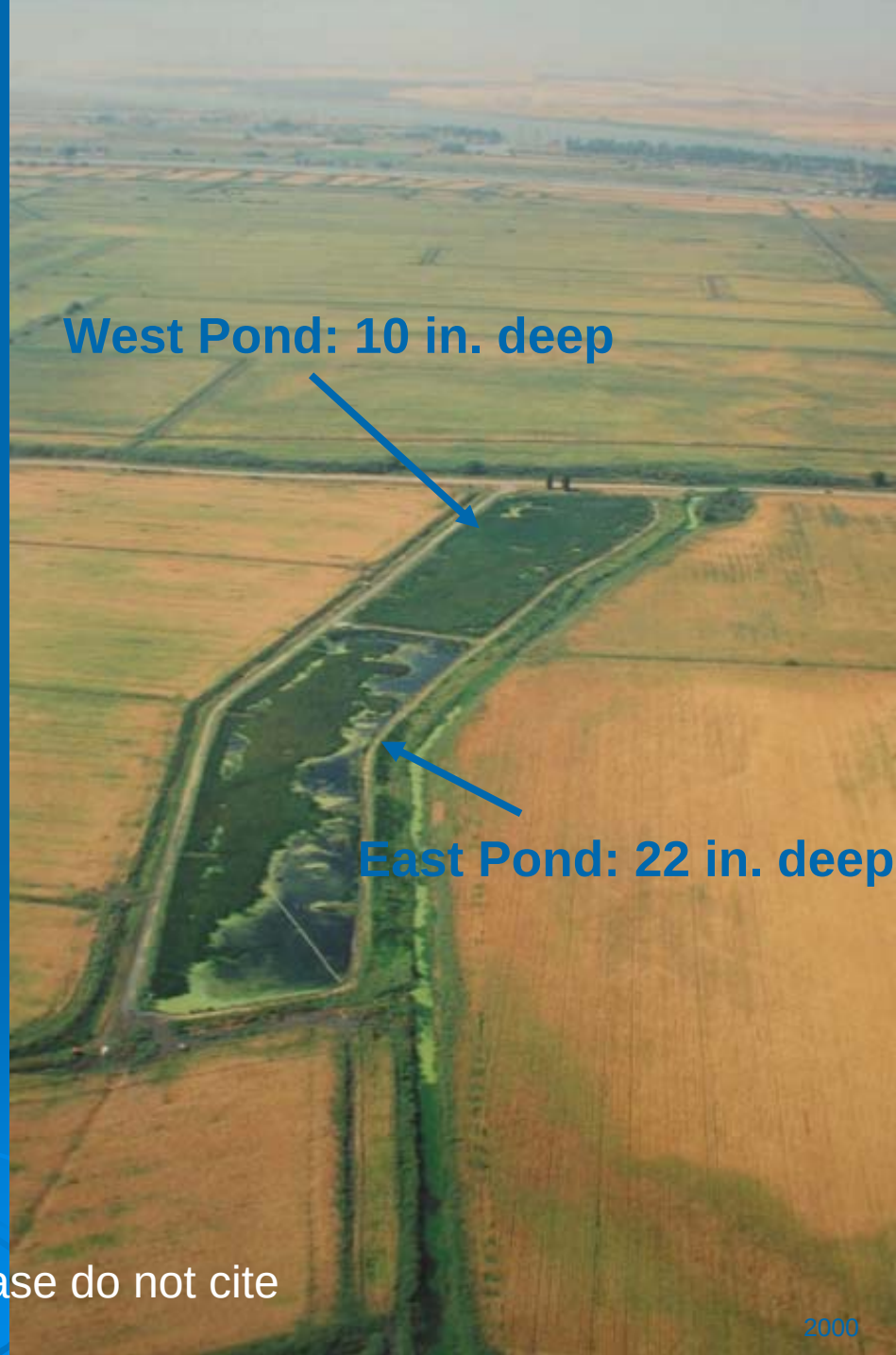
Small Ponds Pilot Project 1993-1997

Shallow, permanent flooding worked best to Reverse Subsidence through Plant Growth

