HISTORICAL ECOLOGY OF THE DELTA

Habitat characteristics of a fluvial-tidal landscape

Alison Whipple
San Francisco Estuary Institute/Aquatic Science Center

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“... the first step in a river restoration program should be to develop a solid understanding of what the targeted rivers were actually like before the changes that restorationists seek to undo or mitigate.”

Montgomery 2008 (*Science 319*: 292)

TRANSLATING LANDSCAPE TO SPECIES SUPPORT FUNCTION

Physical Drivers

FLUVIAL PROCESSES

TIDAL PROCESSES

Habitats

Channels

Marshland

Ponds and lakes

Floodplain basins

Riparian forest

Upland ecotone

Function

Resting

Foraging

Breeding

Migration

1800

Archaeology Reports, Tribal Representatives

Explorer Journals

1850

Travelogues/Memoirs

Diseños, Mexican Land Grant testimony

1900

Maps/Surveys

Landscape photos and paintings

1950

Aerial photography

Interviews with long-time residents

2000

Scholarly & professional reports & records

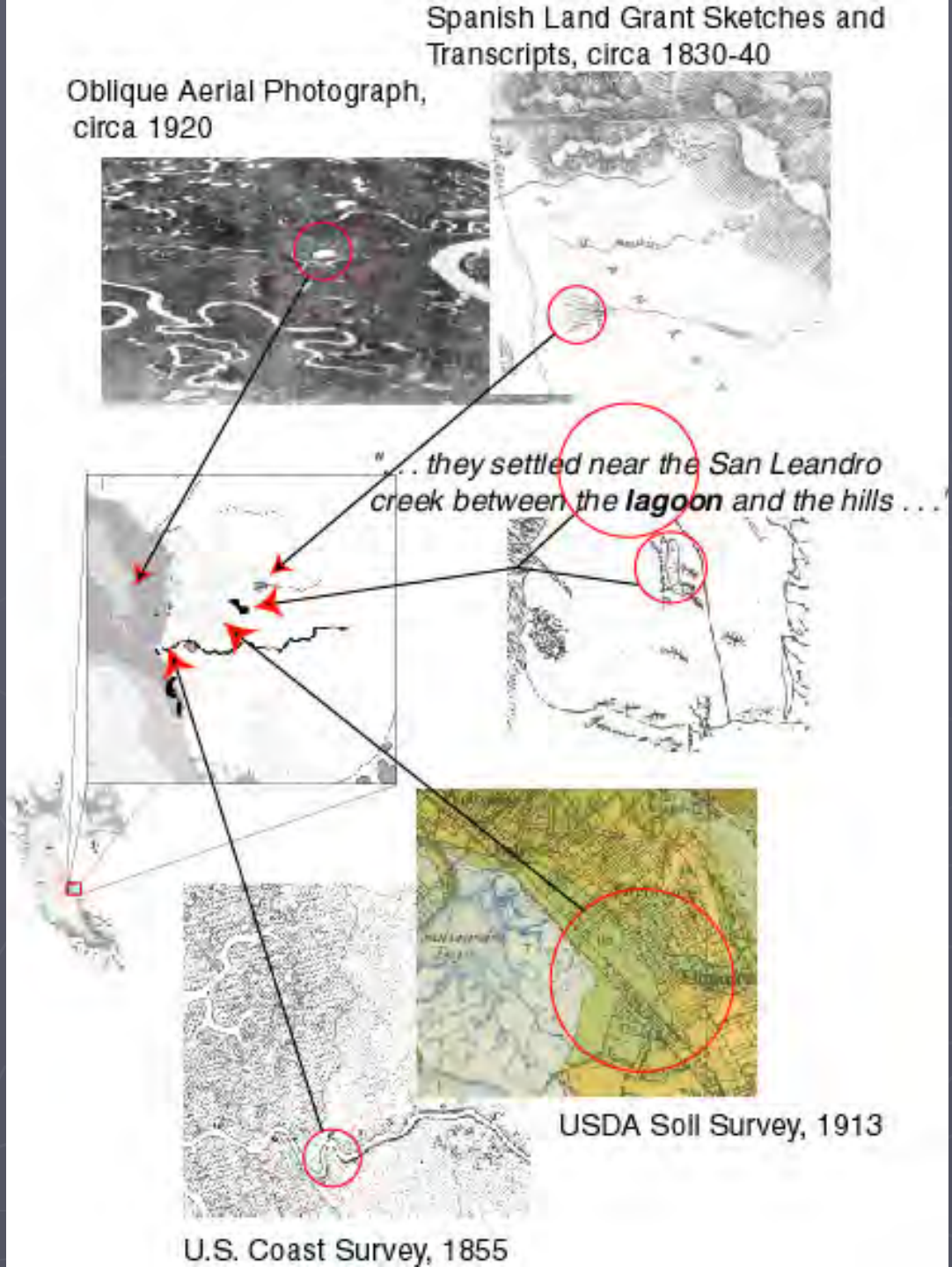
1800

1850

1900

1950

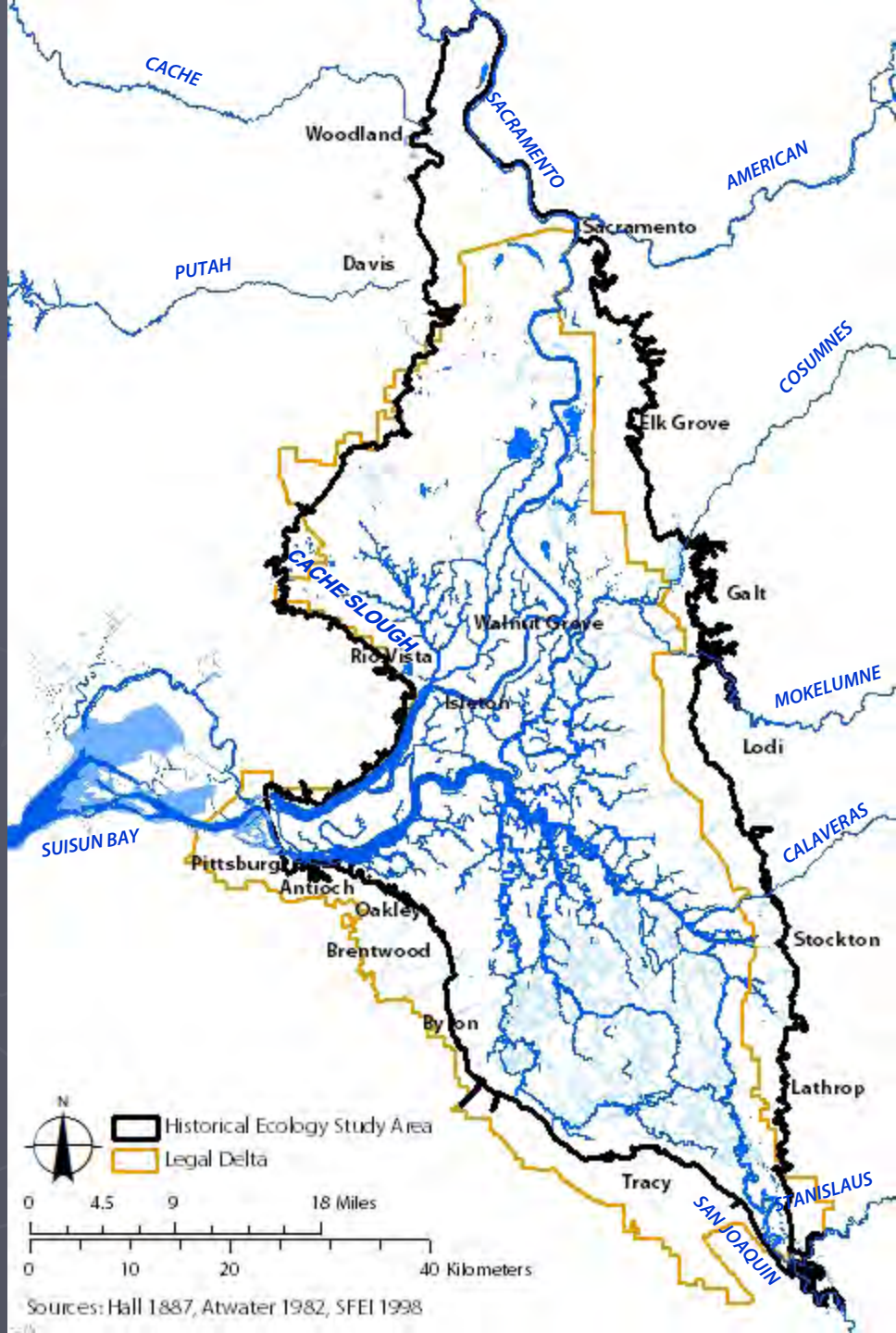
2000



STUDY AREA

Size: ~700,000 acres

Extent: Feather to Stanislaus along the 25-ft contour

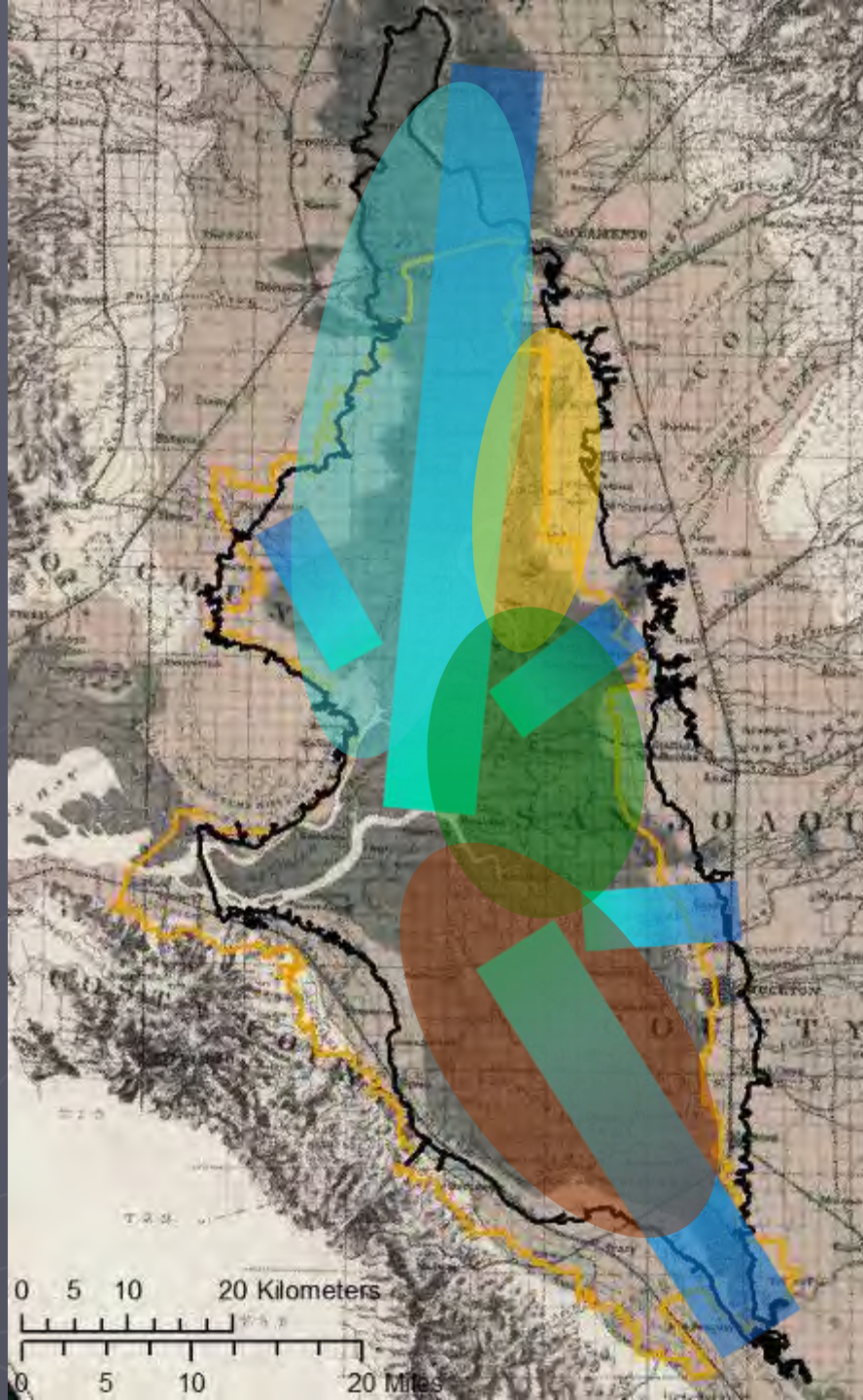


The Delta was composed of

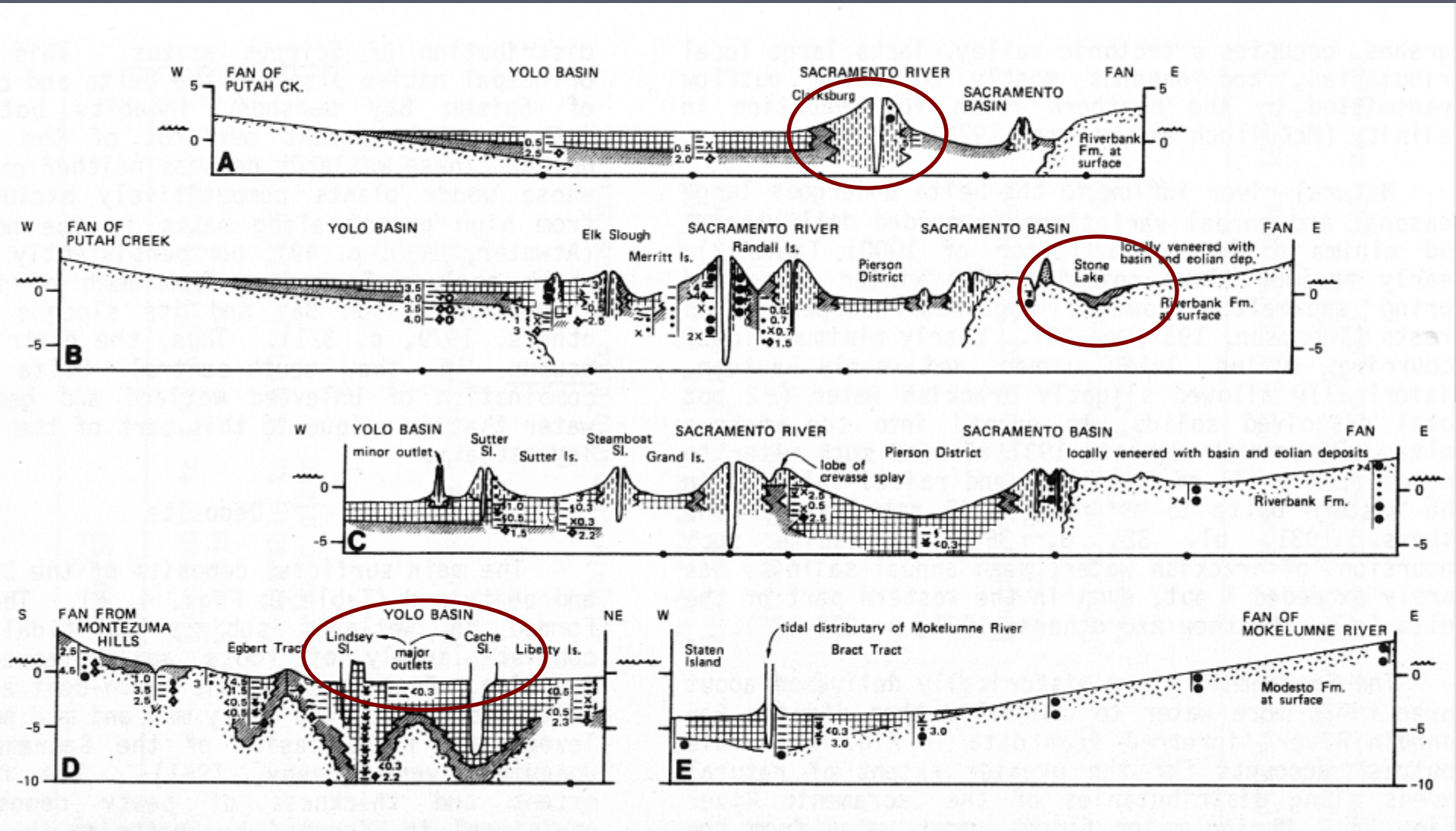
- Component systems created by separate fluvial sources of water and sediment
- Fluvial to tidal gradient
- Habitat mosaics reflect the system's temporal and spatial variability

