Habitat Characteristics of Past Delta Landscapes:

Knowledge for Improving Future Ecosystem Resilience

Alison Whipple
San Francisco Estuary Institute/Aquatic Science Center

2011 Annual IEP Workshop
March 30, 2011

Historical Ecology

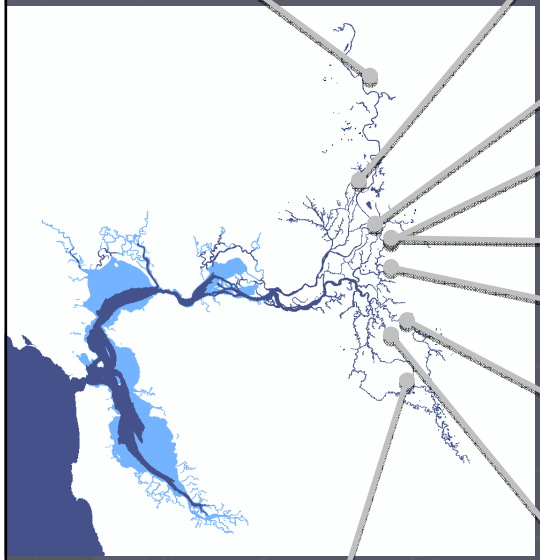
synthesizing historical data into useful information

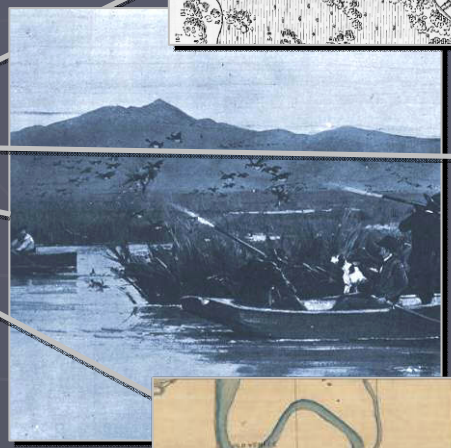
- Improves understanding of relationships between physical processes, habitat, and ecological function
- Describes the conditions within which species evolved
- Challenges assumptions
- Provides information about landscape change
- Helps identify opportunities within the contemporary landscape

***NOT** a template from which to re-create the past*

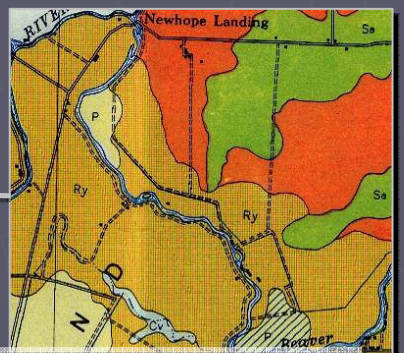
"The lake was situated far out in an impenetrable tule swamp of immense extent...it was a sort of "sanctuary" to which birds came..."

