

# Building a Landscape Perspective for the Delta: Lessons from Historical Ecology

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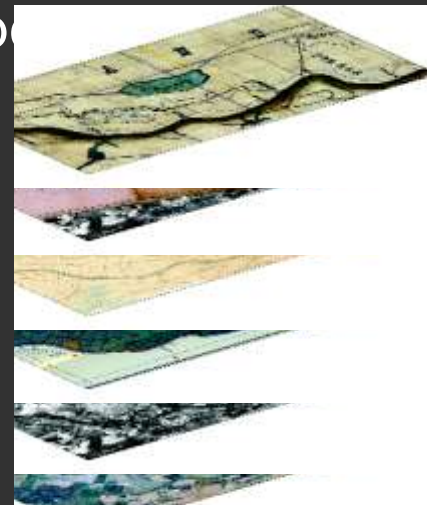
***Bay-Delta Science Conference***  
*October 17, 2012*

# why historical ecology?

Research the **past** to understand the **present** and envision the **future**

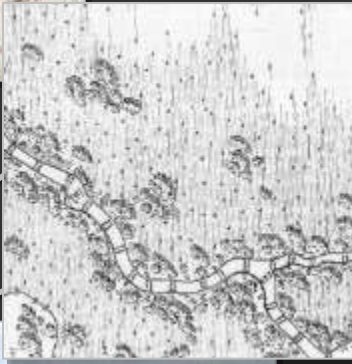
- Links landscape pattern, process, and function
- Describes the conditions to which species are adapted
- Challenges assumptions about past landscapes
- Aids interpretation of the contemporary landscape
- Identifies opportunities and constraints

*(not about recreating the past)*



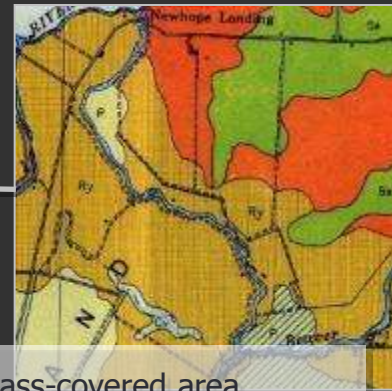
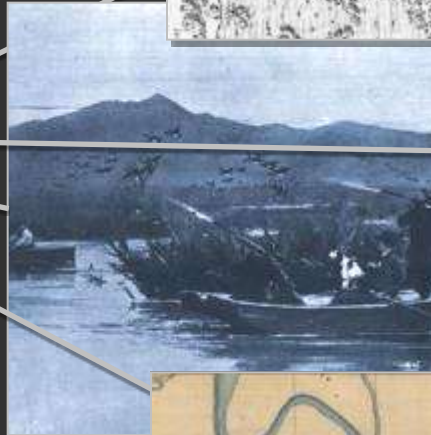
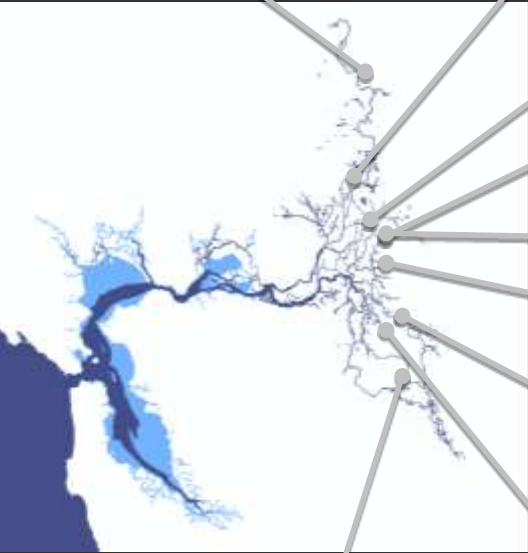
1800

"The lake was situated far out in an impenetrable tule swamp of immense extent...it was a sort of "sanctuary" to which birds came..."



1850

"lagoons...whose waters flowed back swiftly into the Sacramento with the ebbing tides"

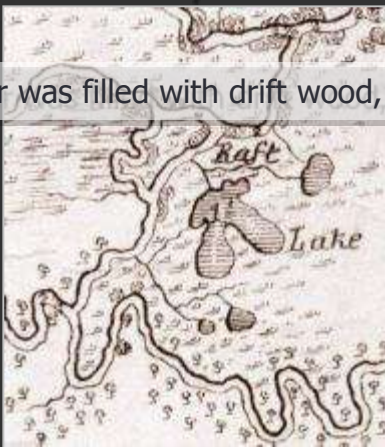


1900

"In a grass-covered area between the forest and swamp"

1950

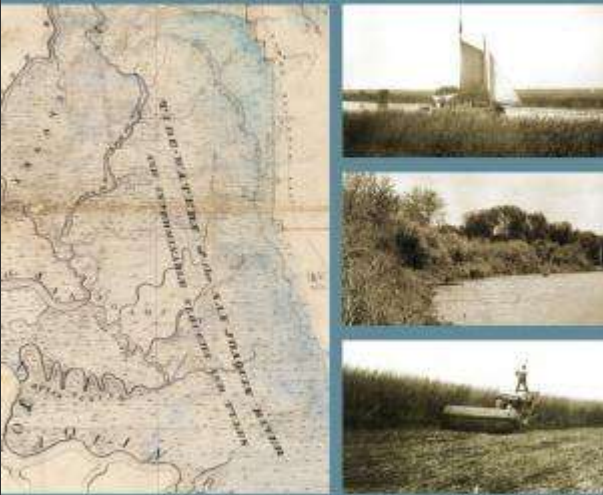
"the river was filled with drift wood, forming a raft"



"nothing but tule, without a tree under which the navigator may find shade"

2000

Sacramento-San Joaquin Delta Historical Ecology Investigation:  
EXPLORING PATTERN AND PROCESS



