Cultivating Ecological Solutions On Agricultural Lands

by Mimicking Natural Process at the Landscape Scale

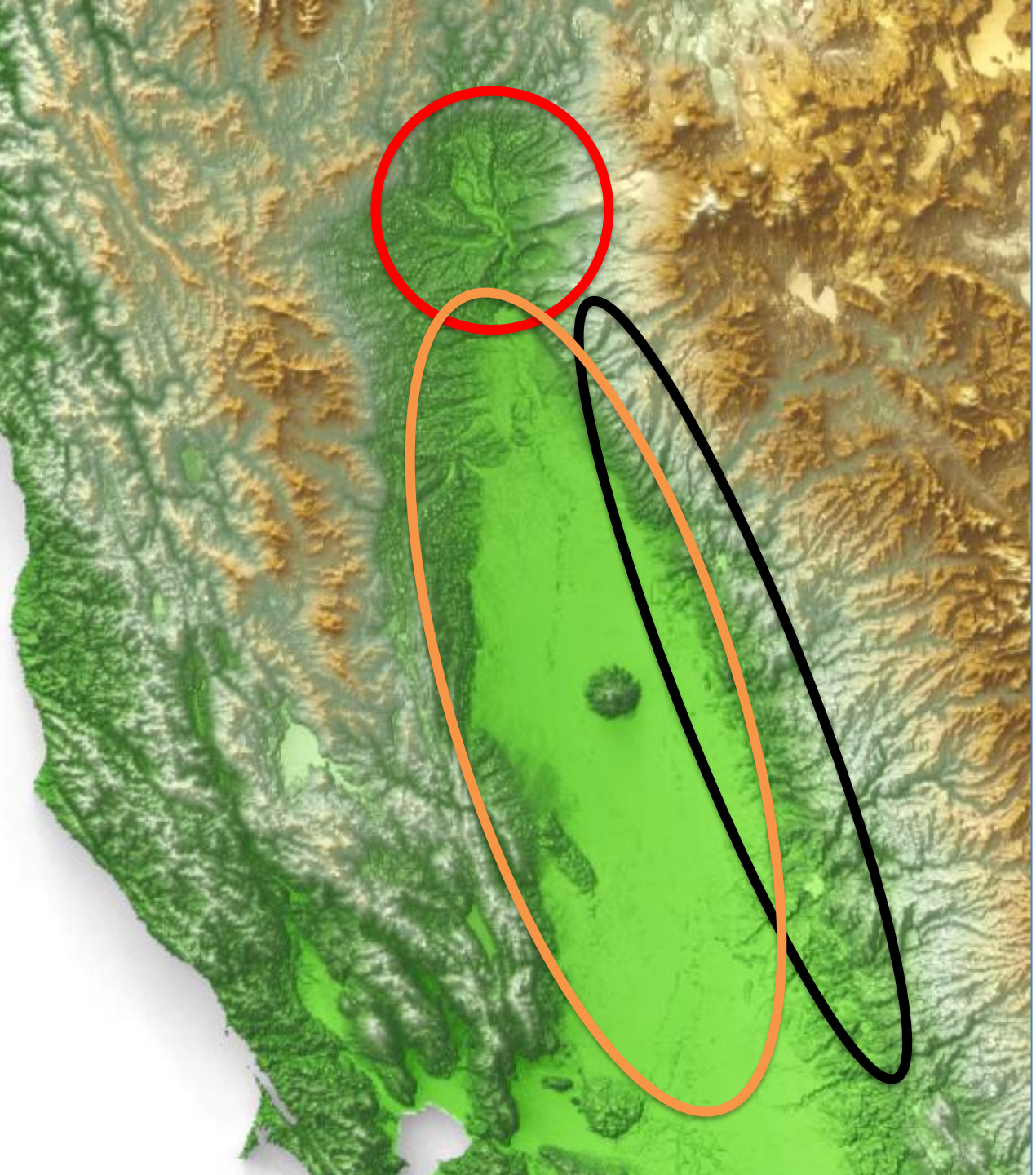
Jacob Katz – California Trout

C. Jeffres


The Pivot to Process

Process-Based Reconciliation

Integrating a working knowledge of natural process, into the management of natural resources