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





ITEMS REMOVED DUE TO COPYRIGHT STATUS



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

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

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

1800

1850

1900

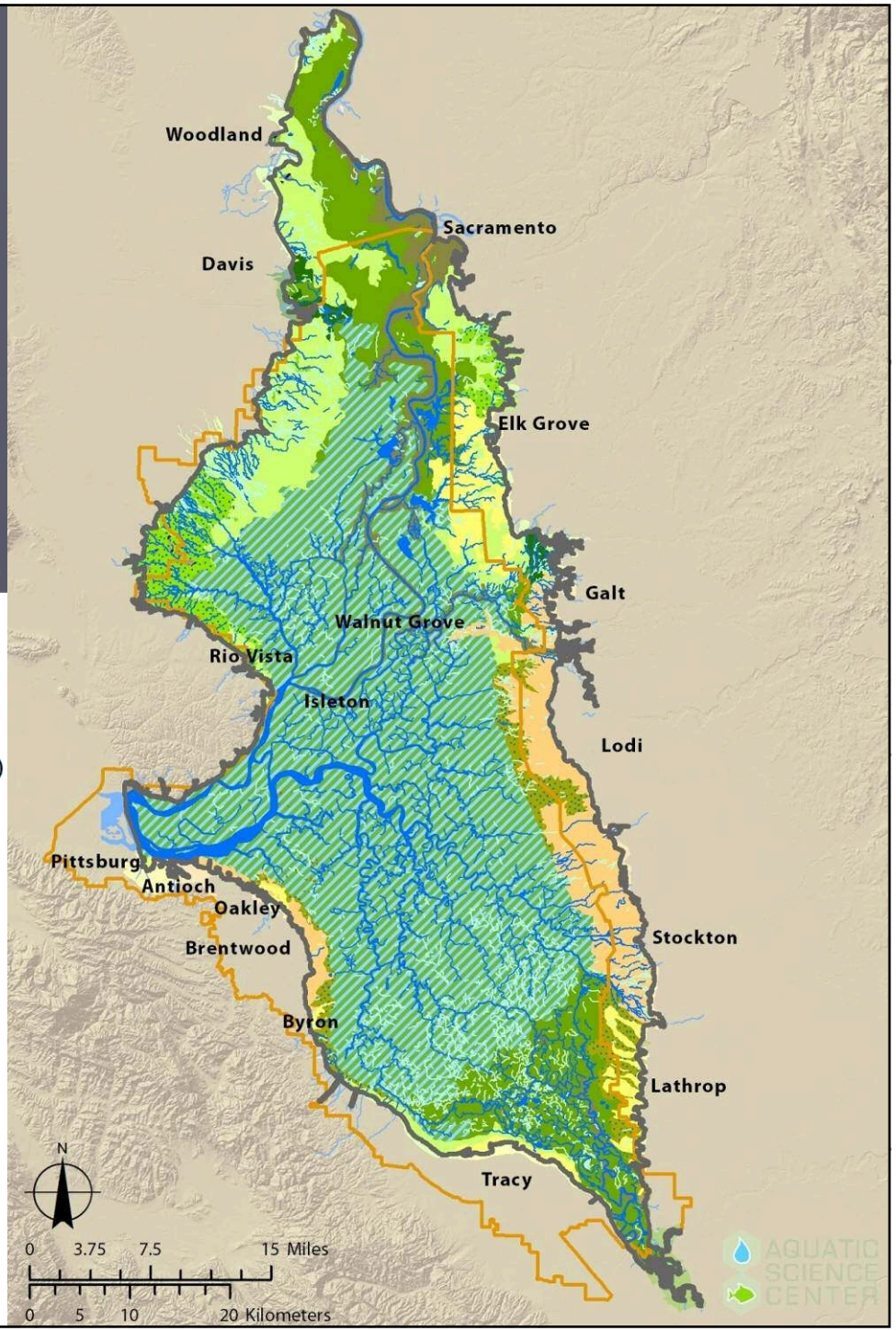
1950

2000

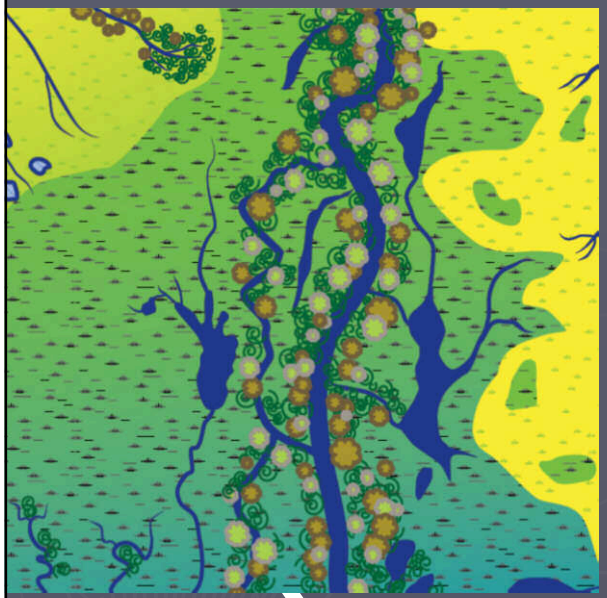
STUDY AREA

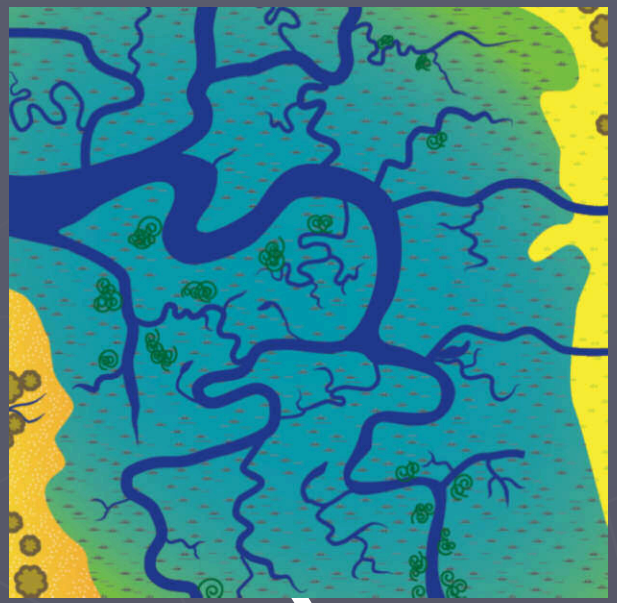
Historical Habitat Map (DRAFT)

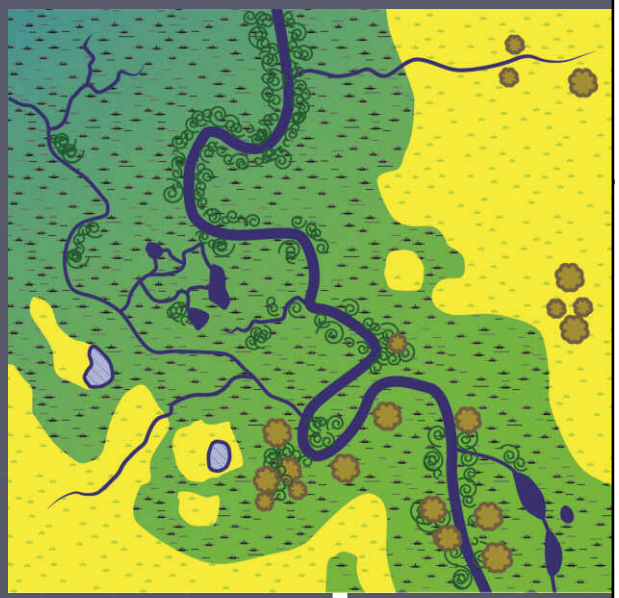
Historical Ecology Study Area
Legal Delta
Delta historical channels
1850s channel
Uncertain (in presence or fluvial-tidal status)
Delta historical habitats
intermittent pond/lake
pond/lake/channel
tidal brackish emergent wetland
nontidal freshwater emergent wetland
willow swamp
willow riparian scrub/shrub
valley foothill riparian
wet meadow/seasonal wetland
vernal pool complex
alkali seasonal wetland complex
grassland
inland dune scrub
woodland/savanna



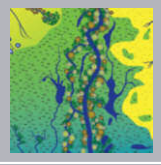
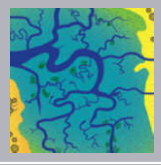
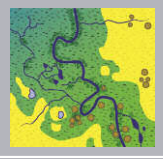
Delta Landscapes





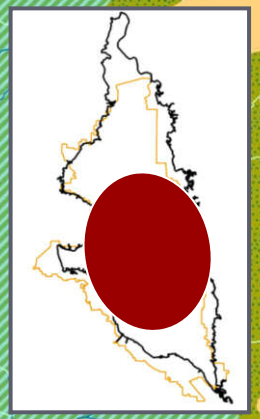


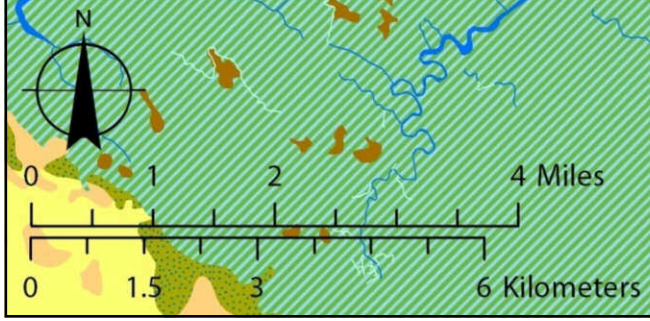
SELECTED LANDSCAPE CHARACTERISTICS

	Flood Basins 	Tidal Islands 	Distributary Rivers 
Relative tidal influence	limited by natural levees and flood basin formation	inundated at least by spring tides	limited by channel complexity and topography
Relative fluvial influence	high	muted by tides	high
Channel plan form	dendritic with density dependent on proximity to tidal source	large, sinuous, patterns repeating at island scales	greatly affected by fluvial processes
Ponds and lakes	large in size, located in flood basins away from tidal and sediment sources	small, apparently uncommon	moderate in size, located in floodplains, created by riverine dynamics
Natural levees	high, stable	low to none	moderate, more dynamic
Riparian vegetation	dense with oaks, sycamores, ash, walnut, vines, rose, and other brush	tule and some willow and other brush	moderately dense with oaks and willow

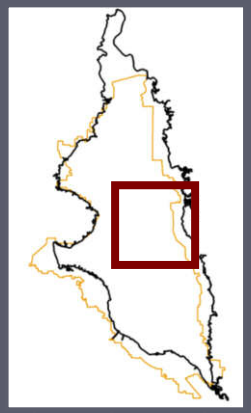
TIDAL ISLANDS: CHANNELS

- Mapped: 23,000 acres out of ~300,000 acres
- ~900 miles of tidal channel
- Densities generally between 20 and 40 ft/ac
- Sinuosity: 1.25 – 4.5