AUGUST 2012  
SAN FRANCISCO ESTUARY INSTITUTE  
AQUATIC SCIENCE CENTER



# Sacramento-San Joaquin Delta Historical Ecology Investigation: Exploring Pattern and Process

- Funded by Ecosystem Restoration Program (CDFG, NOAA, US FWS)
- Final Report/GIS Available: [www.sfei.org/DeltaHEStudy](http://www.sfei.org/DeltaHEStudy)
- Collaboration with KQED QUEST and Stanford's Bill Lane Center for the American West: [science.kqed.org/quest/delta-map/](http://science.kqed.org/quest/delta-map/)





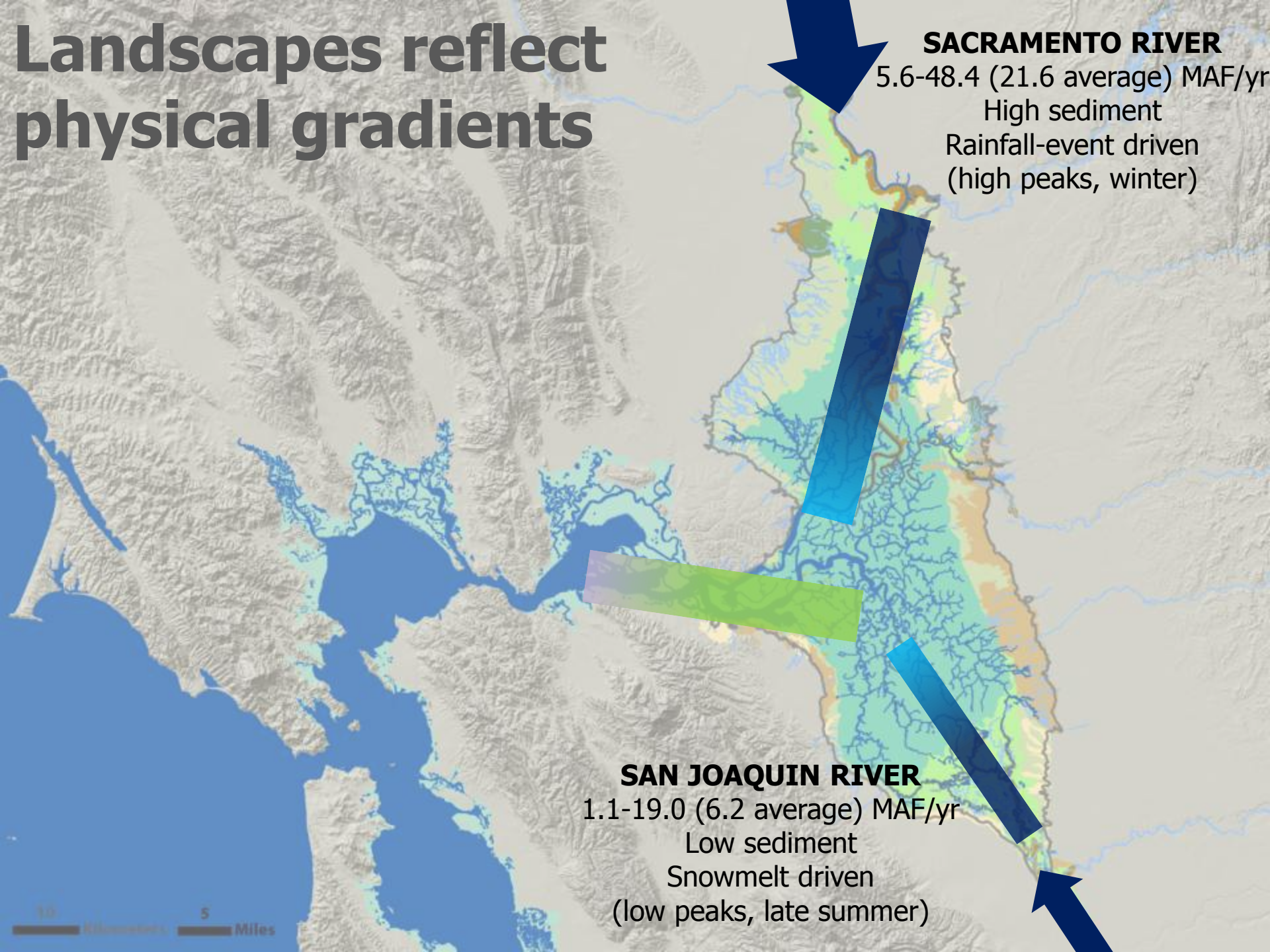
# key points

- Multiple landscapes
  - Habitat mosaics arranged in distinct patterns
  - Expressed across broad physical gradients





# Landscapes reflect physical gradients



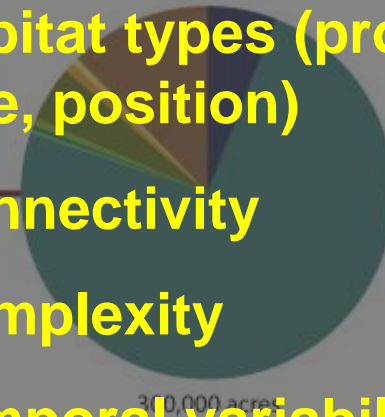
# Conceptual models of historical landscapes



North Delta: flood basins

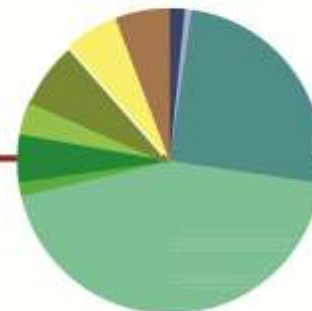
## Different characteristics

- Habitat types (proportion, size, position)
- Connectivity
- Complexity
- Temporal variability



Central Delta: tidal islands

- waterway
- pond/lake
- seasonal pond/lake
- tidal freshwater emergent wetland
- nontidal freshwater emergent wetland
- willow
- valley foothill riparian
- wet meadow/seasonal wetland
- vernal pool complex
- alkali seasonal wetland complex
- inland dune scrub
- grassland
- woodland/savanna