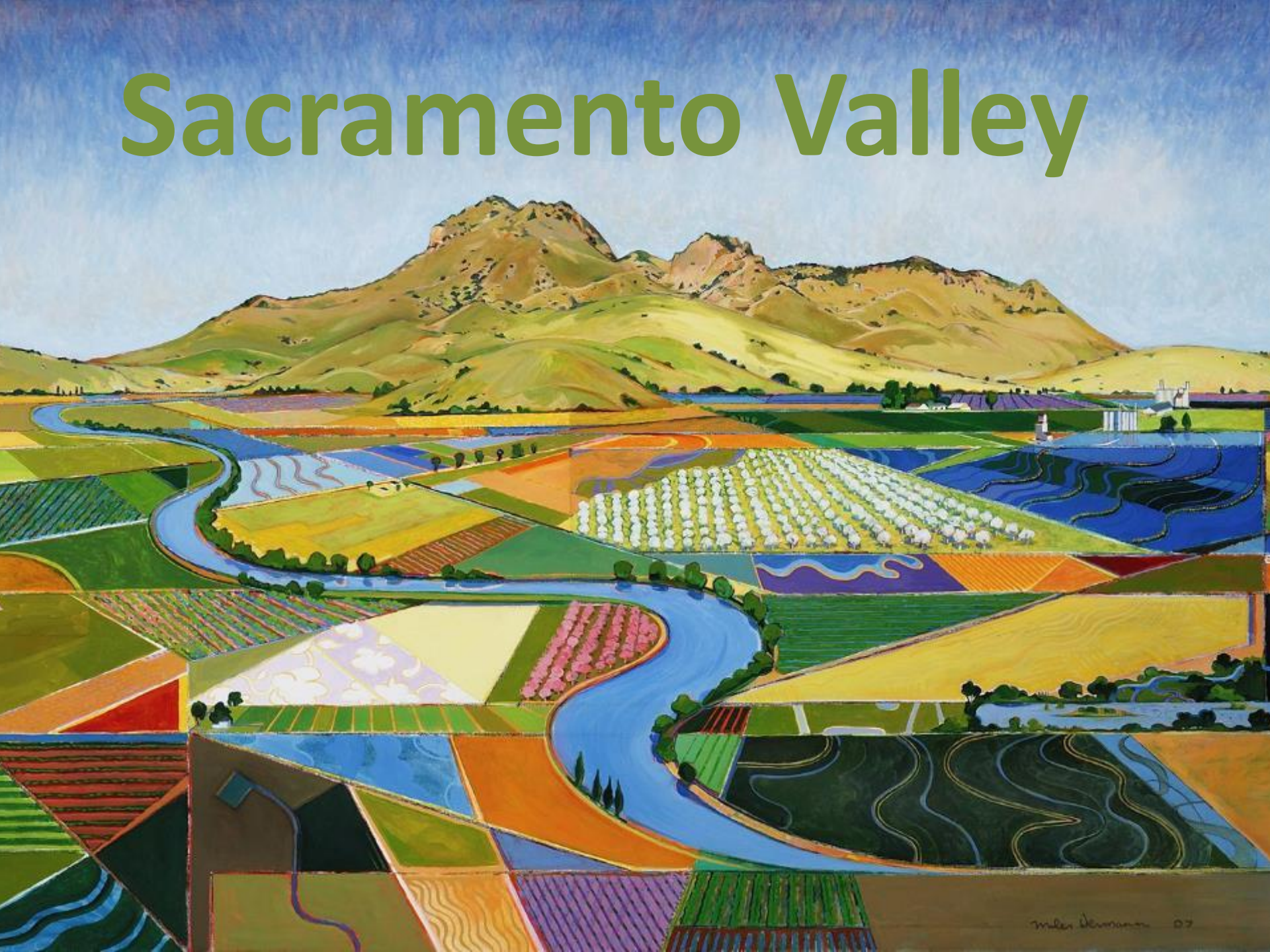


Winter-run:
Headwater springs

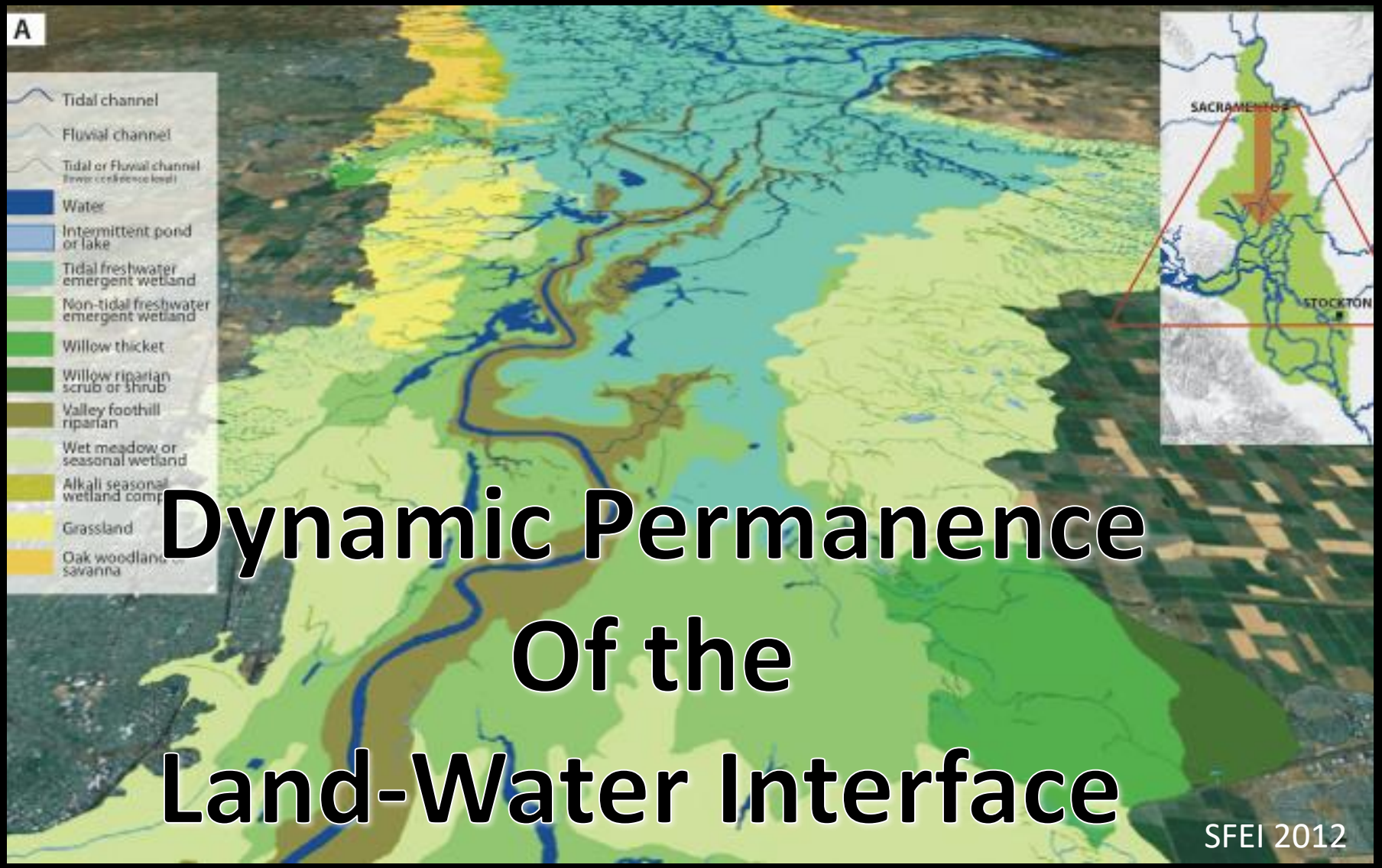
Spring-run:
Snow melt

