



# California's Bay-Delta

## Climate Change and the USGS

Background and Importance

Seismic Risks & Climate Change

USGS Applied Research

Questions

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# PRECIPITATION AND POPULATION















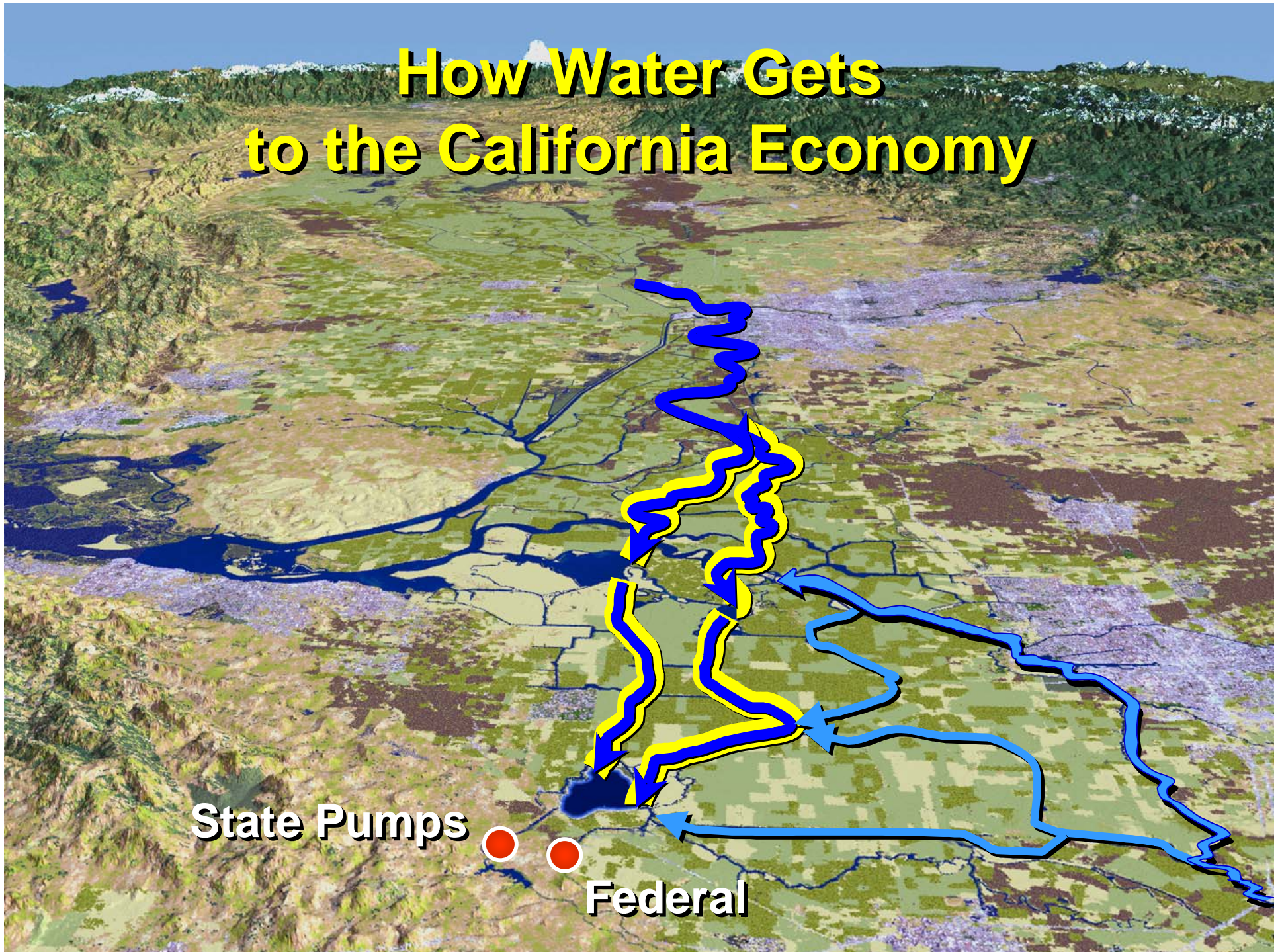








# How Water Gets to the California Economy



State Pumps

Federal



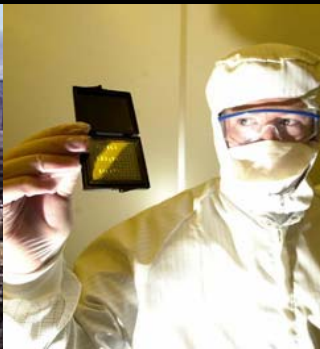
# Importance of the Bay-Delta

- 2/3 of residents rely on Delta
- Supplies Bay Area, Central Valley & So. California
- Irrigates 45% fruits & vegetables produced in US
- 55 fish, 221 bird, 45 mammal & 16 reptile species
- 10% of remaining wetlands in California