Fluvial — Tidal

Hall 1887

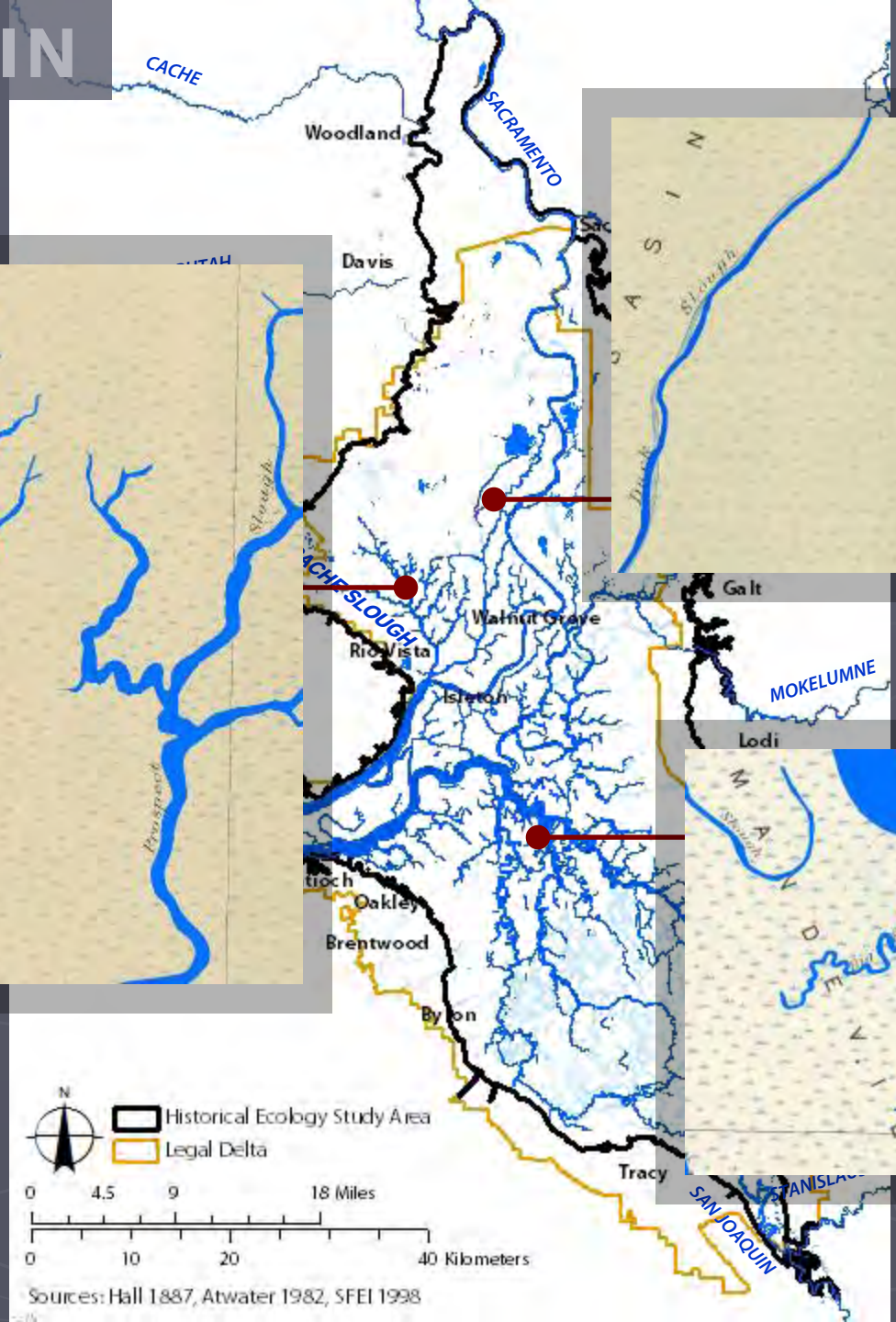


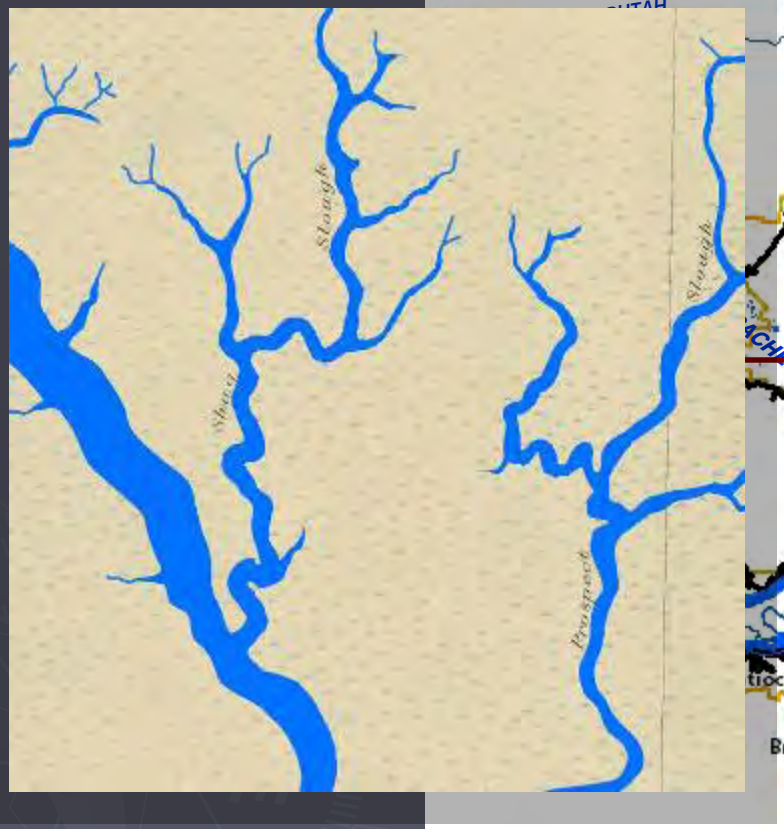
NORTH DELTA BASINS: PHYSICALLY COMPLEX



Atwater 1980

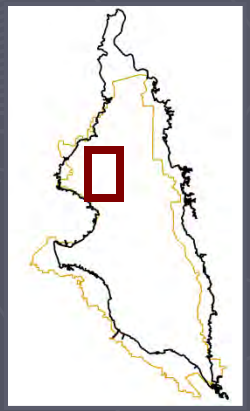
MARSH PLAIN



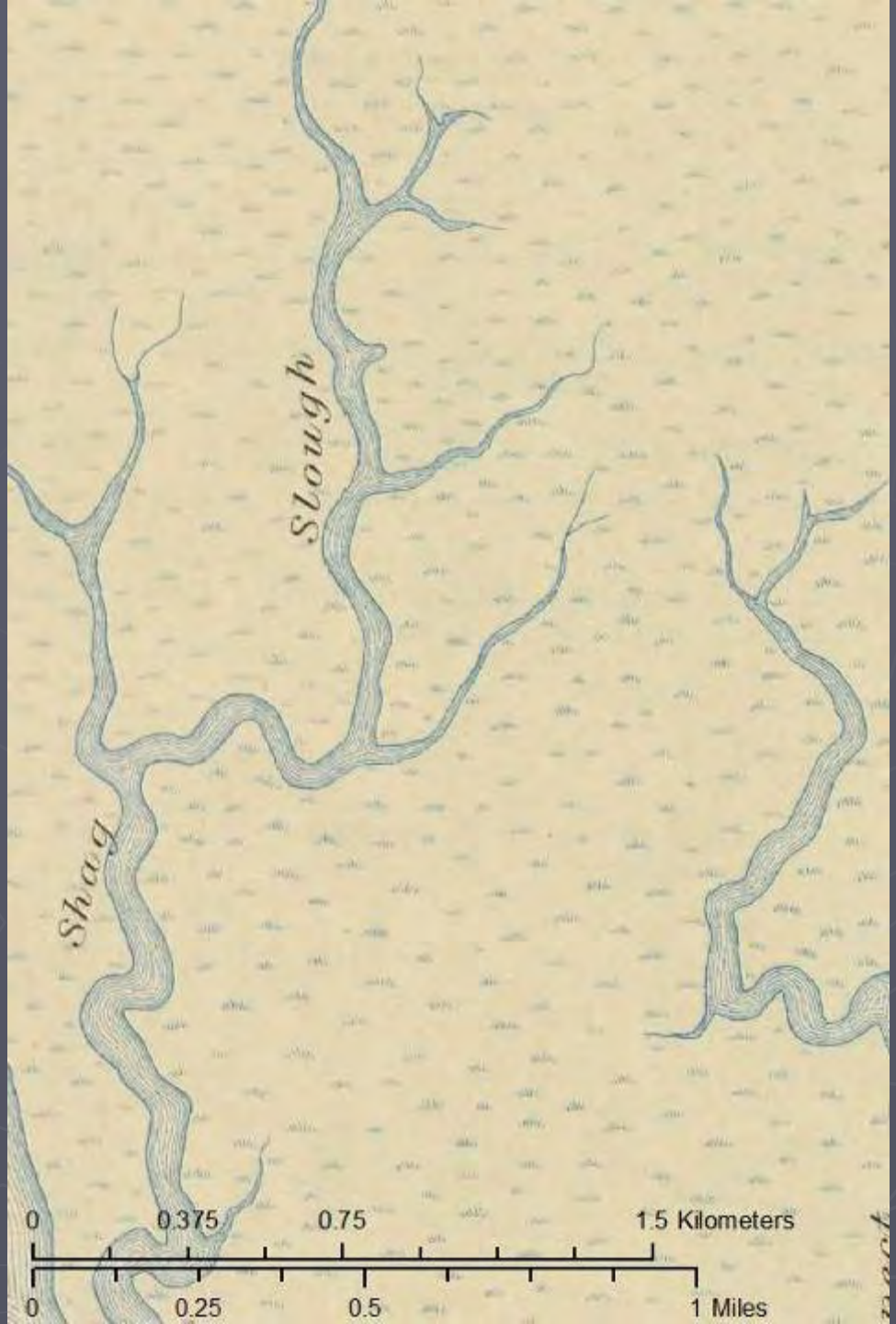


USGS 1906-1916

CACHE SLOUGH



USGS 1906-1916



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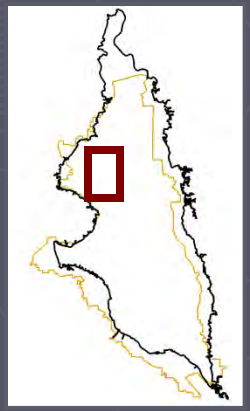
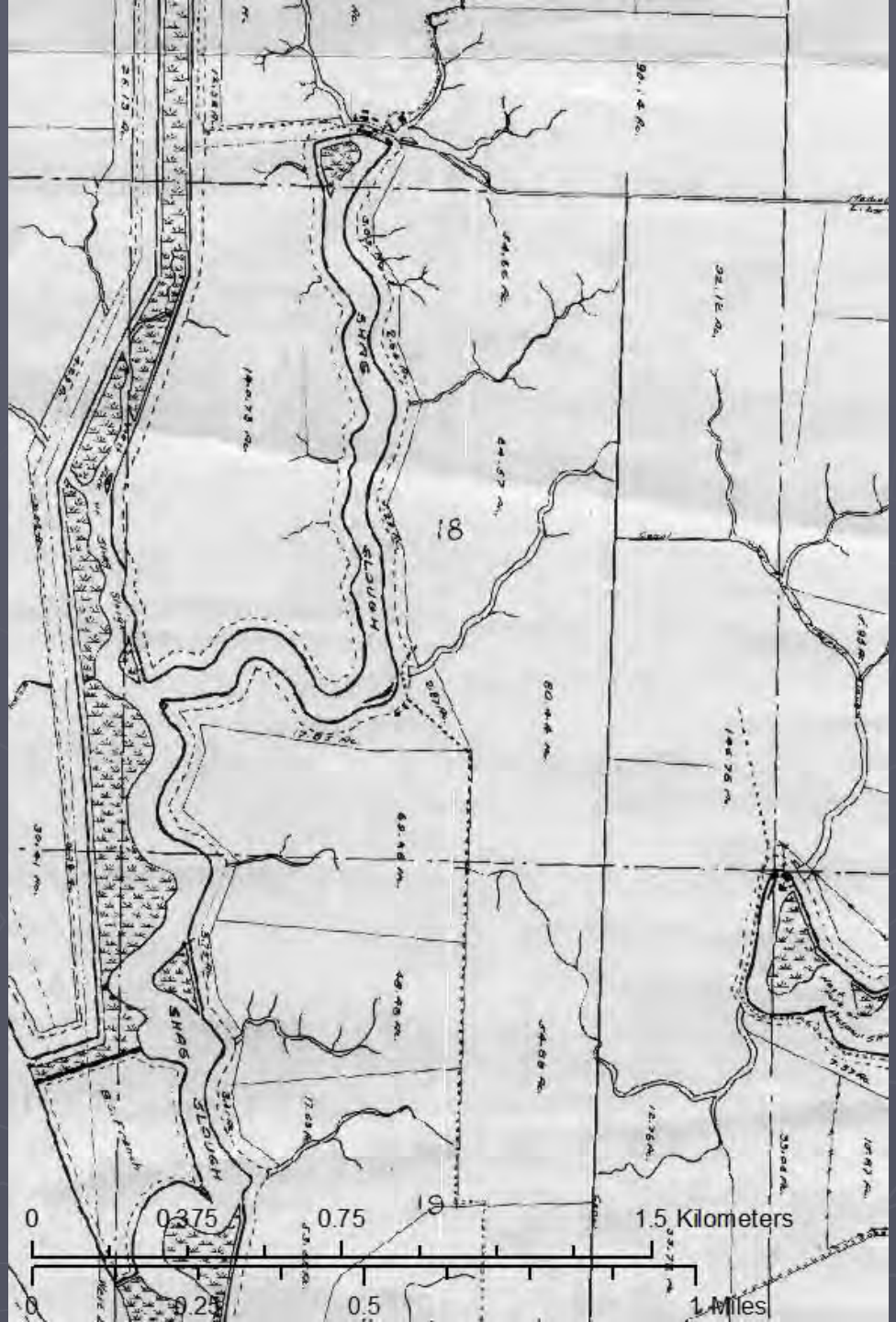
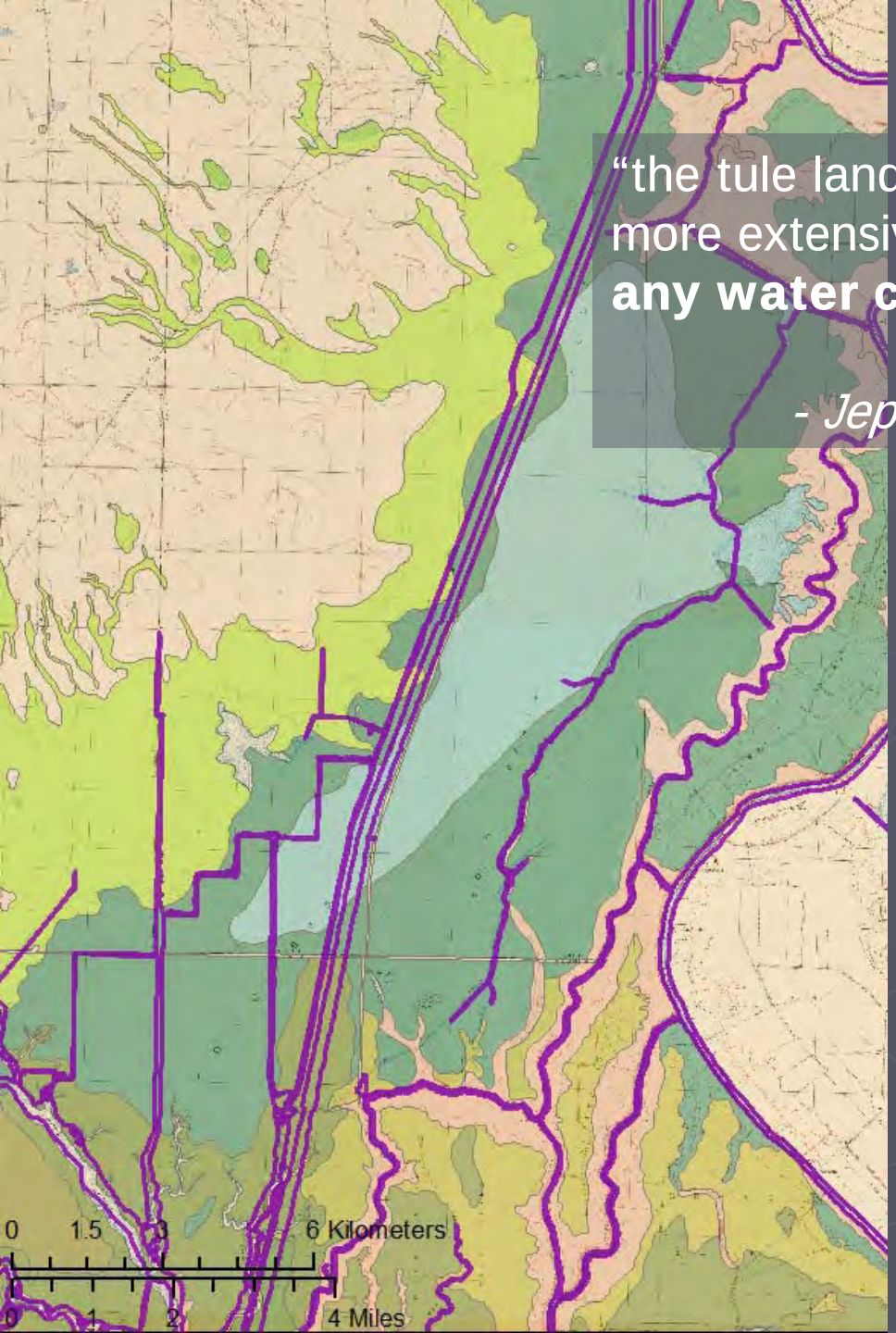


Wheeler 1920

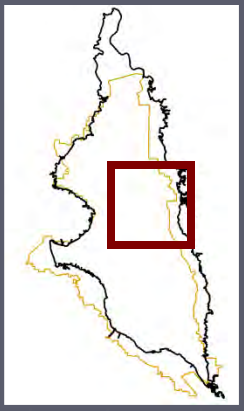




"the tule lands northward from Cache Slough are more extensive and **extend untraversed by any water course** to and beyond Putah Creek..."