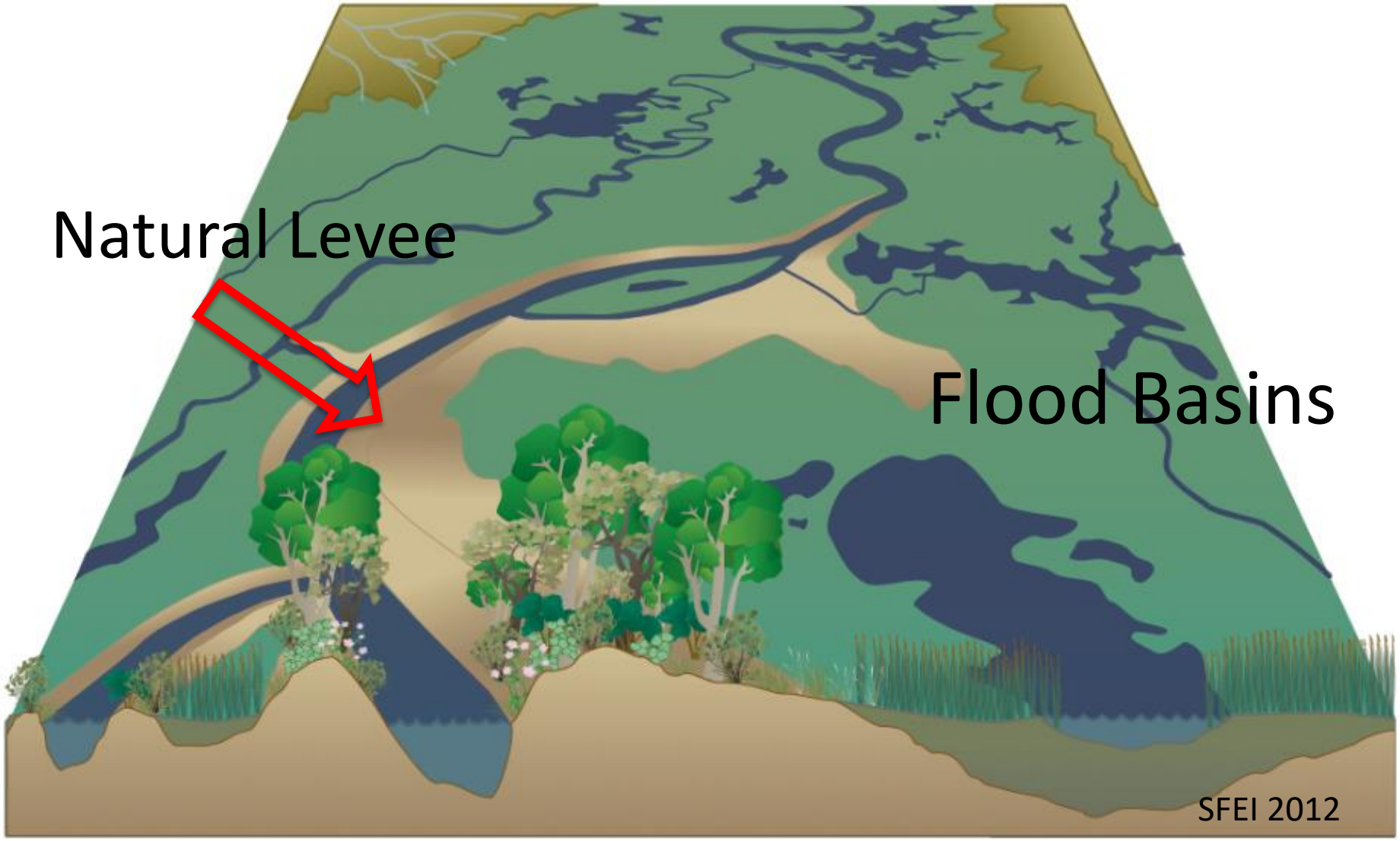
Fall-run:
Rain

Sacramento Valley

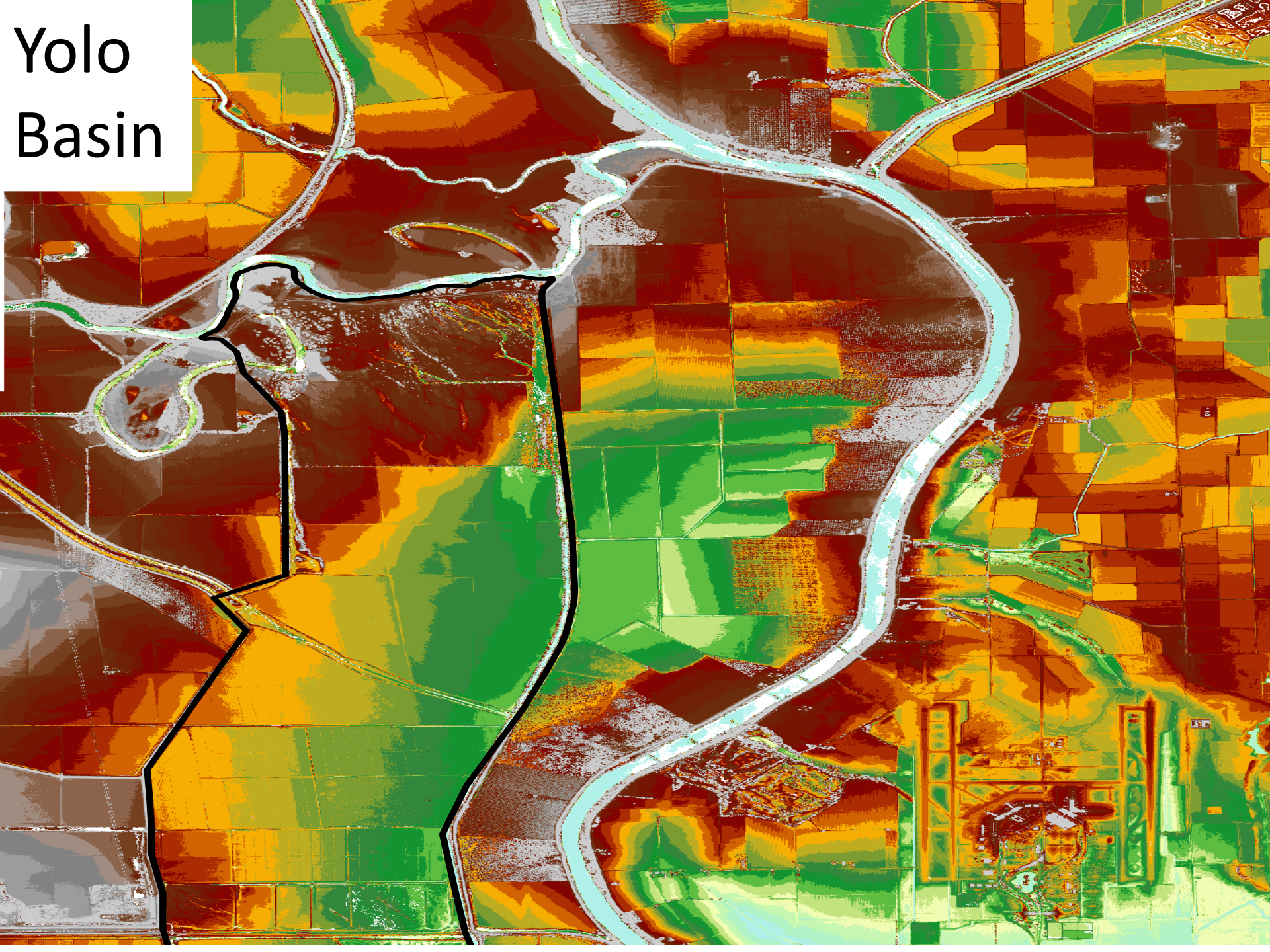


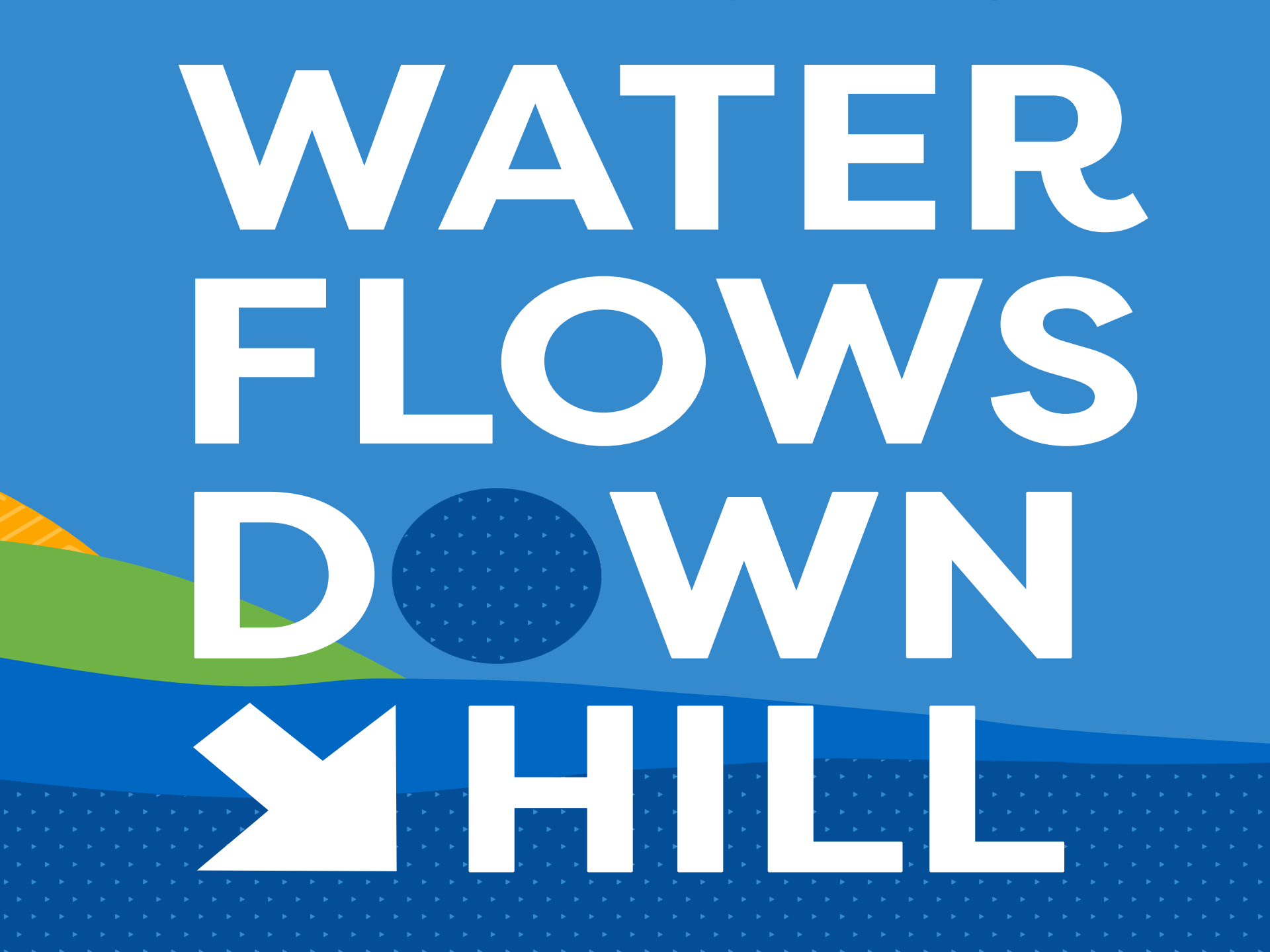