Twitchell Island Demonstration Project 1997-present

- Two 7½ acre wetlands
- Continuously flooded
- Non-tidal system



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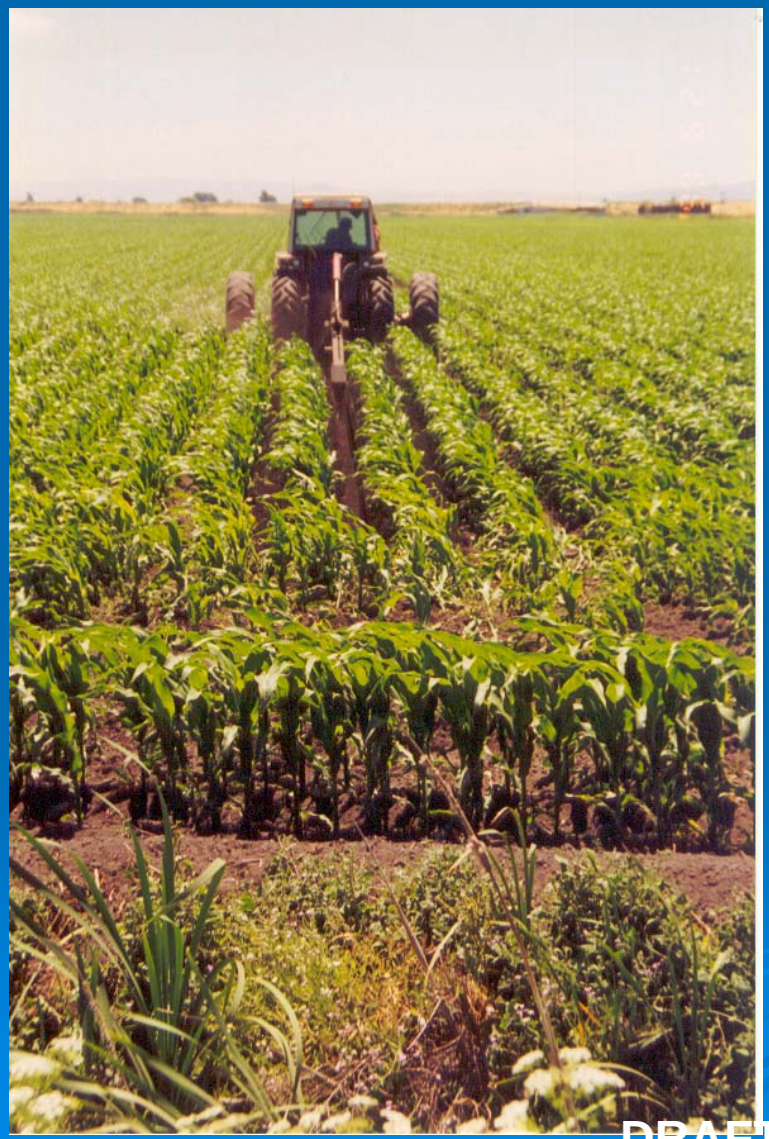
Current agricultural practices promote losses of carbon (CO_2) from the soil



- **This causes high rates of subsidence**
- **And contributes to greenhouse gas emissions**

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Permanently flooded wetlands reduce/stop emissions of carbon (CO_2) from the soil

- **This reverses subsidence**
- **And decreases greenhouse gas emissions**

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Permanently flooded (shallow) wetlands promote sequestration of carbon (carbon fixed by vegetation: photosynthesis)

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Plant material accumulates and raises the land surface (reverses subsidence)

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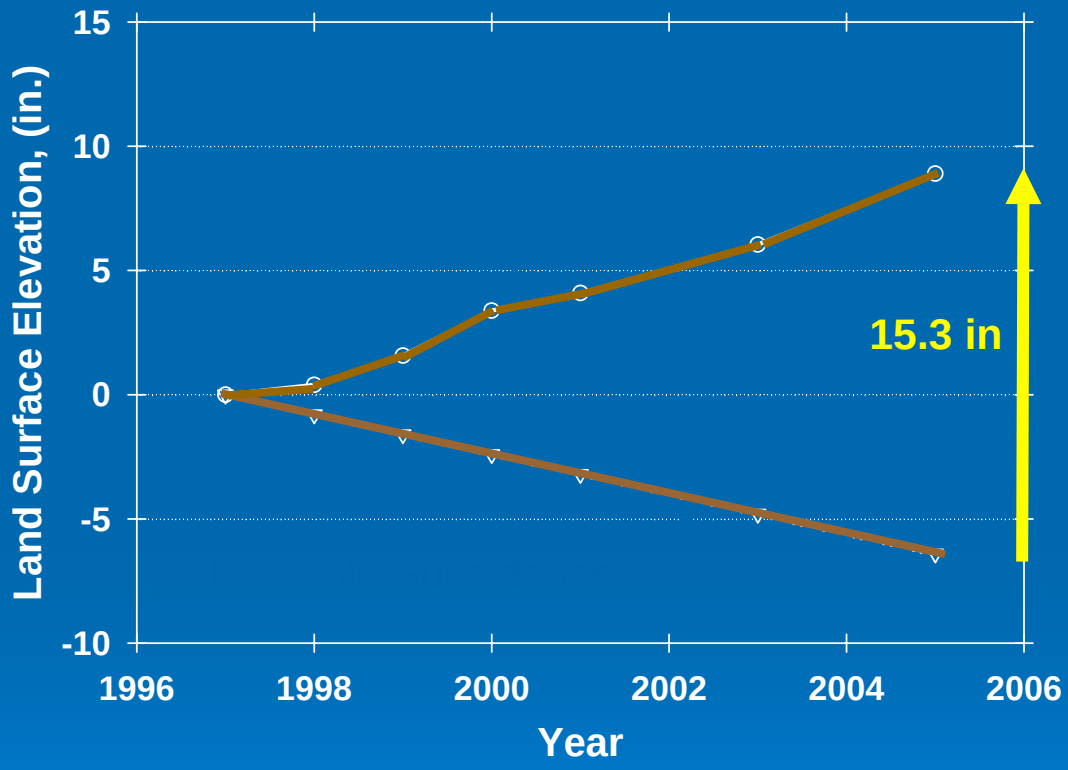
West Wetland, Land Surface Elevation