South Delta: distributary rivers



# Central Delta: where tides dominate



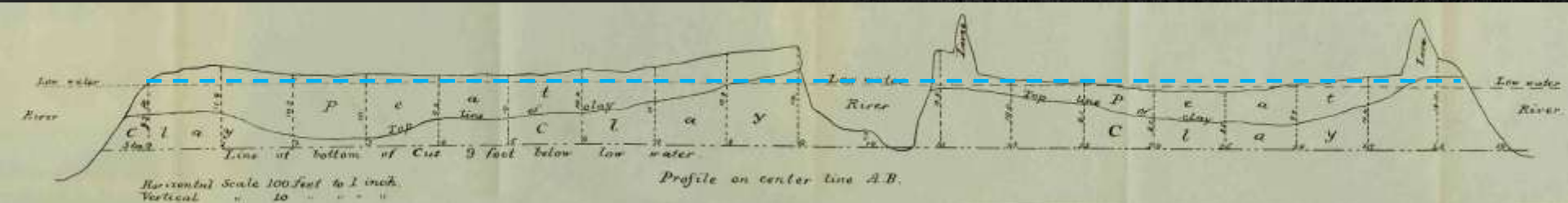


# Central Delta: where tides dominate

- Low banks
- Frequent tidal inundation
- High connectivity between land and water

*"The water reached our blankets at the turn of the tide"*

- October 1811, Abella and Cook 1960



# Central Delta: where tides dominate

- Numerous sinuous tidal channels of different sizes

*"The **number and intricacy** of the winding sloughs and channels that traverse this...low marshy land is worthy of notice."*

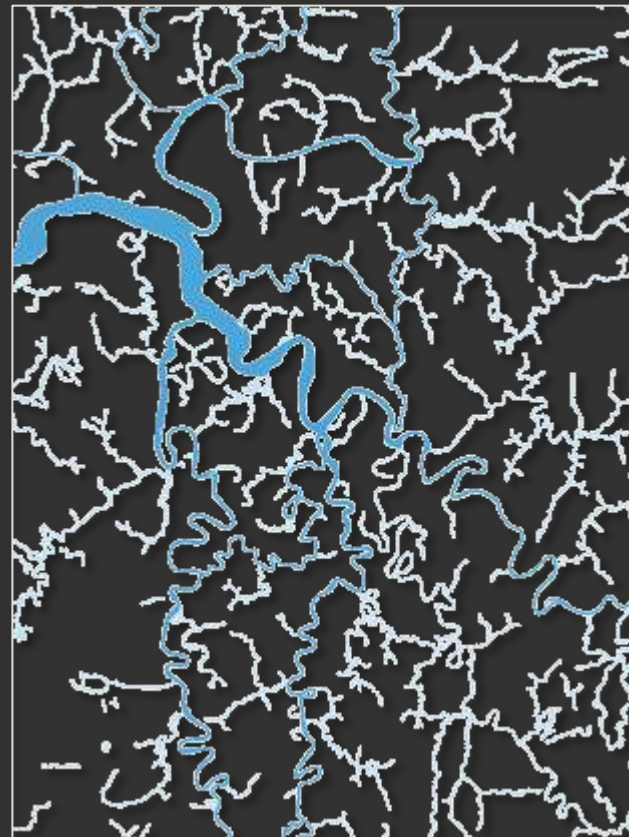
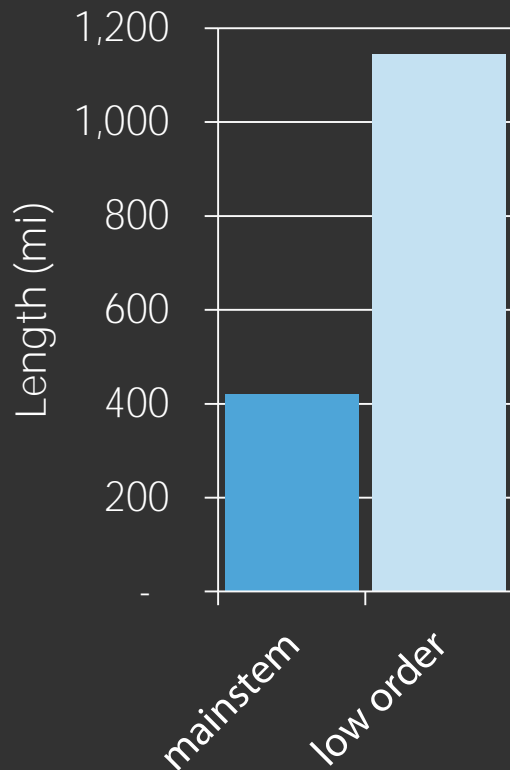
- US War Department 1853

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# Central Delta: where tides dominate

- Numerous sinuous tidal channels of different sizes
- Organized into networks branching into wetland



early 1800s



early 2000s



# Central Delta: where tides dominate

- Diverse vegetation community including willow-fern swamp

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# Central Delta: where tides dominate

- Diverse vegetation community including willow-fern swamp

*"Their edges are not so elevated, nor are they so covered with vegetation, while their interior parts the **tule** is thinner and shorter. **Willows** here grow **in bunches**."*