Urban Needs



Agriculture

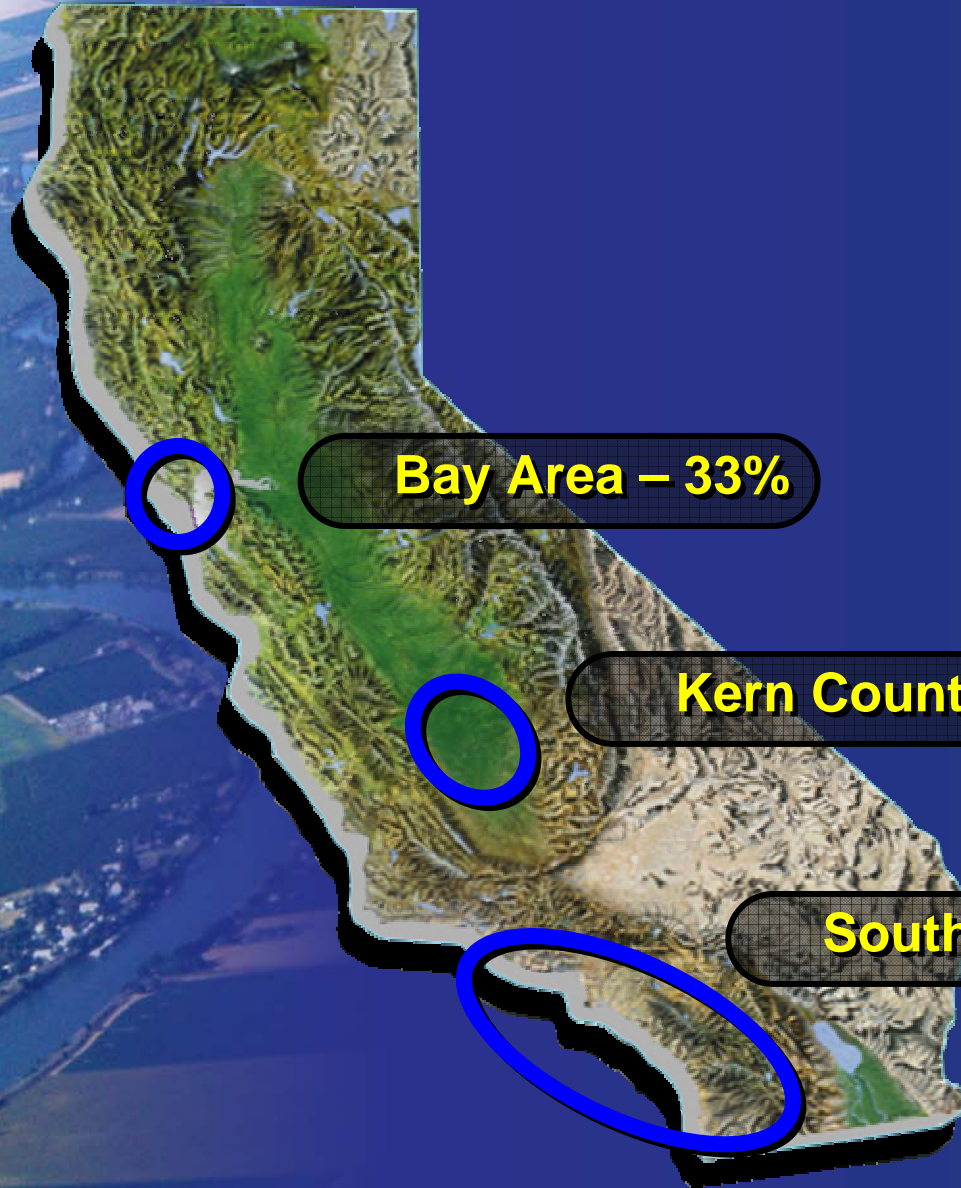


Fisheries & Habitat





# Supplies Bay Area, Central Valley & So. California



**Bay Area – 33%**

**Kern County – 23%**

**Southern Cal – 30%**

**Some regions  
up to 100%  