TIDAL ISLANDS: CHANNELS



Spring tide: 3.5 ft

Tide: 1 in

Tide: 3.5 ft

ITEM REMOVED DUE TO COPYRIGHT STATUS

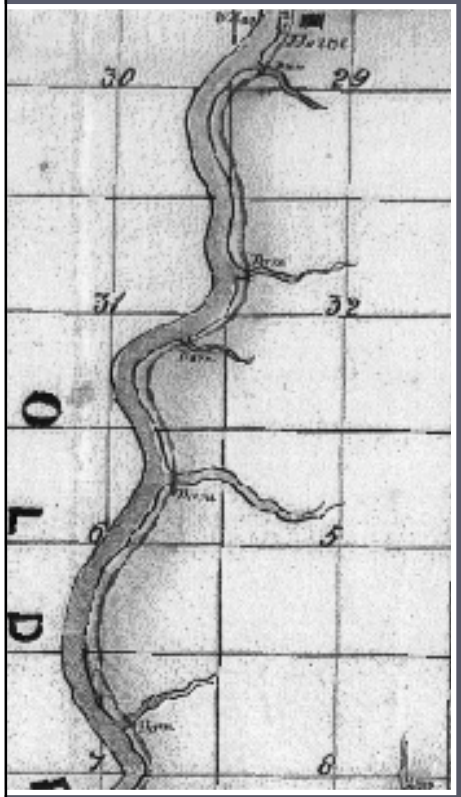
Tide: 4 - 5.5 ft

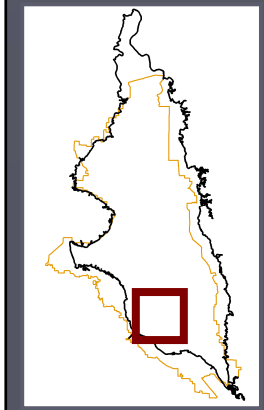
The ordinary tides wet the lands when not leveed, but **do not overflow them except at the spring tides**…" (Day 1869)

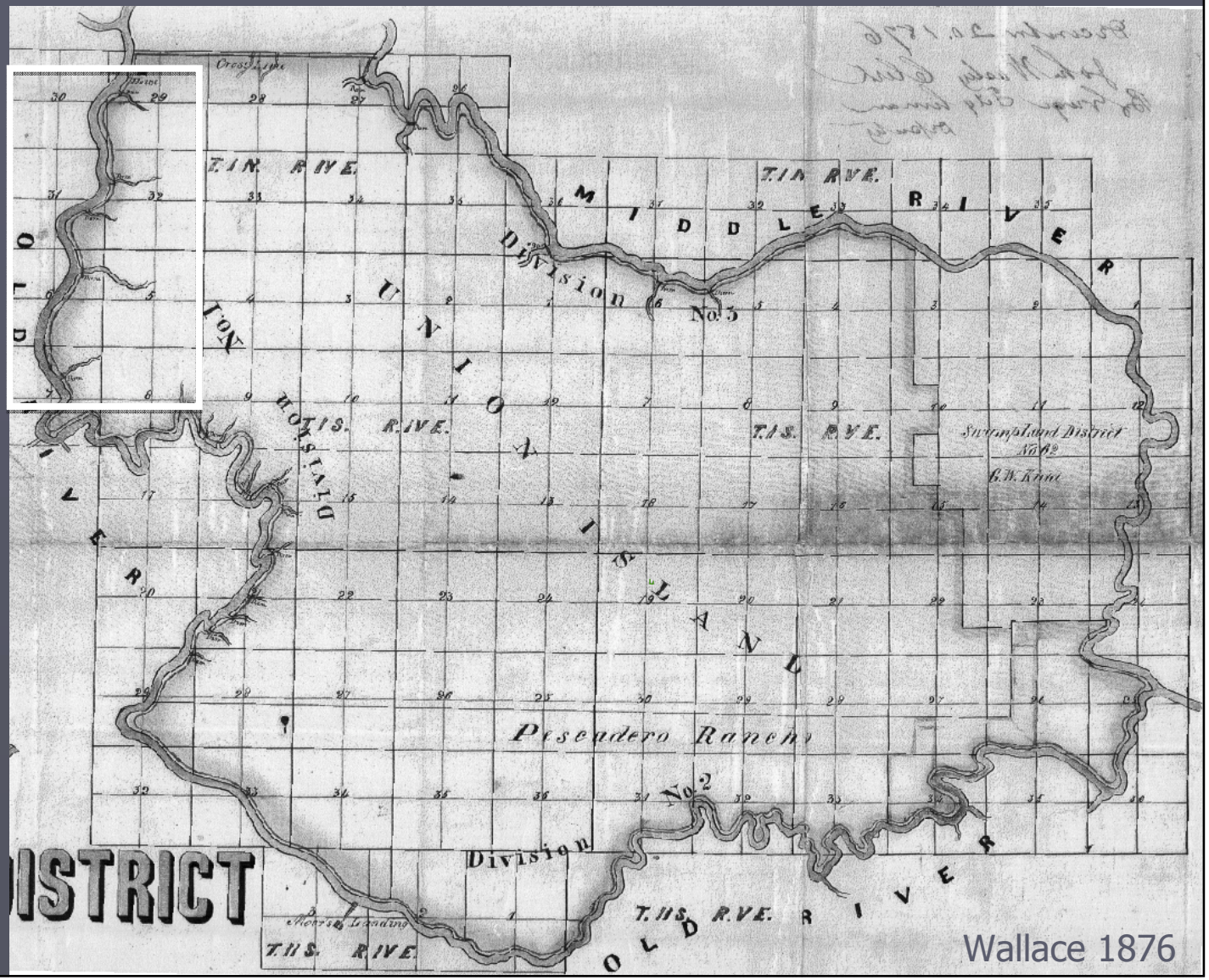
Sherman 1859

TIDAL ISLANDS: CHANNELS

How many sloughs and where?







Wallace 1876

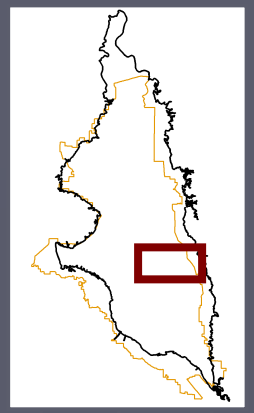
TIDAL ISLANDS: CHANNELS

Bouldin Island:

"In making the circumference of the island the line crosses **3 Beaver cuts and 3 sloughs**. The Beaver cuts being from 4 to 7 feet deep and the sloughs from 10 to 20 feet...The sloughs keep their width and depth for some distance inland and the surface being low at their heads..."
(Beaumont 1861)

TIDAL ISLANDS: CHANNELS

How wide were the sloughs?