Wetland–River Corridors



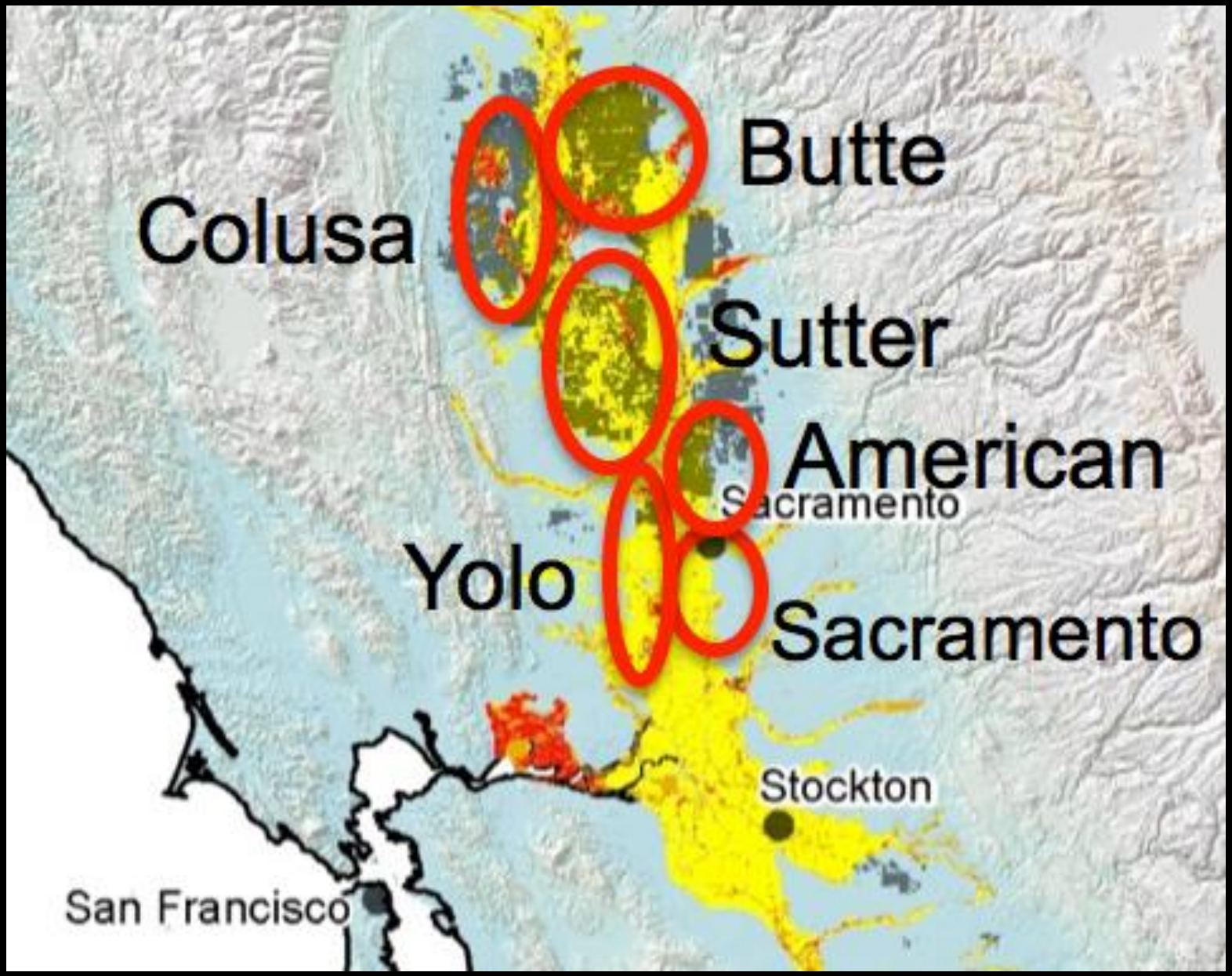


Fluvial Processes


Yolo
Basin


WATER
FLOWS
DOWN