- Jepson 1893

MOKELUMNE RIVER



Spring tide: 3.5 ft

Tide: 1 in

Tide: 3.5 ft

Tide: 4 - 5.5 ft

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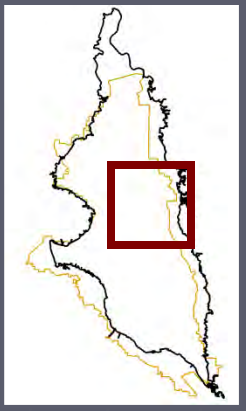
"At **low water** the tide flows out of the Mokelumne river **up the sloughs** and fills the tules. At **high water** the water **runs over the banks** of the river above and flows off into the tules."

- Van Scoyk 1859

Marsh at high tide: 6-8 in

Sherman 1859

MOKELUMNE RIVER – Water Quality



"The color will vary with the rise and fall of the river...

[q38] What is the color of the waters of the Mokelumne above the head of the island up to Bensons in the dry season and at low tide?

[a38] It is muddy but not to a great degree."

- Davis 1859

"water so thoroughly impregnated with decaying vegetable matter that it looked more like sherry than water"

- Wright ca. 1850

Sherman 1859

BASIN DYNAMICS

Interactions between flow, sediment supply, and vegetation govern the temporal conditions of habitat

"Putu [sic] and Cache creeks do not empty their waters immediately into the Sacramento but running into a tule marsh, they form in the rainy season **a lake some 40 miles long, and from 5 to 10 miles wide**. In some years this lake is increased by the overflowing of the Sacramento..."