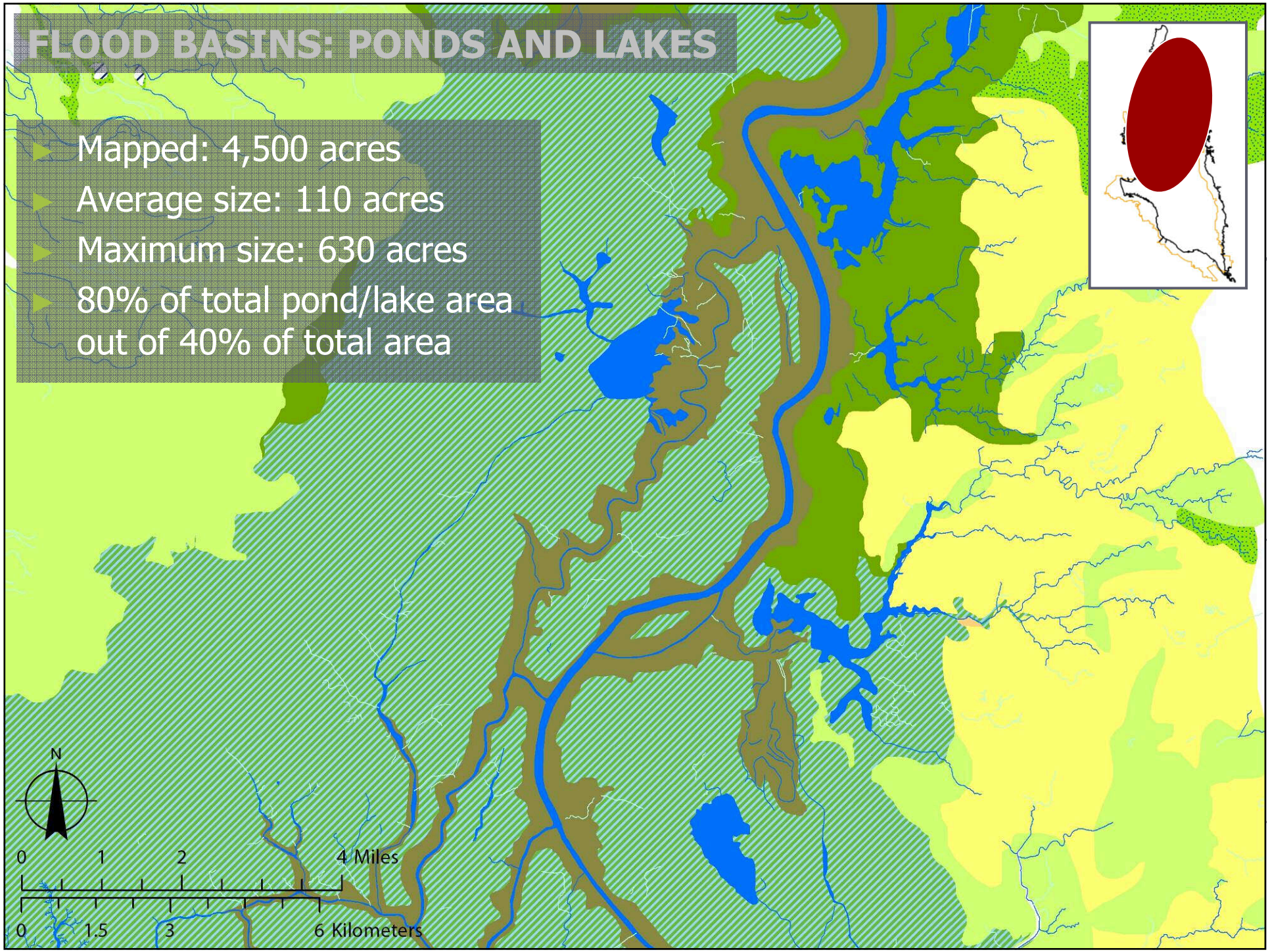


General Land Office Survey

W. F. Benson 1878

FLOOD BASINS: PONDS AND LAKES

- Mapped: 4,500 acres
- Average size: 110 acres
- Maximum size: 630 acres
- 80% of total pond/lake area out of 40% of total area



FLOOD BASINS: PONDS AND LAKES

"Though the lake was a large one it was very shallow - **could be waded in all parts**, except a small streak in the middle..." (Wright ca. 1850)

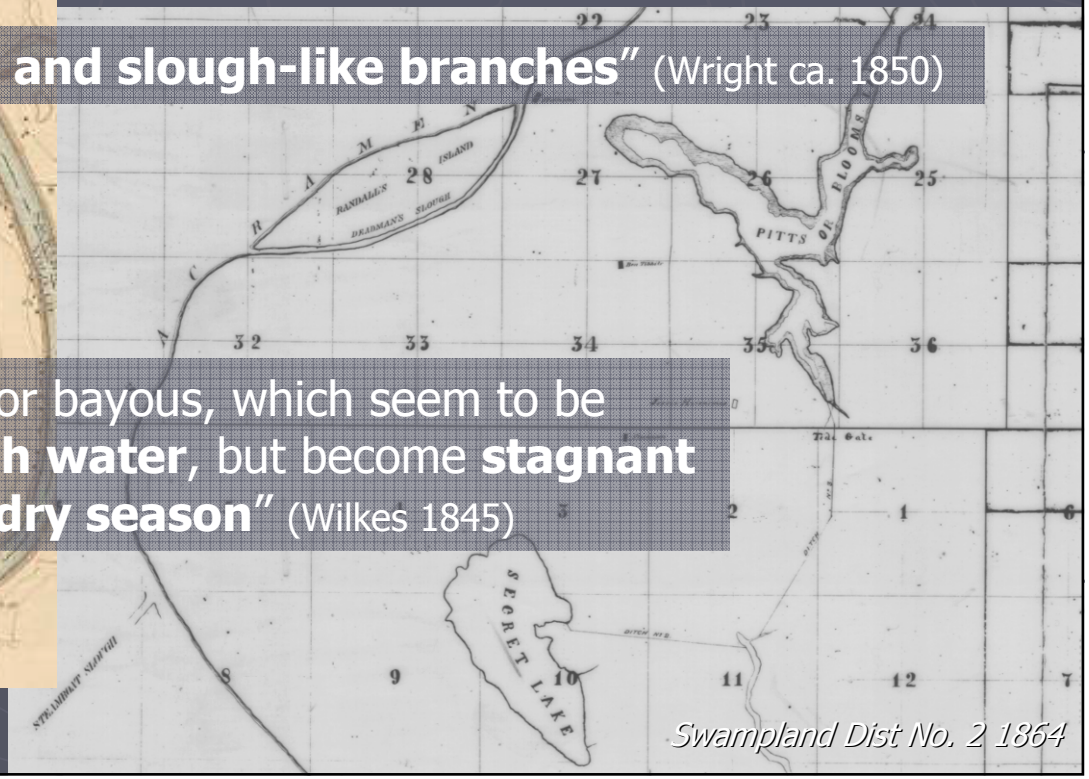
ITEM REMOVED DUE TO COPYRIGHT STATUS

~500 acres

"many **coves and slough-like branches**" (Wright ca. 1850)

"small lakes or bayous, which seem to be **filled at high water**, but become **stagnant during the dry season**" (Wilkes 1845)

USGS 1906-1916



Swampland Dist No. 2 1864

FLOOD BASINS: PONDS AND LAKES

"edge of the lake for a distance of one hundred yards out thickly covered with **lily pads.**" (Wright ca. 1850)

ITEM REMOVED DUE TO COPYRIGHT STATUS

Tule marsh water was "so thoroughly impregnated with decaying vegetable matter that **it looked more like sherry than water**…In order to see the strange creatures in the water no microscope was required; they were visible to the naked eye…In lying down to drink from the edge of a pool we had before us for study **a whole universe of animalcules.**" (Wright ca. 1850)