dependent on the  
Delta**



# Land Subsidence

Due to Farming & Peat Soil Oxidation

- 30 ft.

- 20 ft.

- 5 ft.

## Subsidence

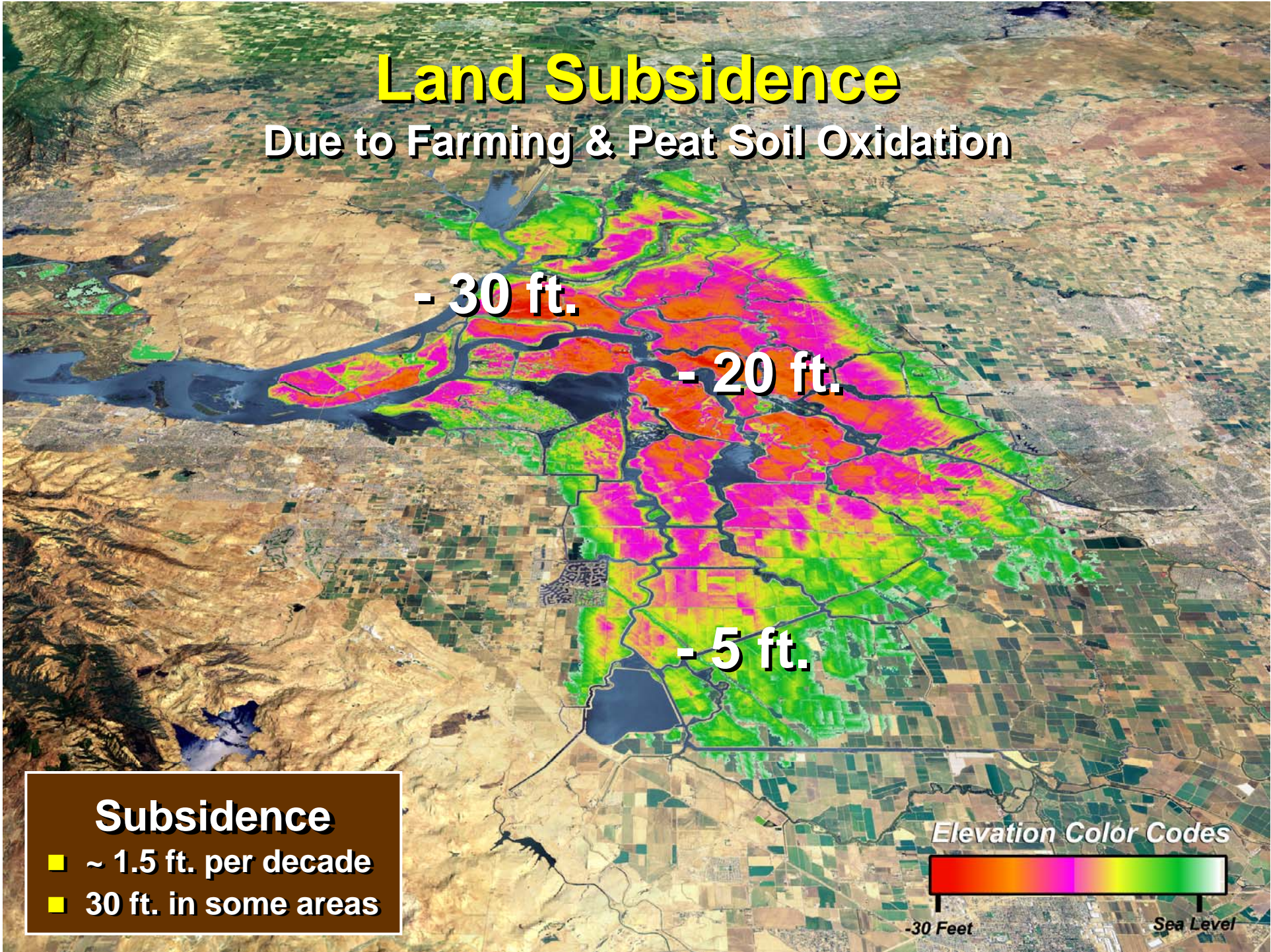
- ~ 1.5 ft. per decade
- 30 ft. in some areas