- USDA 1874



*Daniel Burmester*

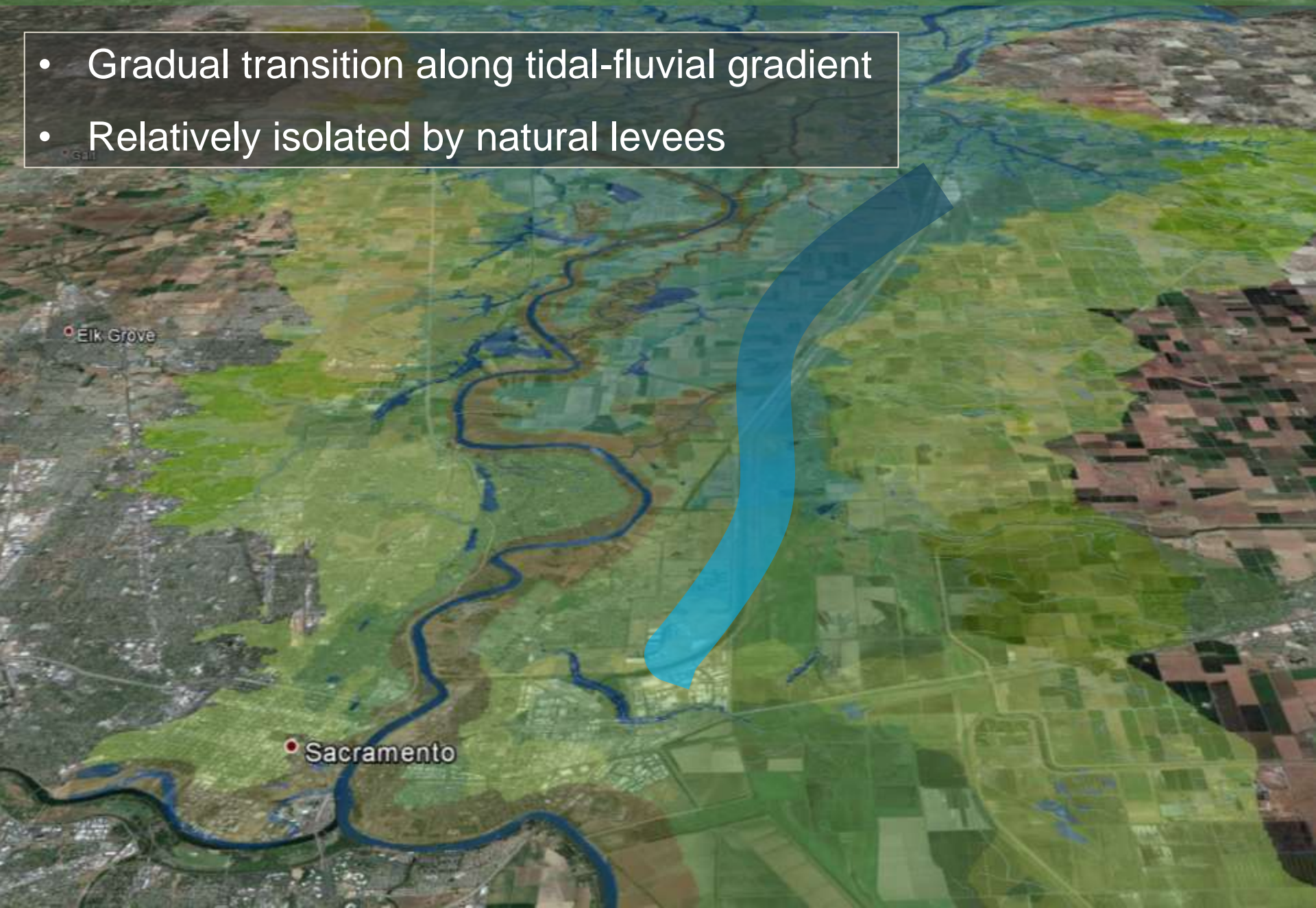
# North Delta: where flood basins flank rivers





# North Delta: where flood basins flank rivers

- Gradual transition along tidal-fluvial gradient
- Relatively isolated by natural levees



# North Delta: where flood basins flank rivers

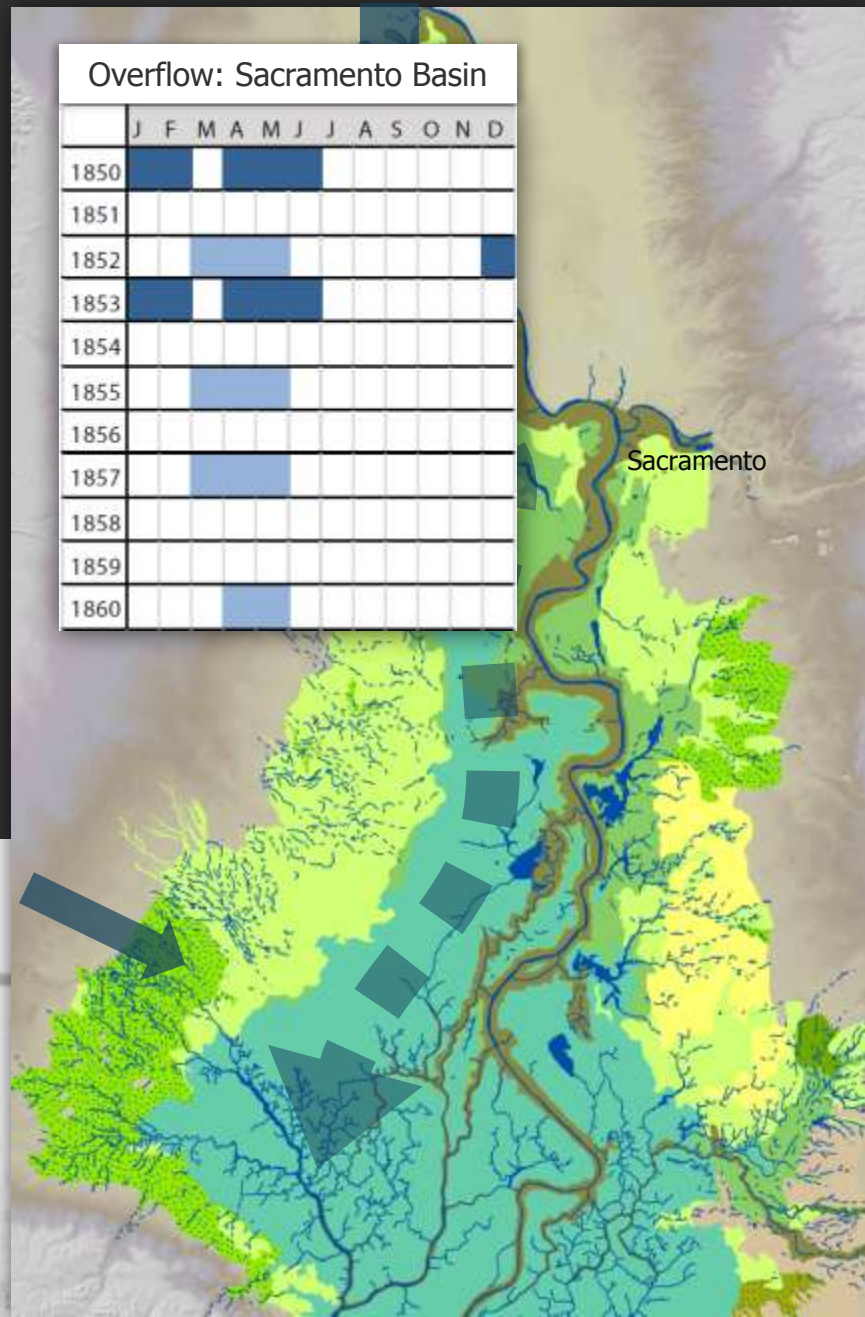
- Floods connected components
- Seasonal and inter-annual variability