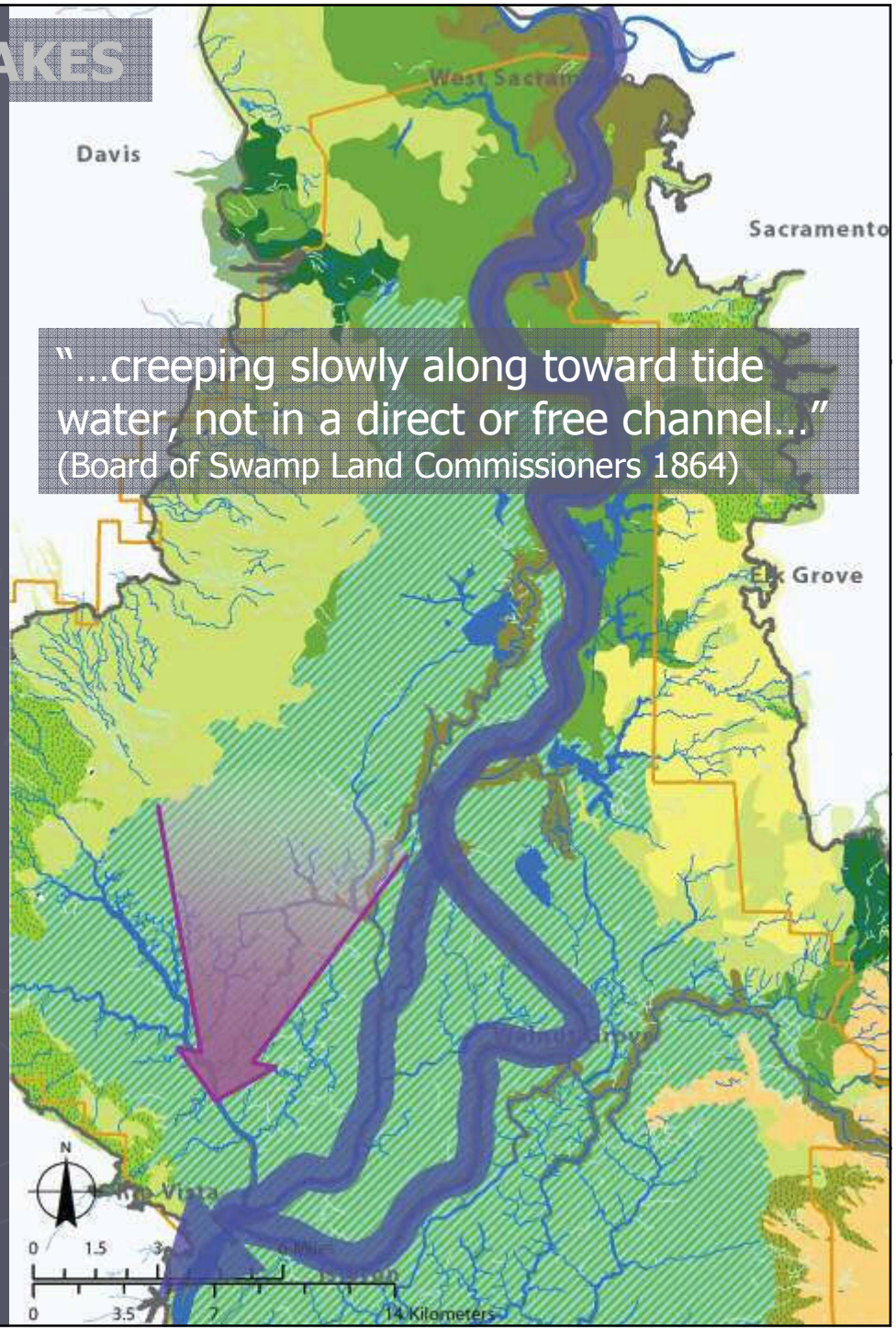
USGS 1907, Courtesy Center for Sacramento History

FLOOD BASINS: PONDS AND LAKES

Character of hydrologic connectivity

In-stream flows: inorganic sediment, short residence time

Tidal marsh discharge: organic material, zooplankton, longer residence time, capacity for nutrient exchange, warmer termperatures



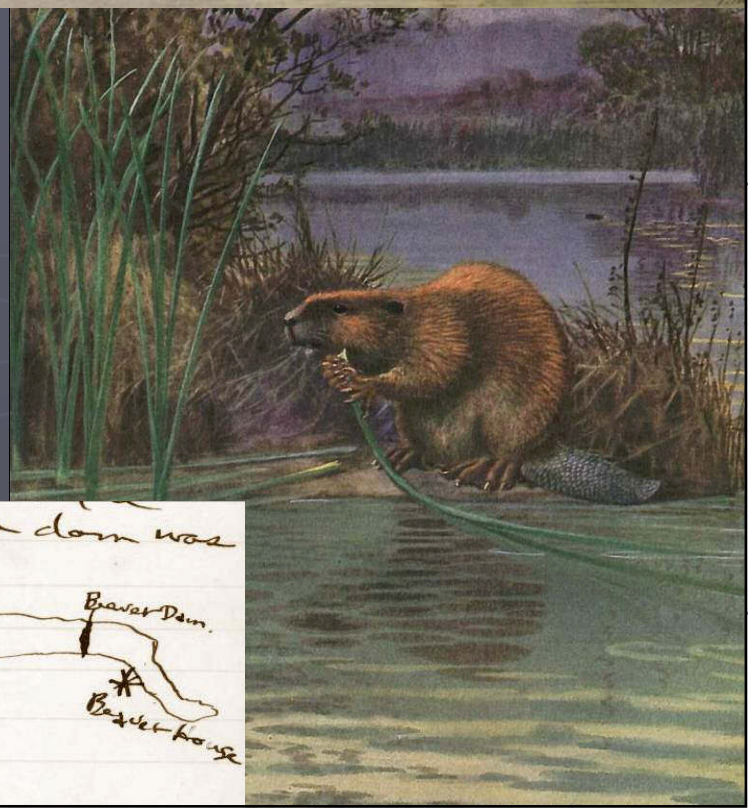
"…creeping slowly along toward tide water, not in a direct or free channel…"
(Board of Swamp Land Commissioners 1864)

FLOOD BASINS: PONDS AND LAKES

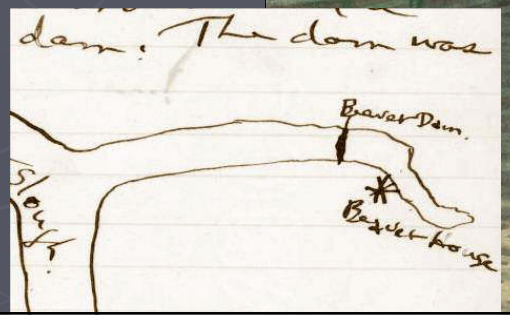
They were used:

"…into the tule to open spaces which were covered with water **where ducks and geese would light**." (Thornton 1859)

"The **small fish run into the sloughs and lakes** as soon as the water gets sufficiently high, and **return to the river when it begins to get low**." (Sacramento Daily Union, 6 June 1854)