Elevation Color Codes



-30 Feet

Sea Level

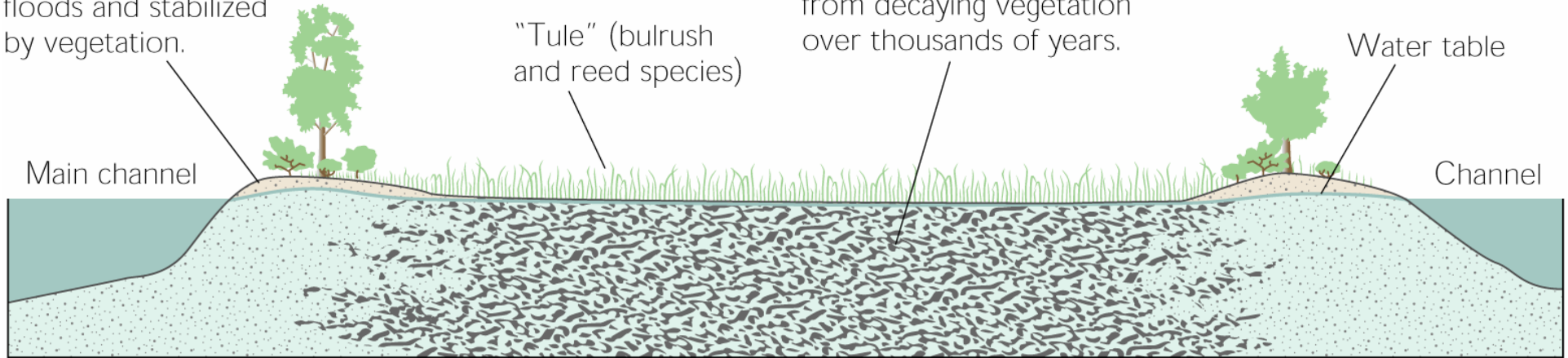




# Delta Land Subsidence

Natural levees were formed by sediments deposited during spring floods and stabilized by vegetation.

Peat soils were formed from decaying vegetation over thousands of years.

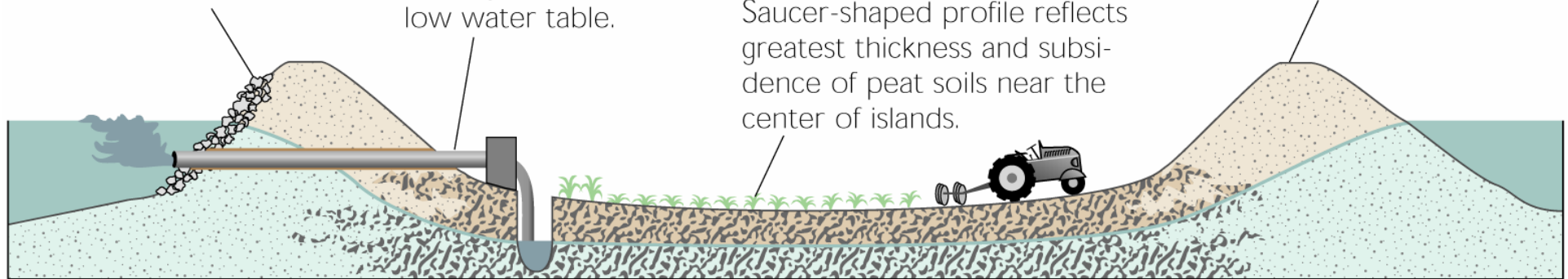


Riparian vegetation was cleared and levees were built to create farmland.