HILL

Sac Valley Defined by its Puddles



Canalized

Thousands of miles of levees

The Land Divorced from the Water

Ubiquitous Drainage

95%

Central Valley wetlands drained

Fish belong in the river…

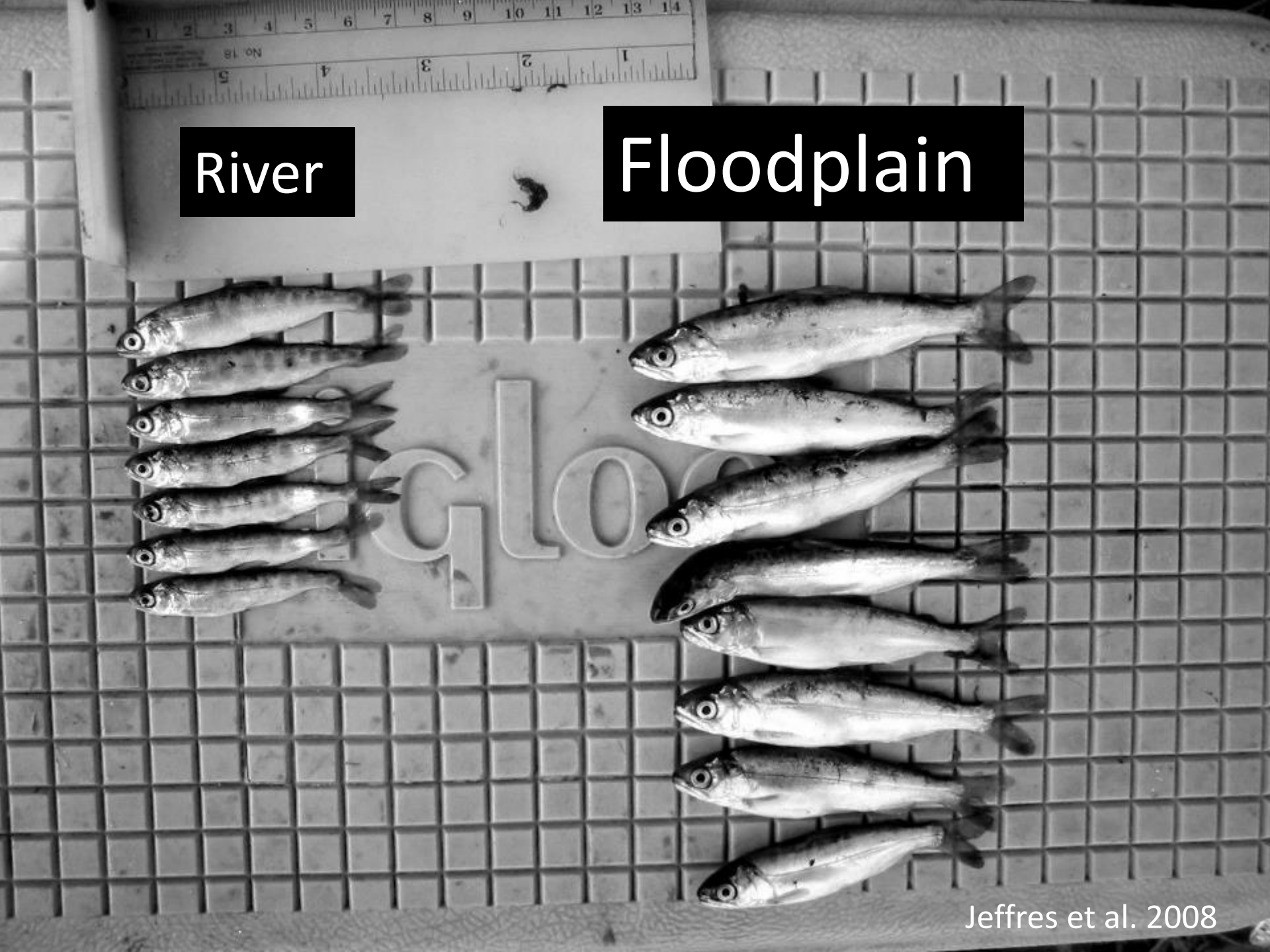
…and the river belongs in its banks.