15.3 inches / 8 years = 1.9 inches/year

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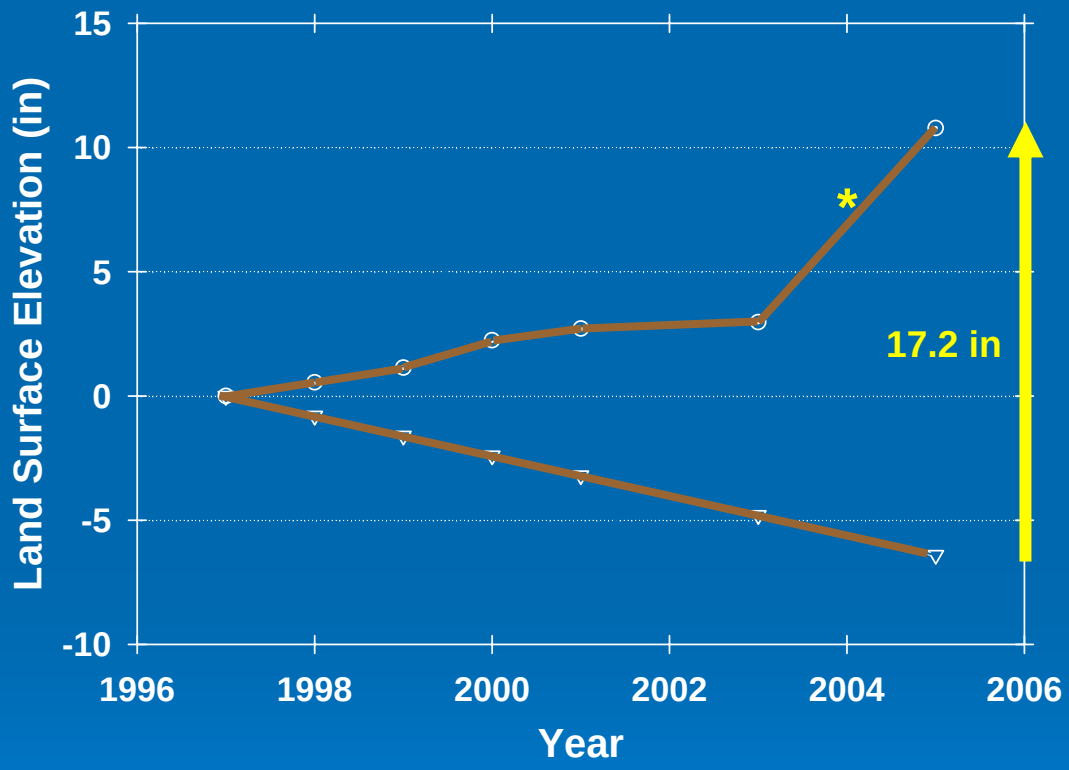
East Wetland, Land Surface Elevation