Semicontinuous pumps remove agricultural drainage to maintain a low water table.

Saucer-shaped profile reflects greatest thickness and subsidence of peat soils near the center of islands.

Levees must be periodically reinforced to support increasing stresses from stream channels.



Not to scale



## Sea-level rise changes salinity

- Depth
- Shoreline
- Tides
- Floods Delta islands





# Earthquake Risks



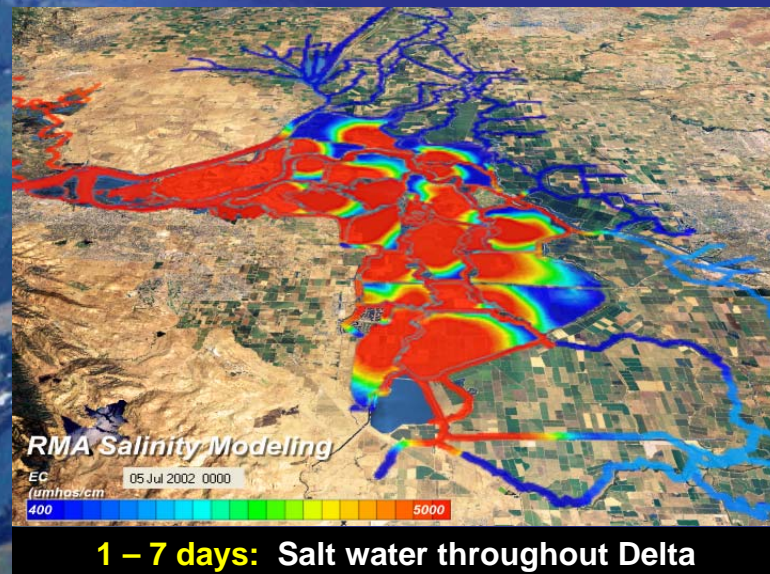
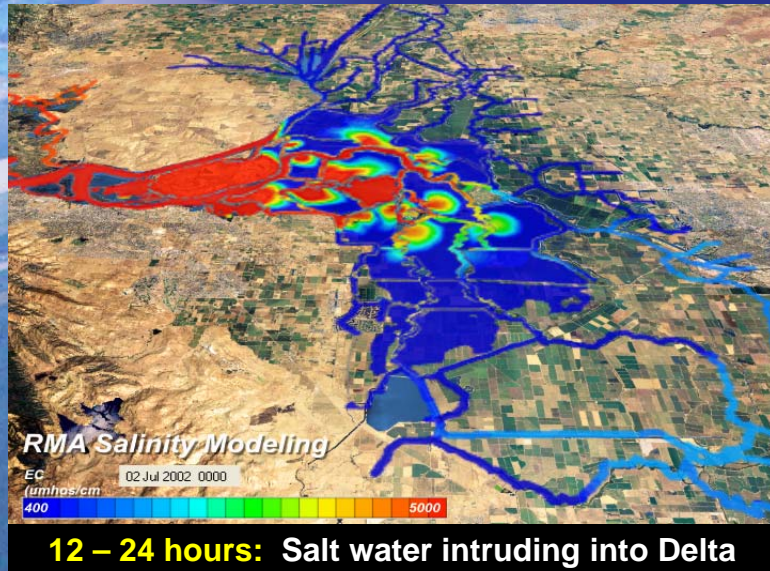
Bay Delta Region Major Faults