“The latest proposal to build canals or by-passes within the overflow basins, so that they will be readily drained as the river falls, would be the saving of myriads of fish, and especially of salmon fry, and should be encouraged.”

-N. Bishop Scofield, 1911

STATE OF CALIFORNIA FISH AND GAME COMMISSION FISH BULLETIN NO. 1

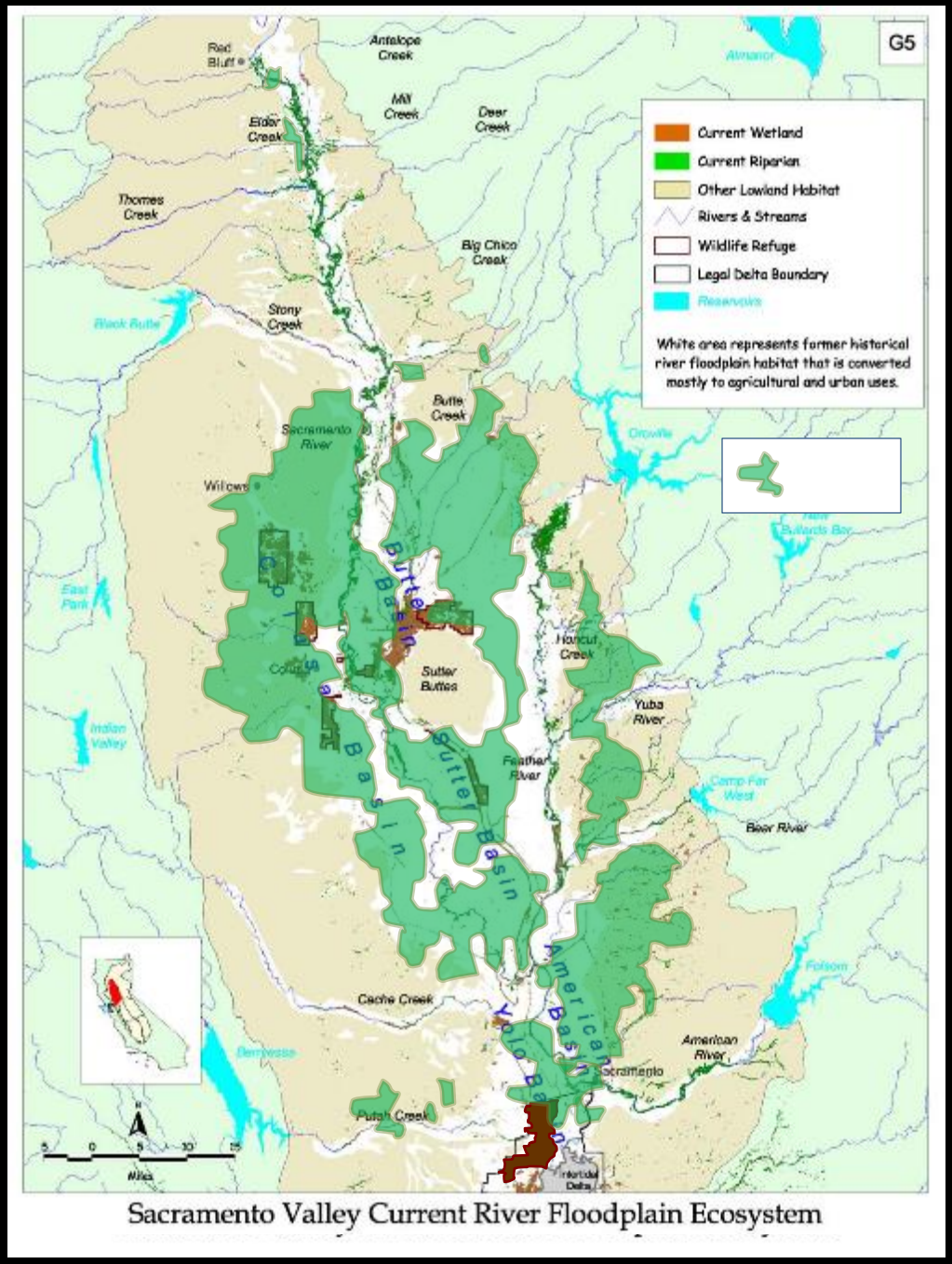