- Californian, 26 April 1848

Browning 1851

LAKES AND PONDS

~500 acres

Courtesy UC Davis, Dept. of Special Collections

~10 acres

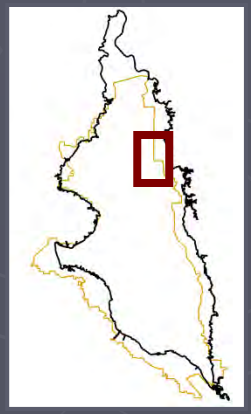
USGS 1906-1916

50-200 acres

Gibbes 1850

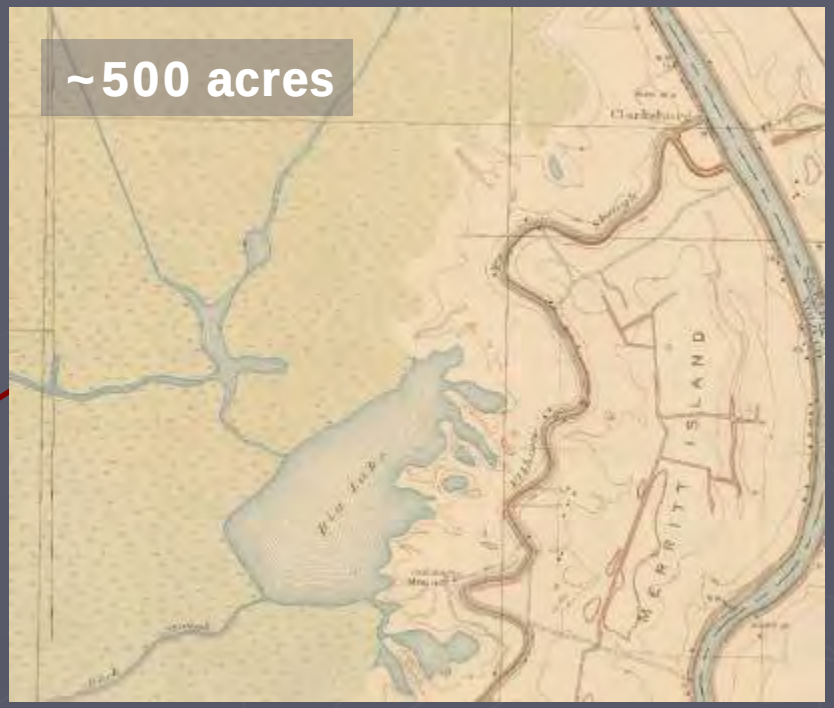
SACRAMENTO BASIN

Large open water bodies along periphery of perennial marsh

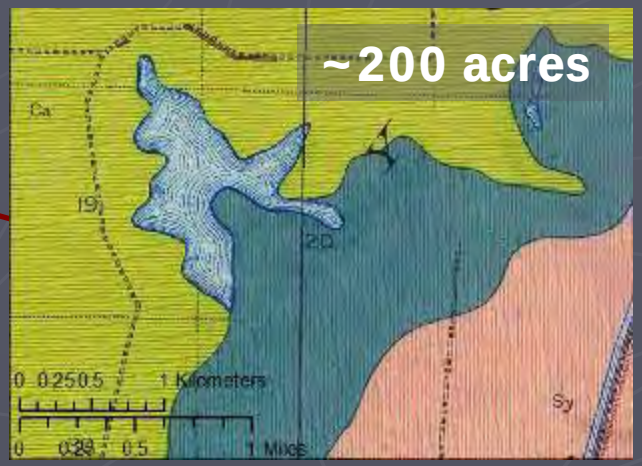


USDA 1915

YOLO BASIN



USGS 1906-1916



USDA 1930

0 1.5 3 6 Kilometers

0 1 2 4 Miles

Stories from a duck hunter: Lakes and ponds create locally complex habitat

"On all sides stretched a vast wilderness of tules"

"came to a region of small pools abounding in mallard"

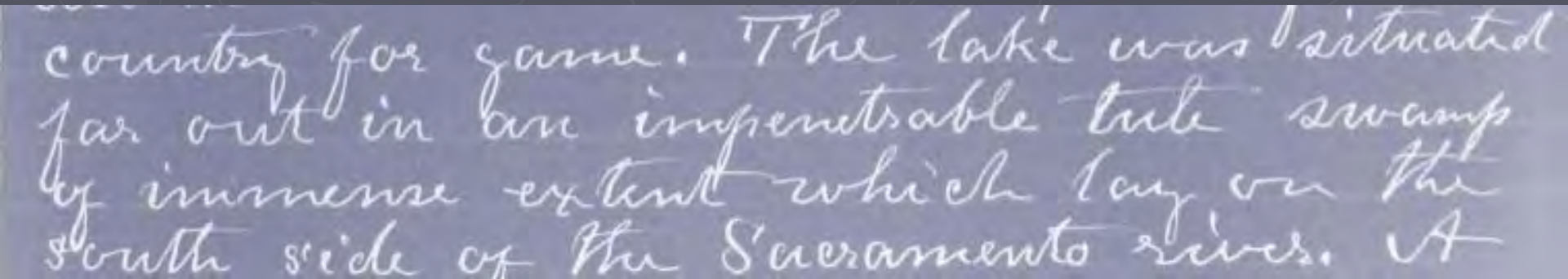
"we struck no places in which the water came above our breasts... subterranean excavations of the beaver always gave us a perpendicular drop of about two feet "

"Though the lake was a large one it was very shallow"

"many coves and slough-like branches"