# Magnitude 6.5 Earthquake causing 20-Island Failure (very complex analysis)

## USGS contributions

1. Salt/Freshwater Mixing
2. Channel Bathymetry
3. Model Development





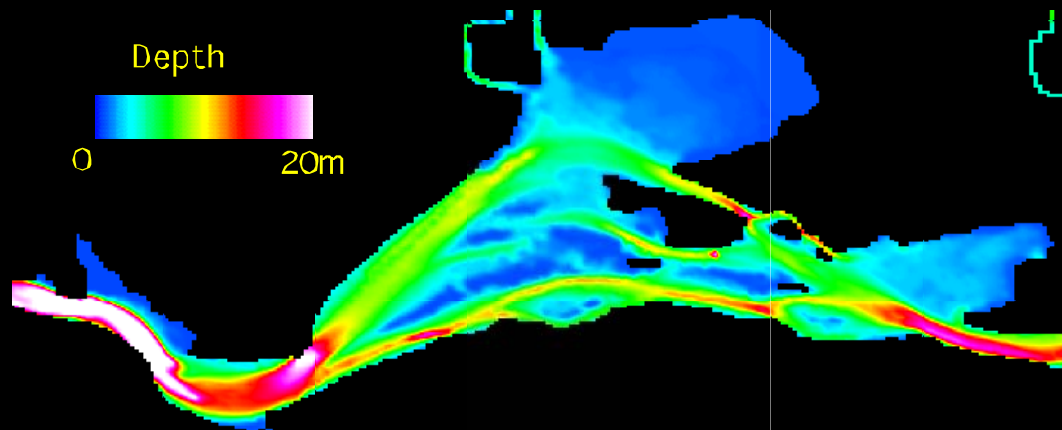


**Net Delta  
Outflow**



**USGS data**

**Bathymetry**

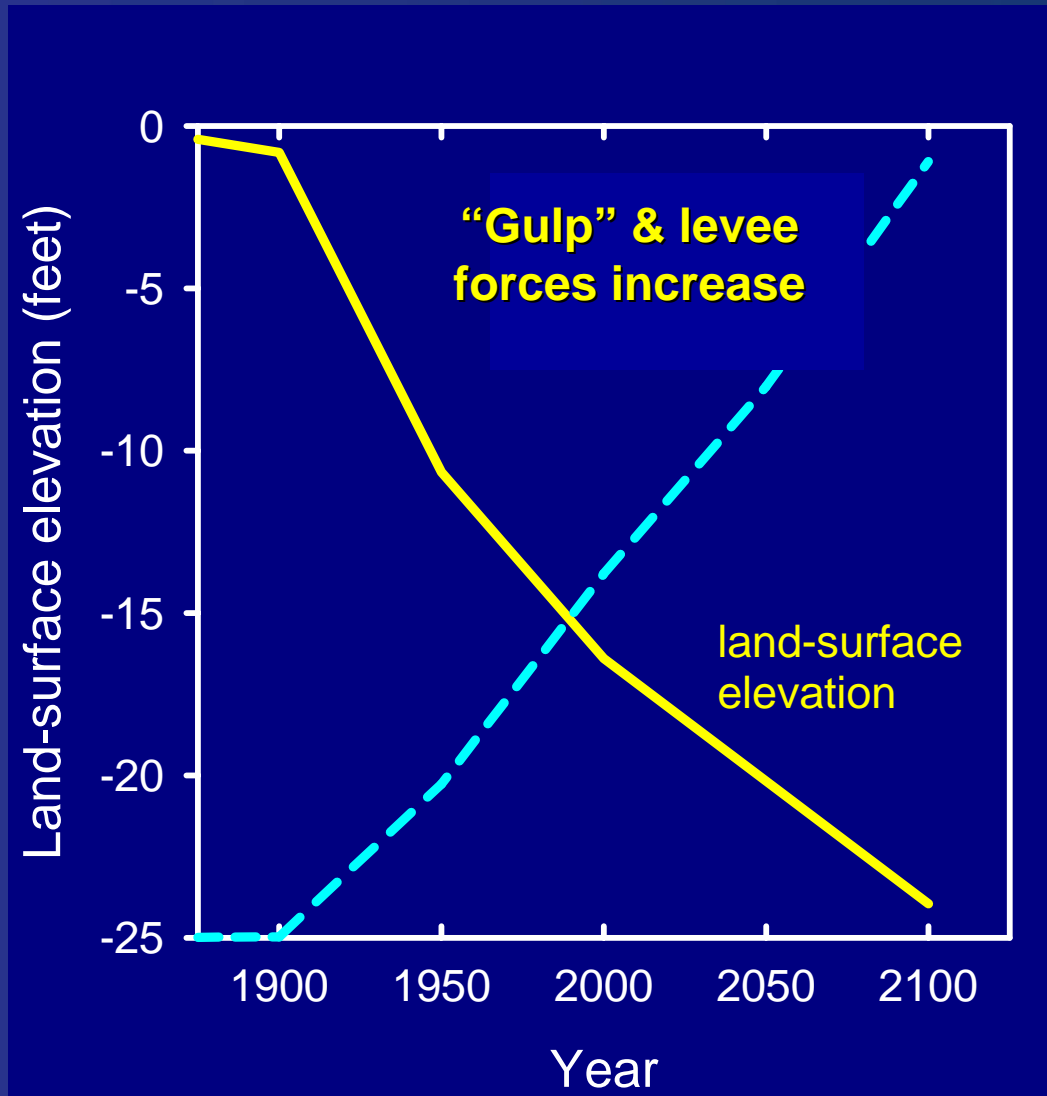