17.2 inches / 8 years = 2.15 inches/year

*** 2003 - 2005: 3.9 inches/year**

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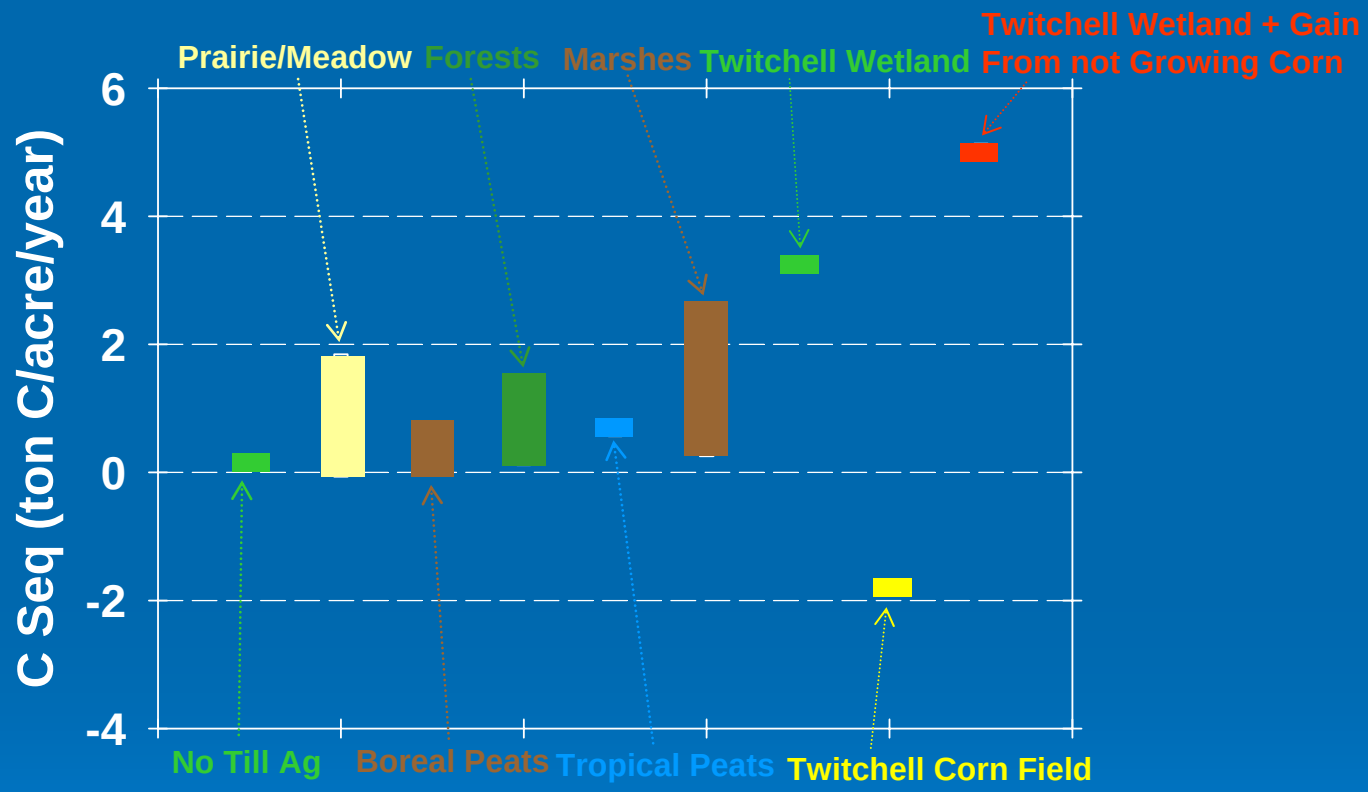
Carbon Sequestration for Different Land Uses



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Major Conclusions

- Managed, restored wetlands can mitigate and reverse land subsidence on subsided Delta islands
- The dominant emergent marsh vegetation (cattails and tules) making up these wetlands sequesters much greater amounts of carbon than other land uses (forests, marshes, etc.)

Overall goals: to demonstrate at the farm scale that

- we can **mitigate and reverse subsidence** through re-establishing emergent marsh wetlands on peat islands in the Delta
- the re-established wetland **sequester carbon** at rates that could, in the future, make this land use economically feasible in the Delta
- we can **minimize** any **unwanted** drinking water or ecological **byproducts** from this land use

Project Objectives:

1. To reverse subsidence on the 670-acre re-established wetland on Sherman Island
2. To test and identify the variables that can be managed to optimize the processes to:
    - maximize plant biomass accretion
    - maximize sequestration of CO_2 from the atmosphere
    - minimize discharges of greenhouse gases, MeHg, and DOC

Project Objectives continued:

3. To develop and transfer technology by
    - summarizing steps to asses and optimize wetland performance
    - developing a processed-based model using project data for broad Delta use that predicts potential subsidence reversal, C sequestration, and unwanted byproduct generation

Potential Site for C Sequestration Subsidence Reversal Re-established Wetland

- Recent discussions have guided the site for this demonstration project to Twitchell Island instead of Sherman Island
- Other sites and sizes for the re-established wetland and experimental cells currently are under consideration
- Future updates are planned after key decisions have been made

Potential Adverse Impacts

- Release of dissolved organic matter to channel waters – drinking water disinfection byproduct precursors
- Release of greenhouse gases – CO_2, methane, nitrous oxide
- Formation of MeHg and incorporation into foodweb

Major Areas of Research

- Plant Growth and Biomass Accretion
- Greenhouse Gas Emissions
- Methylmercury Production and Accumulation into the Foodweb
- Dissolved Organic Carbon