- *William Wright ca. 1850*

USGS 1907, Courtesy Center for Sacramento History



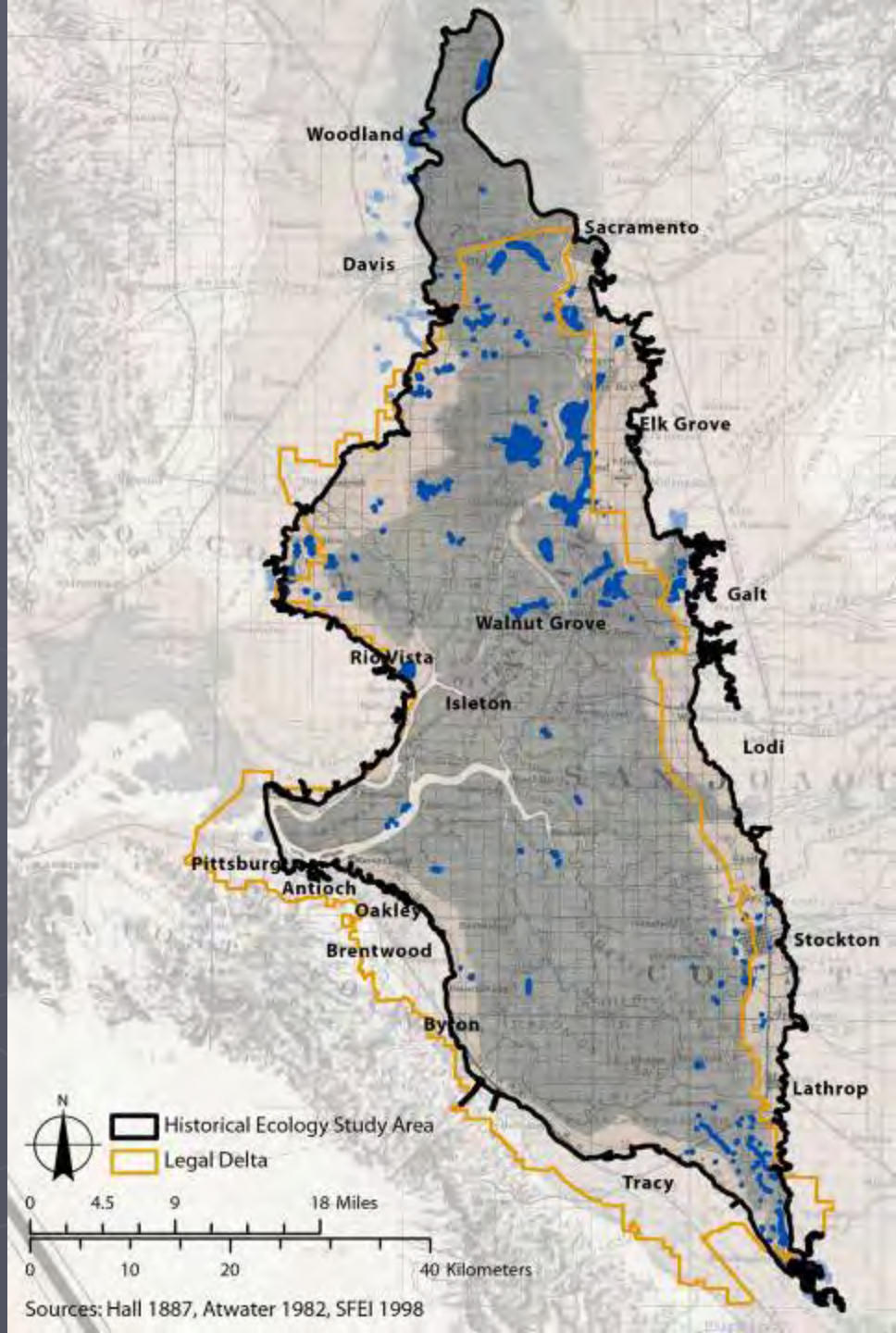
Small fish…

"...strings of pan-fish, taken from a **small pond** about half a mile distant..."

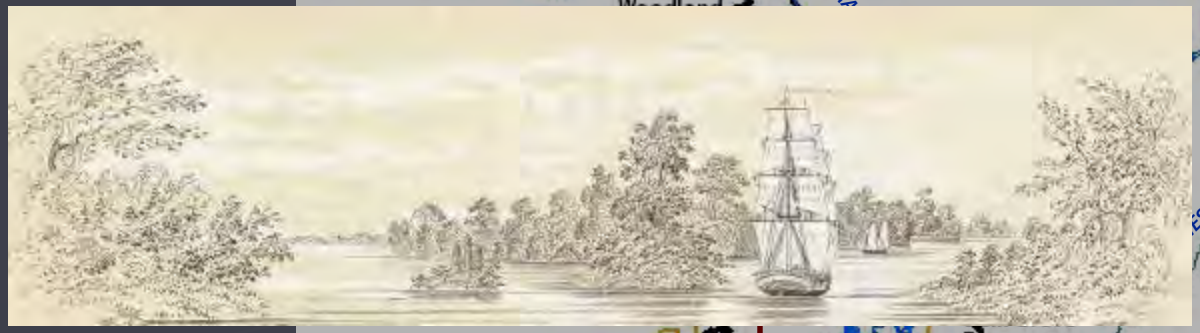
- *Bryant 1848*

"The Sacramento Fisheries. 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**, at which times they are taken in unusually large numbers... During the high stage of water these lakes all communicate with the Sacramento."

- *Sacramento Daily Union, 6 June 1854*



RIPARIAN VEGETATION



Ringgold 1852

Bonnett 2009, "Down River"

Grunsky ca. 1875

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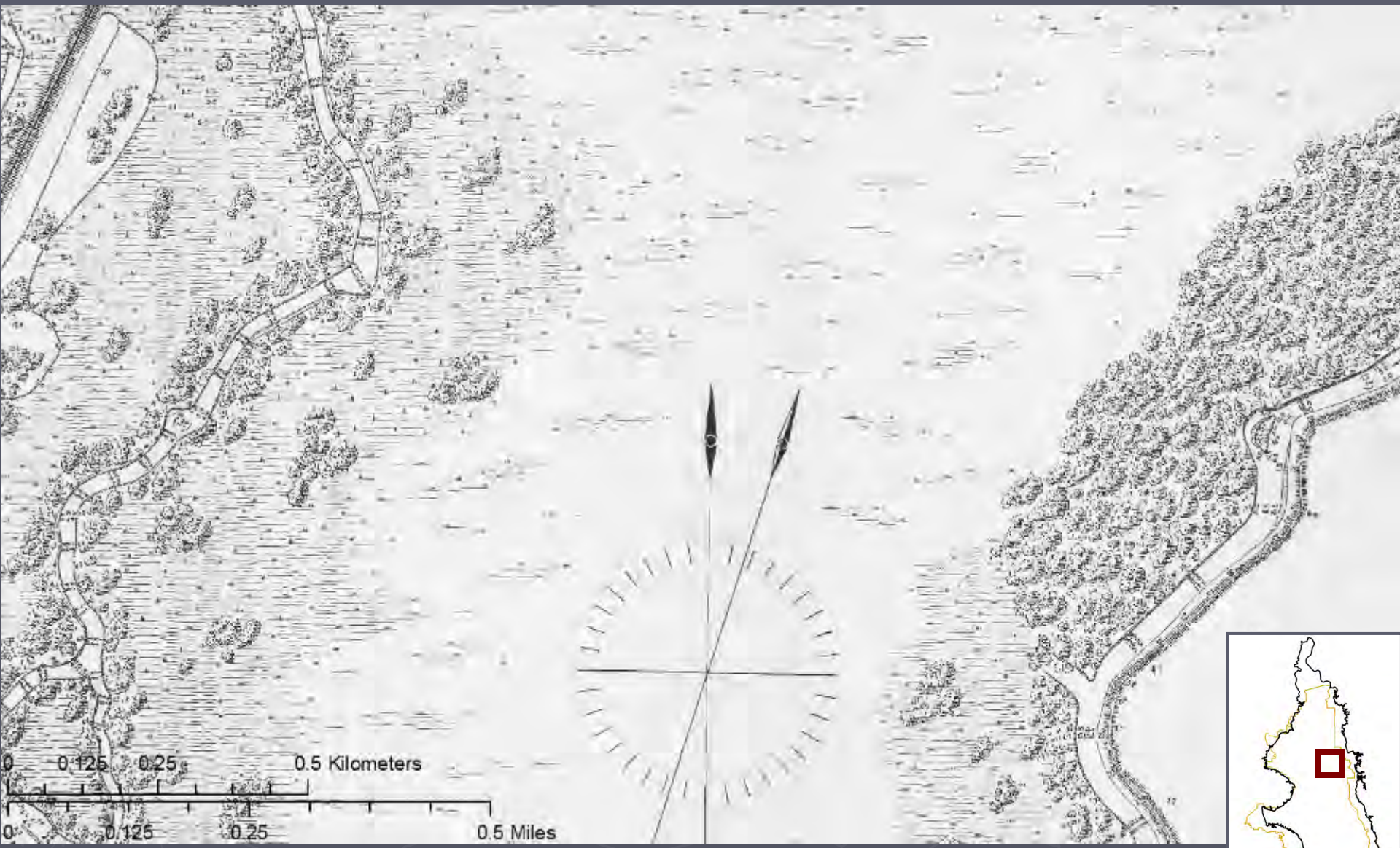
NATURAL LEVEES

McCORMACK WILLIAMSON TRACT



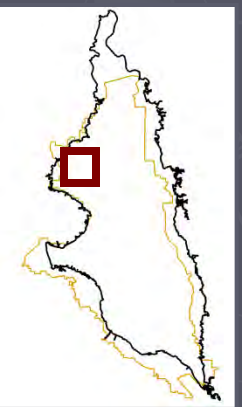
Debris Commission 1914

McCORMACK WILLIAMSON TRACT

NAIP 2005

“Cache slough has numerous tributaries, many of which are navigable, and all of which are skirted by a light growth of timber.”