# Why subsidence matters

Increases risks from

1. earthquakes
2. sea-level rise





# Delta Farming Promotes Carbon (CO<sub>2</sub>) & Soil Losses



1. Causes subsidence
2. Contributes to greenhouse gas emissions



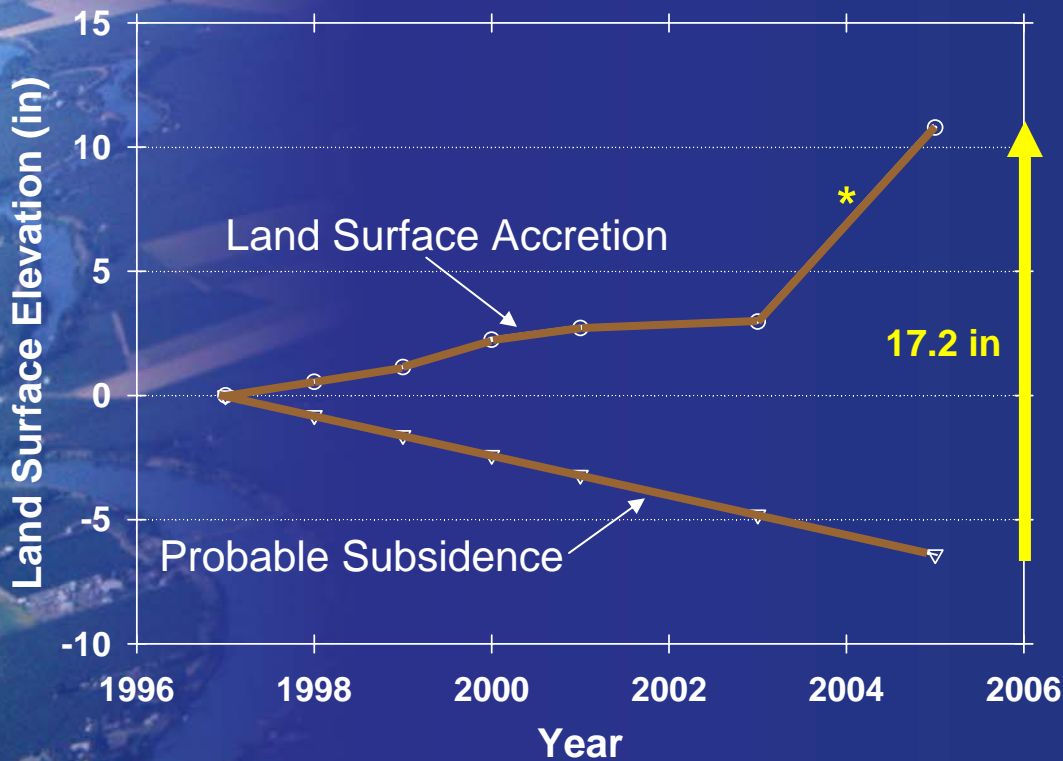
# Restoring Natural Processes Wetlands Reverse Problem