*"the great basins...act as **enormous regulating reservoirs**...to cut down the crest of the great flood waves"*

- Dabney Commission 1905

Overflow: Sacramento Basin												
	J	F	M	A	M	J	J	A	S	O	N	D
1850												
1851												
1852												
1853												
1854												
1855												
1856												
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1858												
1859												
1860												

Sacramento





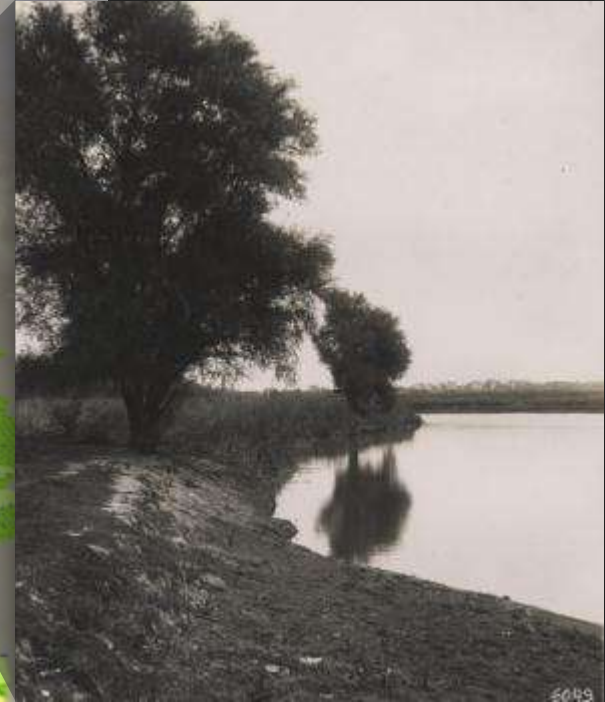
# North Delta: where flood basins flank rivers

- Different features depending on position along gradients

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*Courtesy of Solano County Surveyor*



*Courtesy of California State Library*



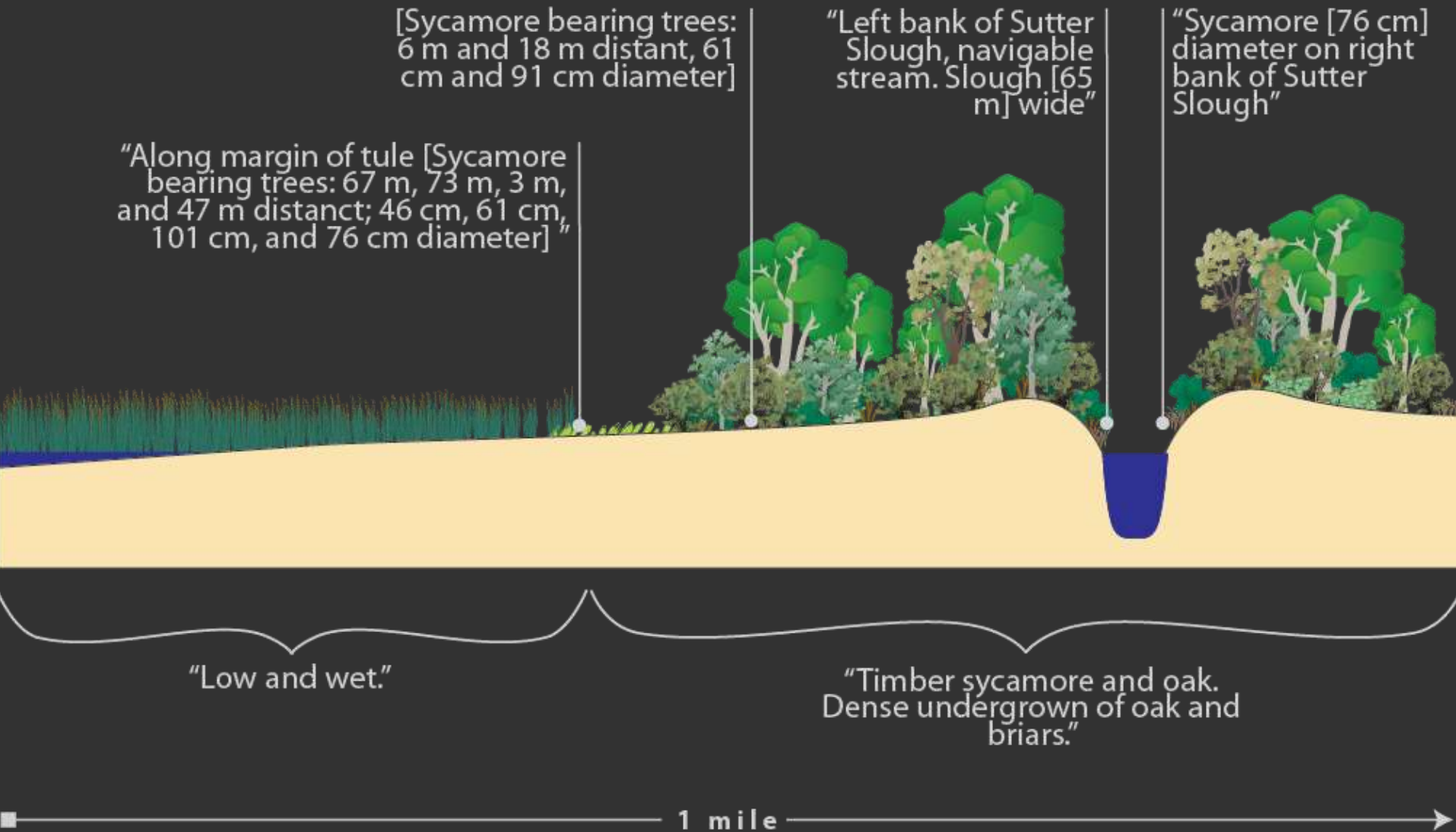
# North Delta: where flood basins flank rivers