- Dunn 1915



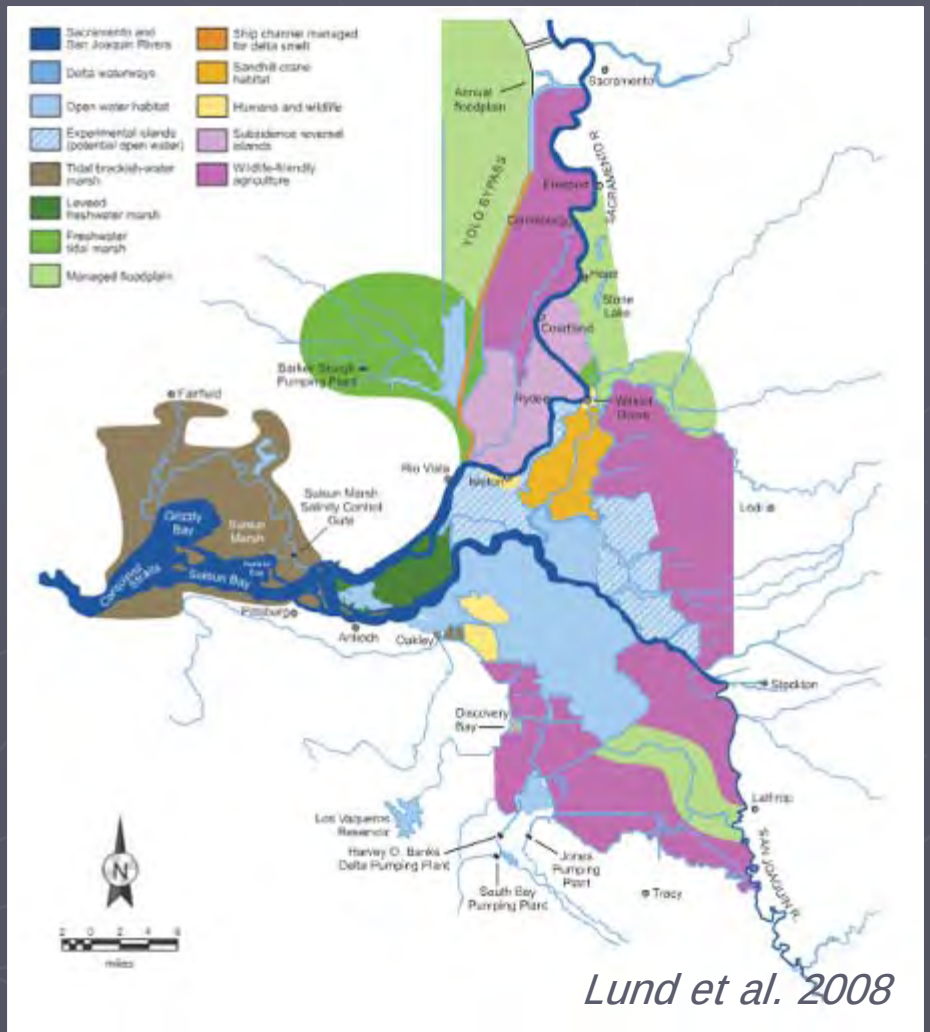
YOLO BASIN SINKS

Henning 1871

EMERGING CONCEPTS: LANDSCAPE FORM

- Interactions between fluvial and tidal process vary at multiple spatial and temporal scales
- Creating a dynamic physical template for diverse Delta ecosystems

→ **Manage toward target ecological functions along physical gradients**



Lund et al. 2008

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RESEARCHERS:

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

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

OTHER CONTRIBUTORS:

Brian Atwater

Chris Enright

Elise Brewster

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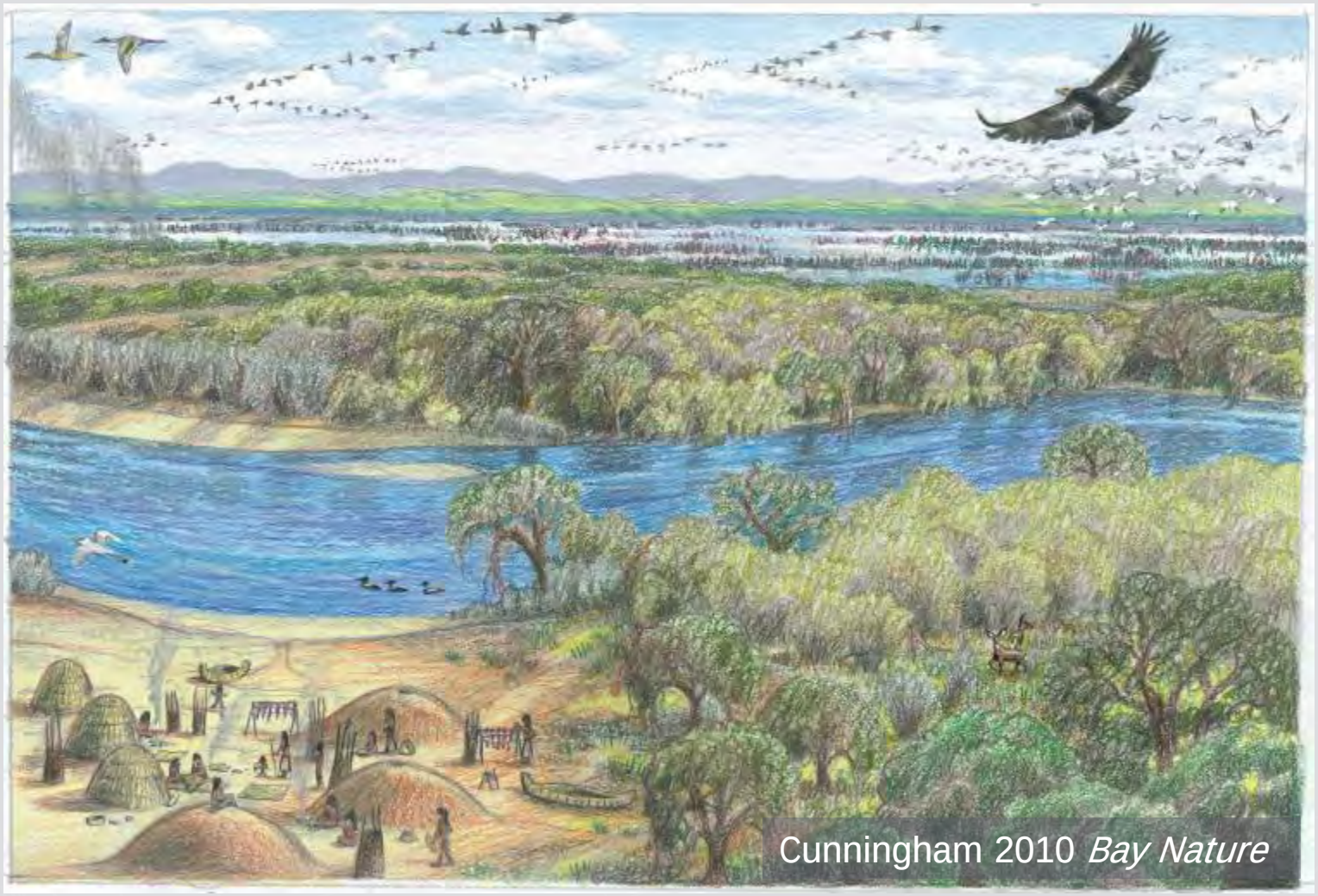
Thank You



alison@sfei.org