1. Raise land surfaces
2. Capture CO<sub>2</sub> gas



# Delta Land Surface Elevation



**17.2 inches / 8 years = 2.15 inches/year**

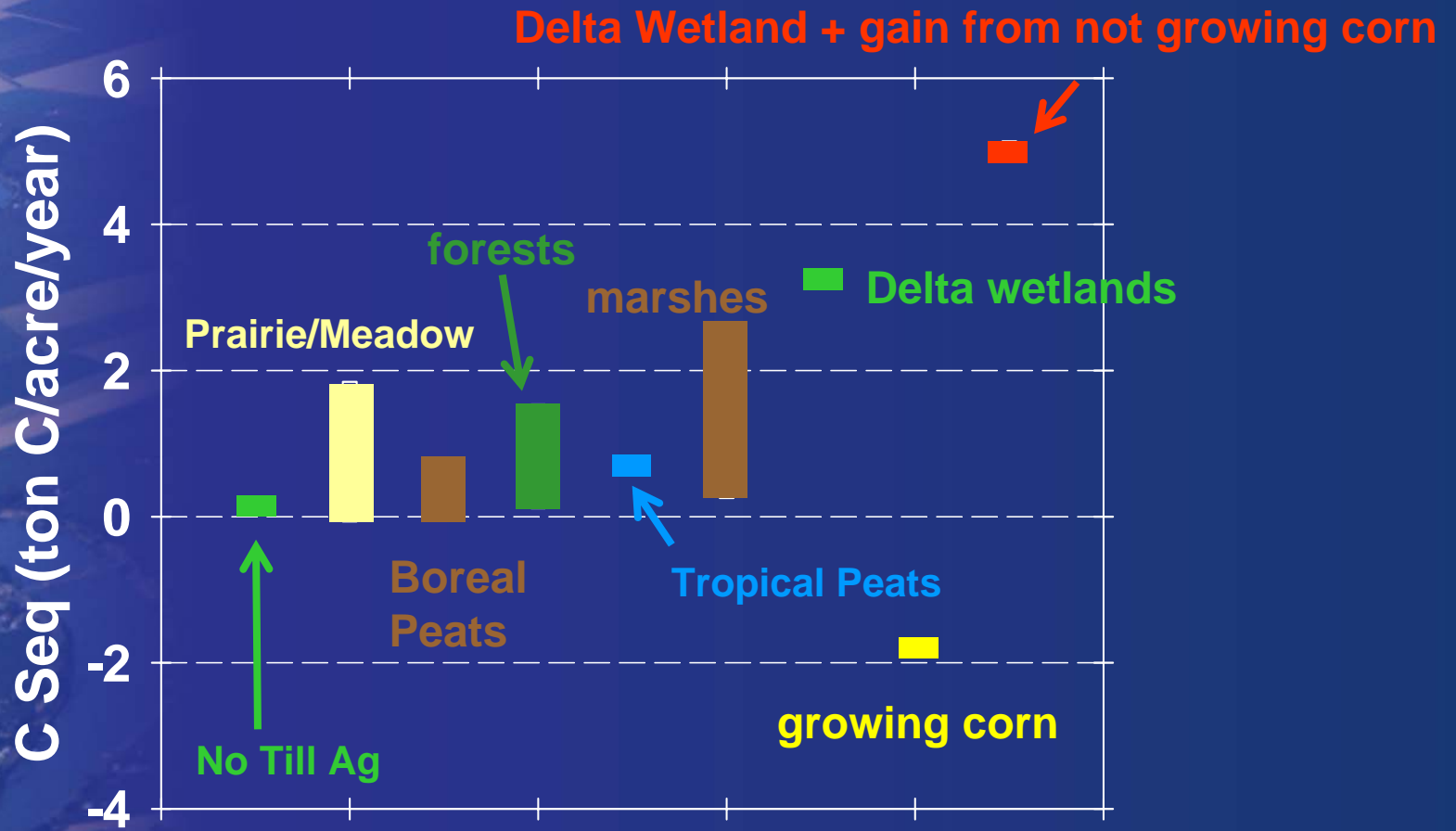
**\* 2003 - 2005: 3.9 inches/year**



**USGS data**



# Carbon Sequestration for Different Land Uses



USGS data



# The Delta's Current Course is Non-sustainable



State & Federal Pumping Plants

California's Bay-Delta