- Dense and structurally complex riparian forest

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# North Delta: where flood basins flank rivers

- Riparian forest on natural levees bounded flood basins



William J. Lewis, November 1859

# South Delta: where floodplains meet tides



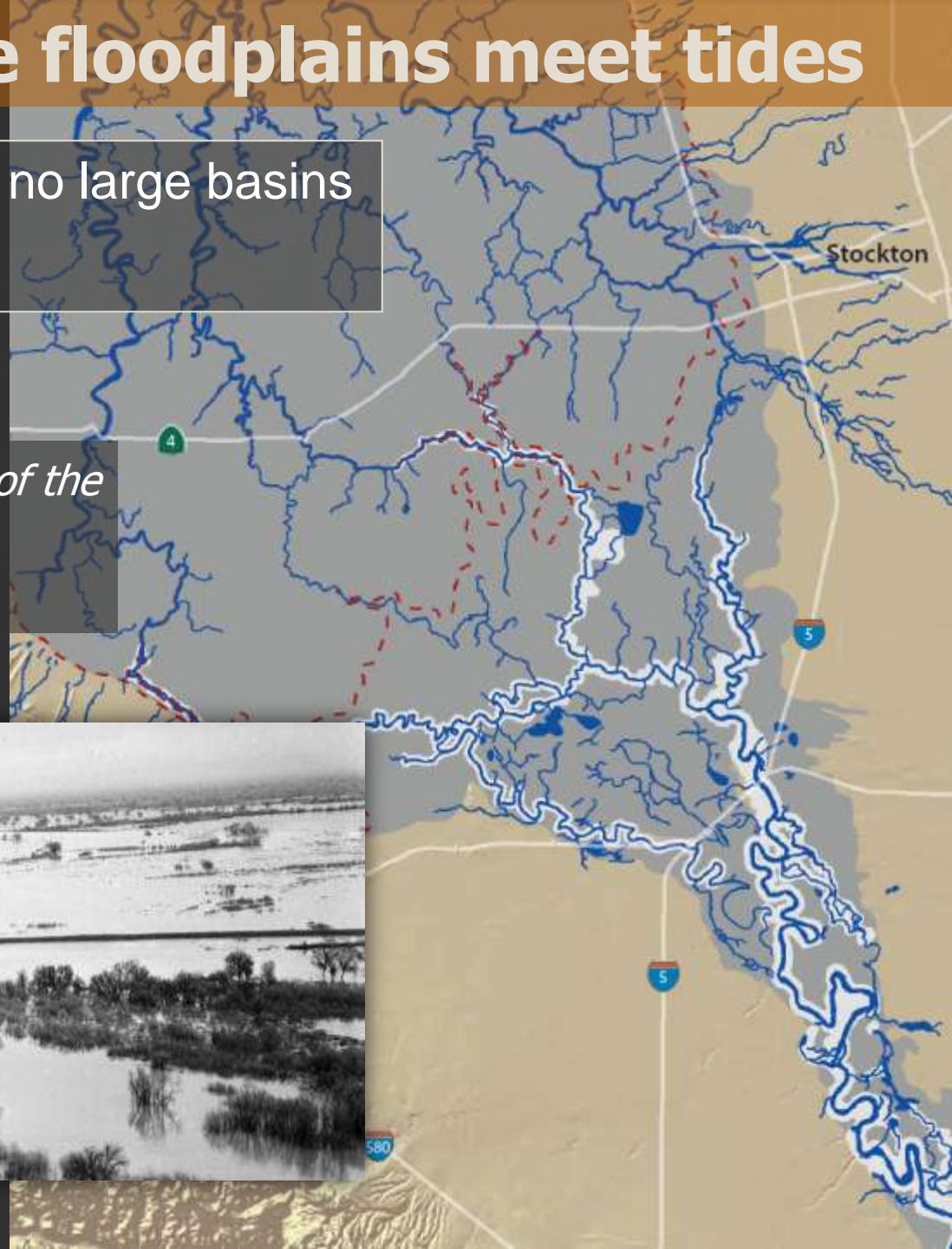


# South Delta: where floodplains meet tides

- Broadening floodplain with no large basins
- Wet late into summer

*"Inundated during the high water of the rivers, which is in the summer."*

- Viader 1810



Courtesy of The Bank of Stockton

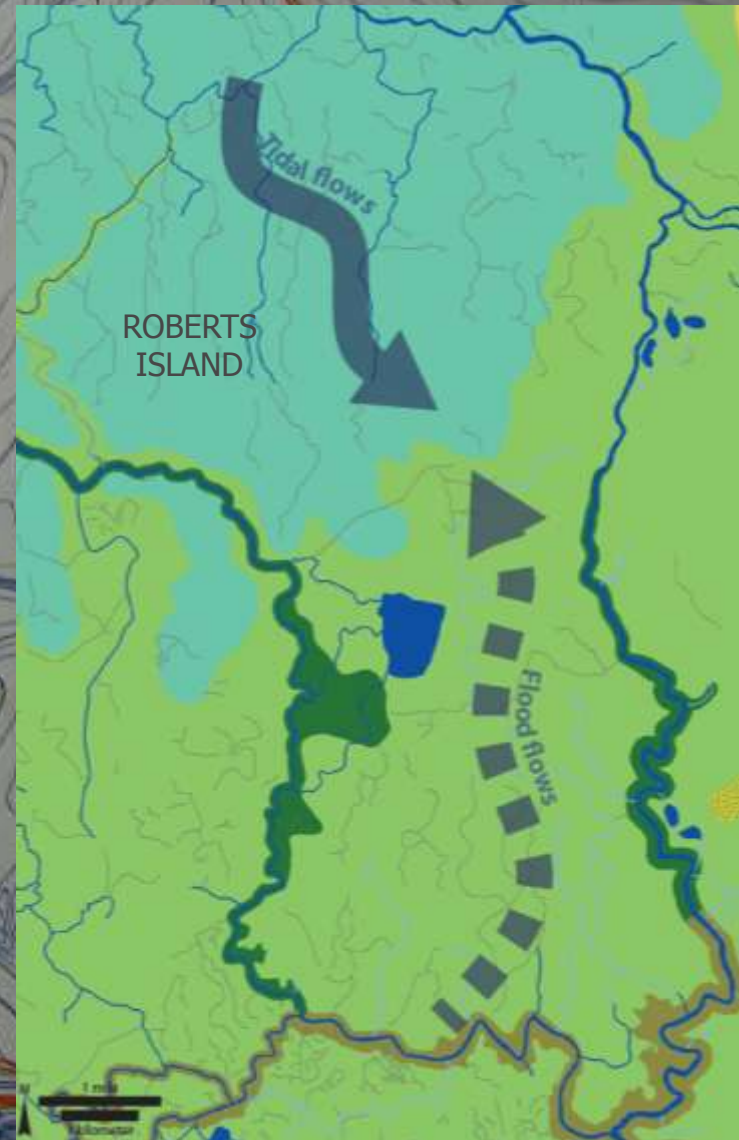


# South Delta: where floodplains meet tides

- Complex flows across topographically variable landscape