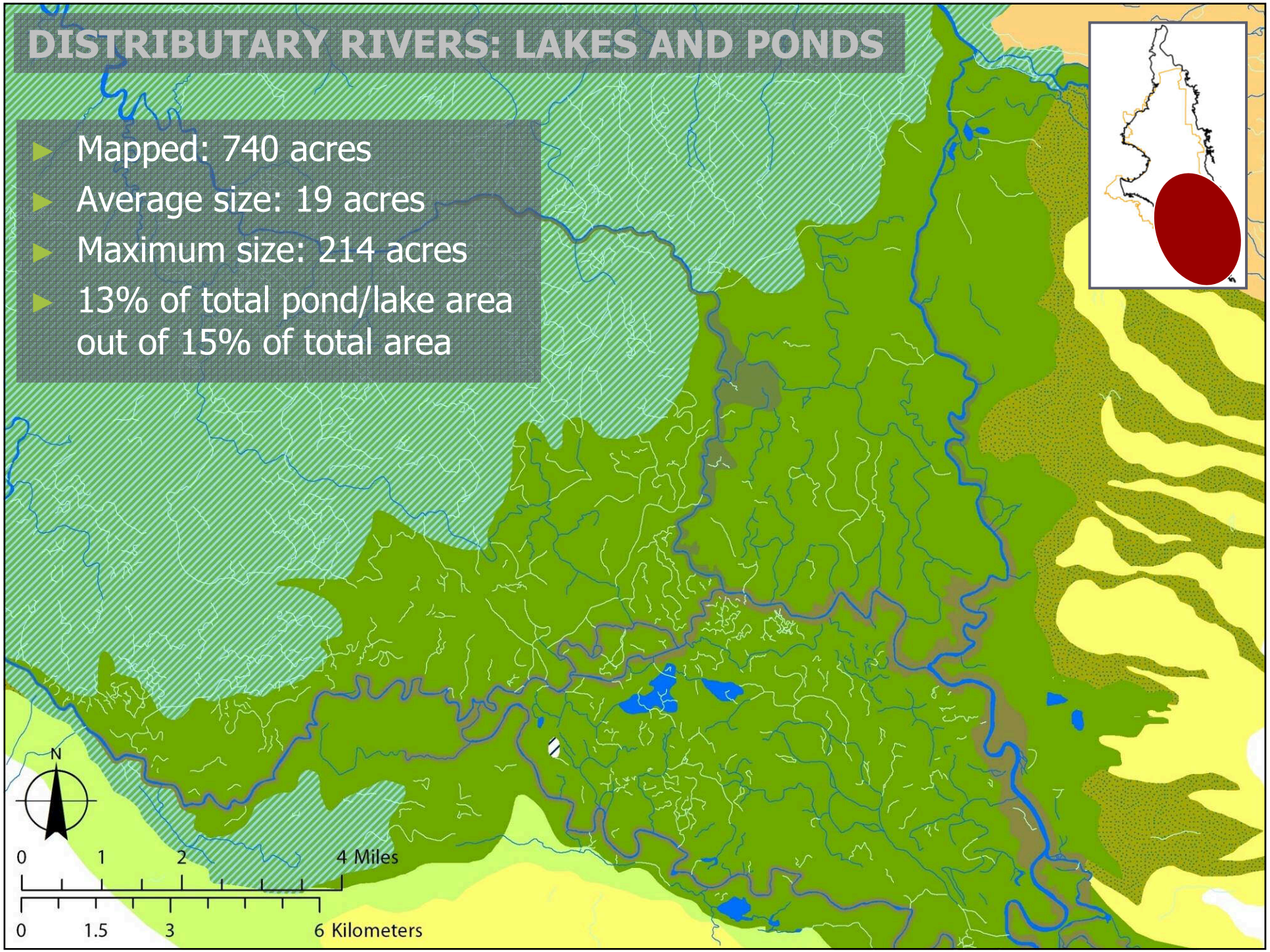


"**subterranean excavations of the beaver** always gave us a perpendicular drop of about two feet " (Wright ca. 1850)



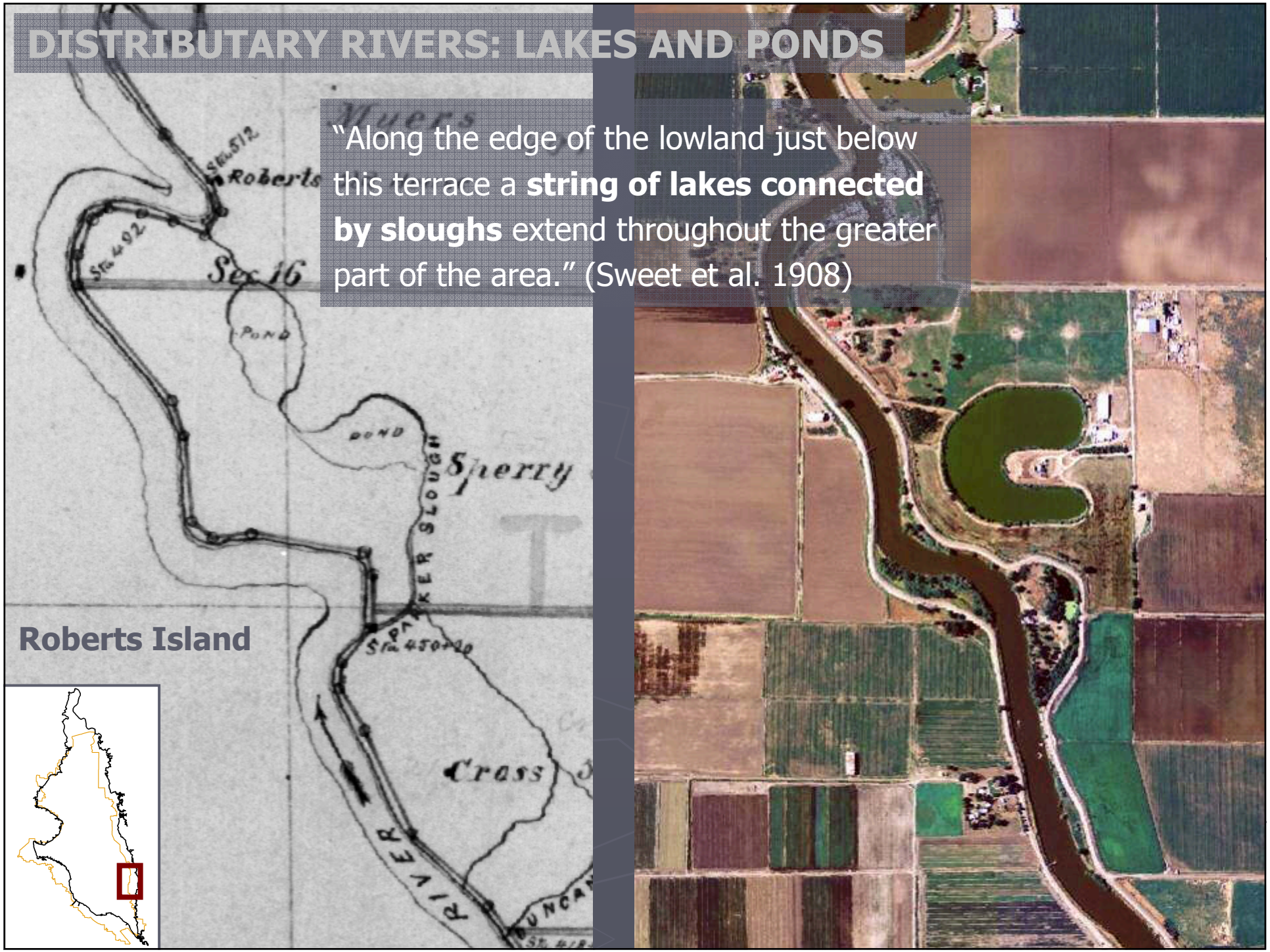
DISTRIBUTARY RIVERS: LAKES AND PONDS

- Mapped: 740 acres
- Average size: 19 acres
- Maximum size: 214 acres
- 13% of total pond/lake area out of 15% of total area

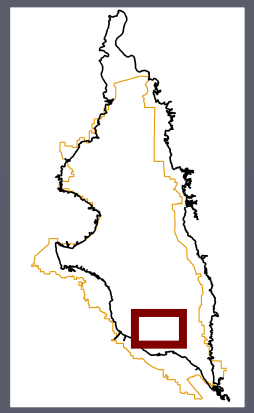


DISTRIBUTARY RIVERS: LAKES AND PONDS

"Along the edge of the lowland just below this terrace a **string of lakes connected by sloughs** extend throughout the greater part of the area." (Sweet et al. 1908)



DISTRIBUTARY RIVERS: LAKES AND PONDS



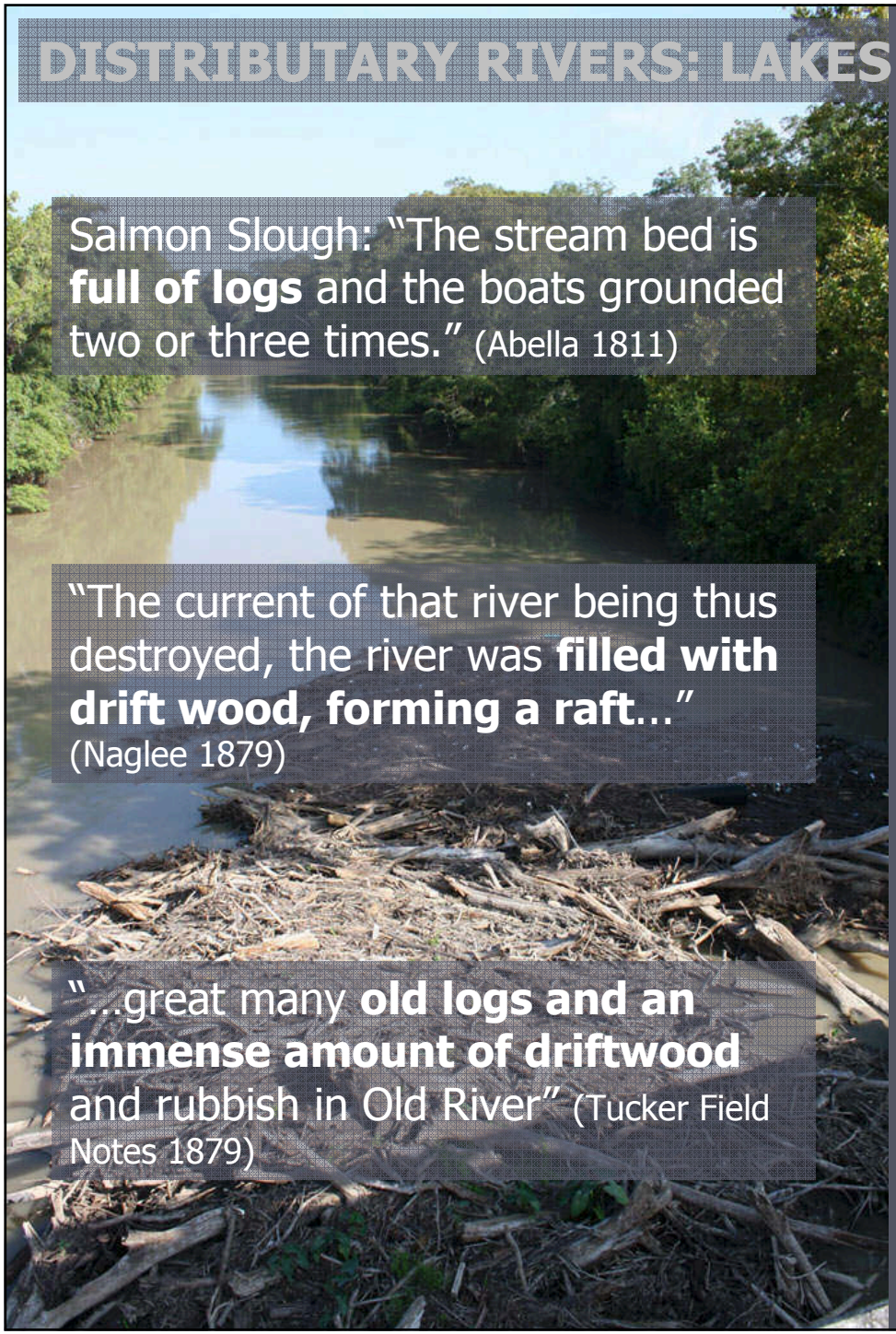
ITEM REMOVED DUE TO COPYRIGHT STATUS

Depth: 1 ½ fathoms = 9 ft

Area: 150-200 acres

Gibbes 1850

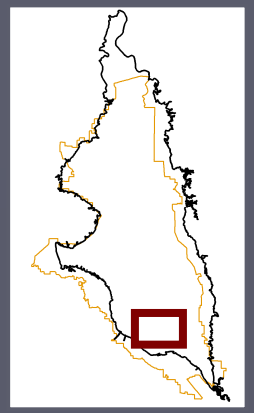
DISTRIBUTARY RIVERS: LAKES AND PONDS



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

"The current of that river being thus destroyed, the river was **filled with drift wood, forming a raft**…" (Naglee 1879)

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



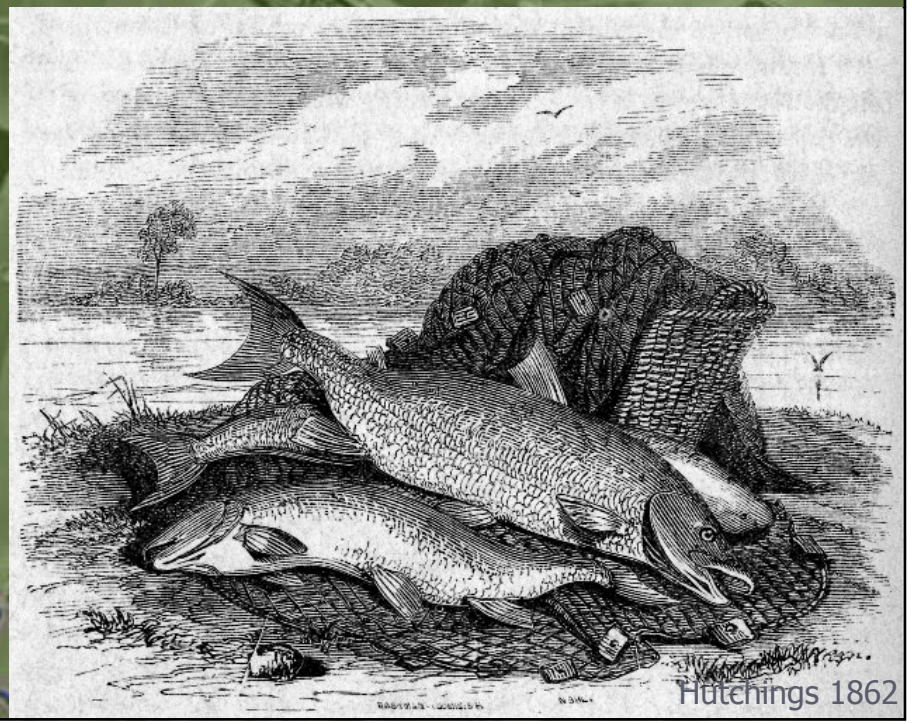
ITEM REMOVED DUE TO COPYRIGHT STATUS

DISTRIBUTARY RIVERS: LAKES AND PONDS

"Río del Pescadero [Old River]…**fishing is done in it for salmon**."
(Cook 1960, "Report of Hermenegildo Sal," January 31, 1796)

"…it was **salmon, tenderer, fatter, and more savory**…for perhaps because there is so much fresh water here it grows larger, fatter, and better flavored."
(Bolton [ed] 1927, "Anza's California Expeditions" 1776)