*"These discharge into **small lakes or spread out** in the tule, and are **drained off by the slues**"*

- Gibbs 1850

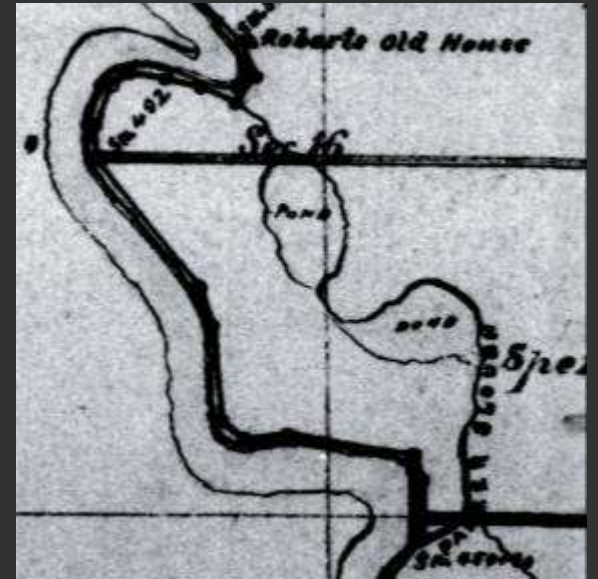
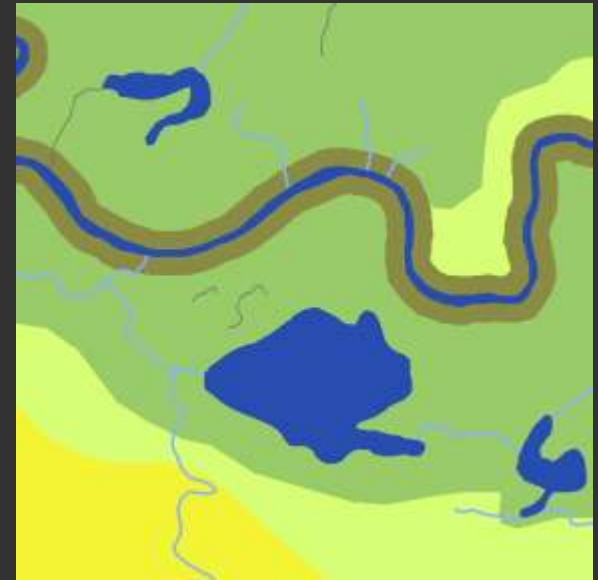


# South Delta: where floodplains meet tides

- Lakes and ponds connected to rivers

*"Along the edge of the lowland...a **string of lakes connected by sloughs** extend throughout the greater part of the area."*

- Sweet et al. 1908





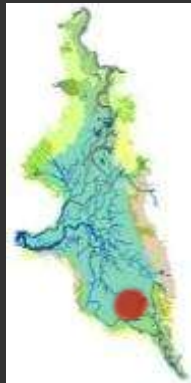
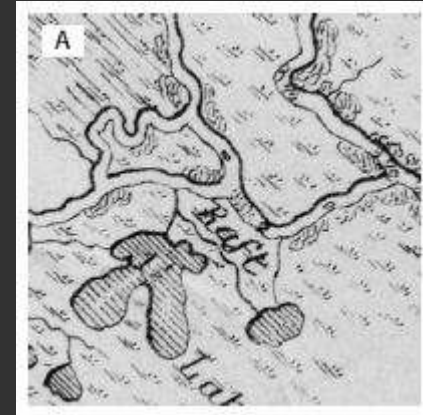
# South Delta: where floodplains meet tides

- Channel complexity

Salmon Slough: "The stream bed is **full of logs** and the boats grounded two or three times." (Abella 1811)