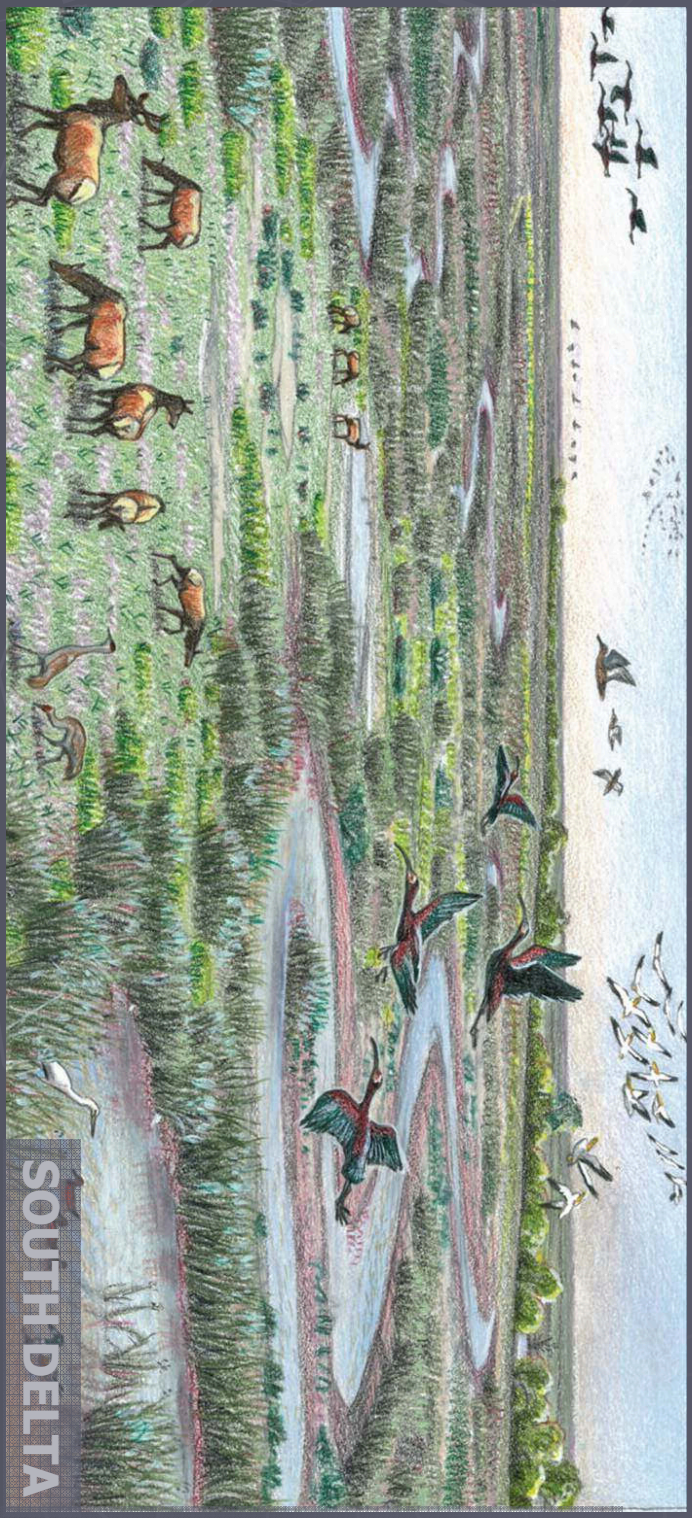
"…we rested here [El Pescadero] and passed the time well with **fresh salmon** and wild grapes" (Cook 1960, "Father Vaider's Second Trip," October 29, 1810)

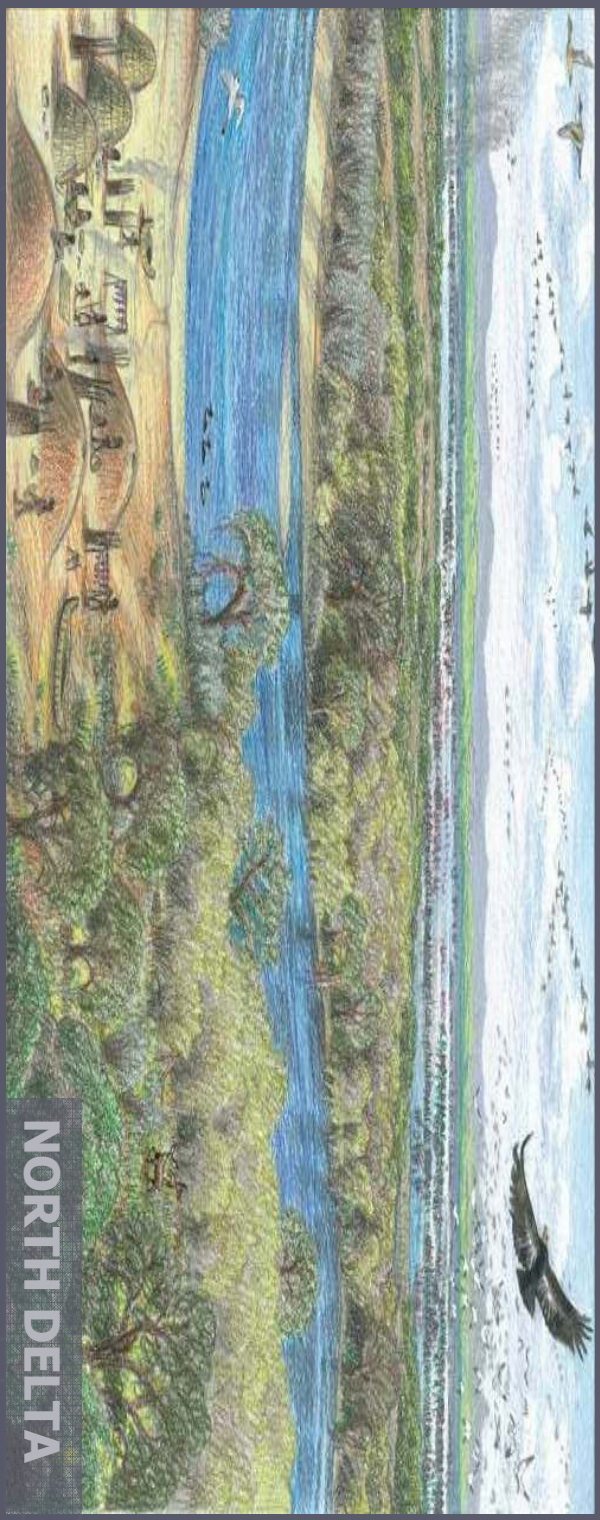


Hutchings 1862

BENEFITS TO DELTA RESTORATION AND MANAGEMENT

- Improves understanding of the relationship between habitats and physical process
- Provides knowledge of the evolutionary template for species of concern and overall biological productivity
- Contributes to efforts to establish design principles and target metrics and recalibrates expectations
- Is useful to the process of establishing a unified vision for the future Delta
- Identifies opportunities (and constraints) within the contemporary landscape
- Helps individual restoration projects link into functional landscape units





Cunningham 2010 *Bay Nature*

THANKS TO

FUNDING:

California Department of Fish and Game

RESEARCHERS:

SFEI/ASC: Ruth Askevold, Erin Beller, Josh Collins, Robin Grossinger, Micha Salomon, Bronwen Stanford, Chuck Striplen

DFG team: Carie Battistone, Daniel Burmester, Gena Glasko, Bronwyn Hogan, Amy Lyons, Daniel Rankin, Ciprian Simon, Carl Wilcox, Dave Zezulak

THANK YOU

ITEM REMOVED DUE TO COPYRIGHT STATUS

www.sfei.org/HEP
alison@sfei.org