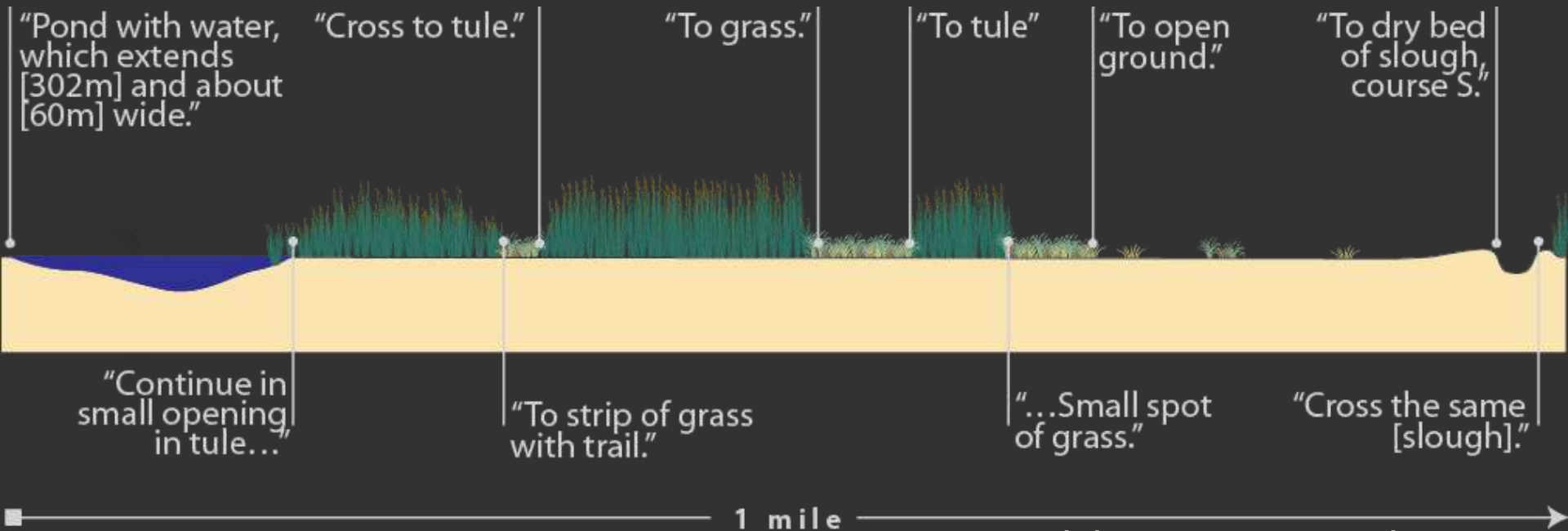
"I came to a **raft of large timber**, and after some hard work in cutting and sawing logs, we succeeded in dragging our boat through." (Gibbes 1850)

"...great many **old logs and an immense amount of driftwood** and rubbish in Old River" (Tucker Field Notes 1879)



# South Delta: where floodplains meet tides

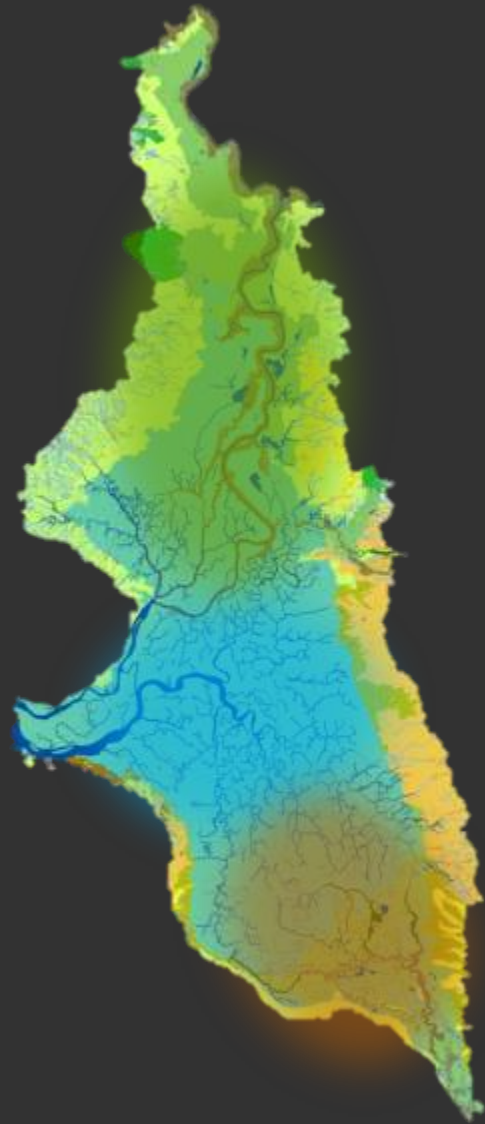
- Diverse suite of habitat types at local-scale



Ralph W. Norris, October 1851



# summary



- Floods wetted and connected landscape
- Different features along gradients
- Dense riparian forest bordering tule basins



- High degree of tidal influence
- Networks of branching channels
- Tidal wetland of tule and willow-fern swamp



- Floods interacted with complex landscape to meet the tides
- Side-channel systems connected to rivers
- Habitat type diversity at local scale





*"Restore **large areas of interconnected habitats** within the Delta and its watershed by 2100"*

- Water Code section 85302

*"Restoration of the health of the Delta's ecological systems by addressing **ecological functions and processes at a broad landscape scale**"*

- Bay Delta Conservation Plan draft

*"Management plans and decisions need to be informed by a **landscape perspective** that recognized interrelationships among patterns of land and water use, patch size, location and connectivity, and species success."*

- Delta Plan draft

# parting thoughts

- Large and interconnected habitats may mean different things for different places.
- Manage and plan with current and future expected physical gradients in mind.
- Think at the large scale and in the long term.
- The future will be different from both the present and the past, but emphasizing certain patterns and processes over others may yield a healthier ecosystem.

# thanks to

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## **CONTRIBUTORS:**

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# THANK YOU

[www.sfei.org/DeltaHEStudy](http://www.sfei.org/DeltaHEStudy)

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