Cosumnes River



Jeffres et al. 2008

We are never going back

but maybe by looking back, we can reconcile the world we've inherited with the one we desire



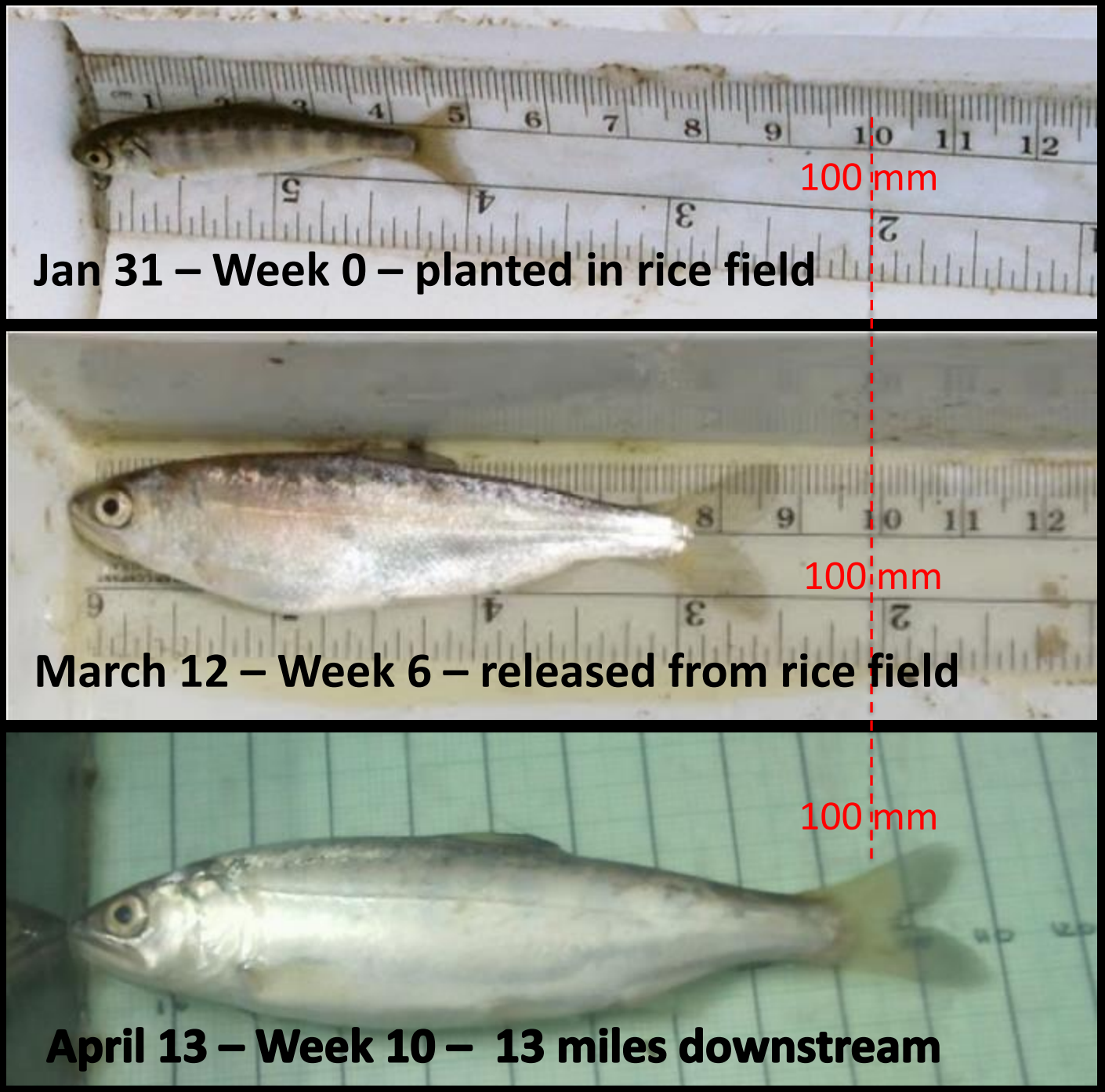
Sacramento Valley Current River Floodplain Ecosystem

Central Valley Waterfowl – Success Fills the Sky

the floodplain is still here

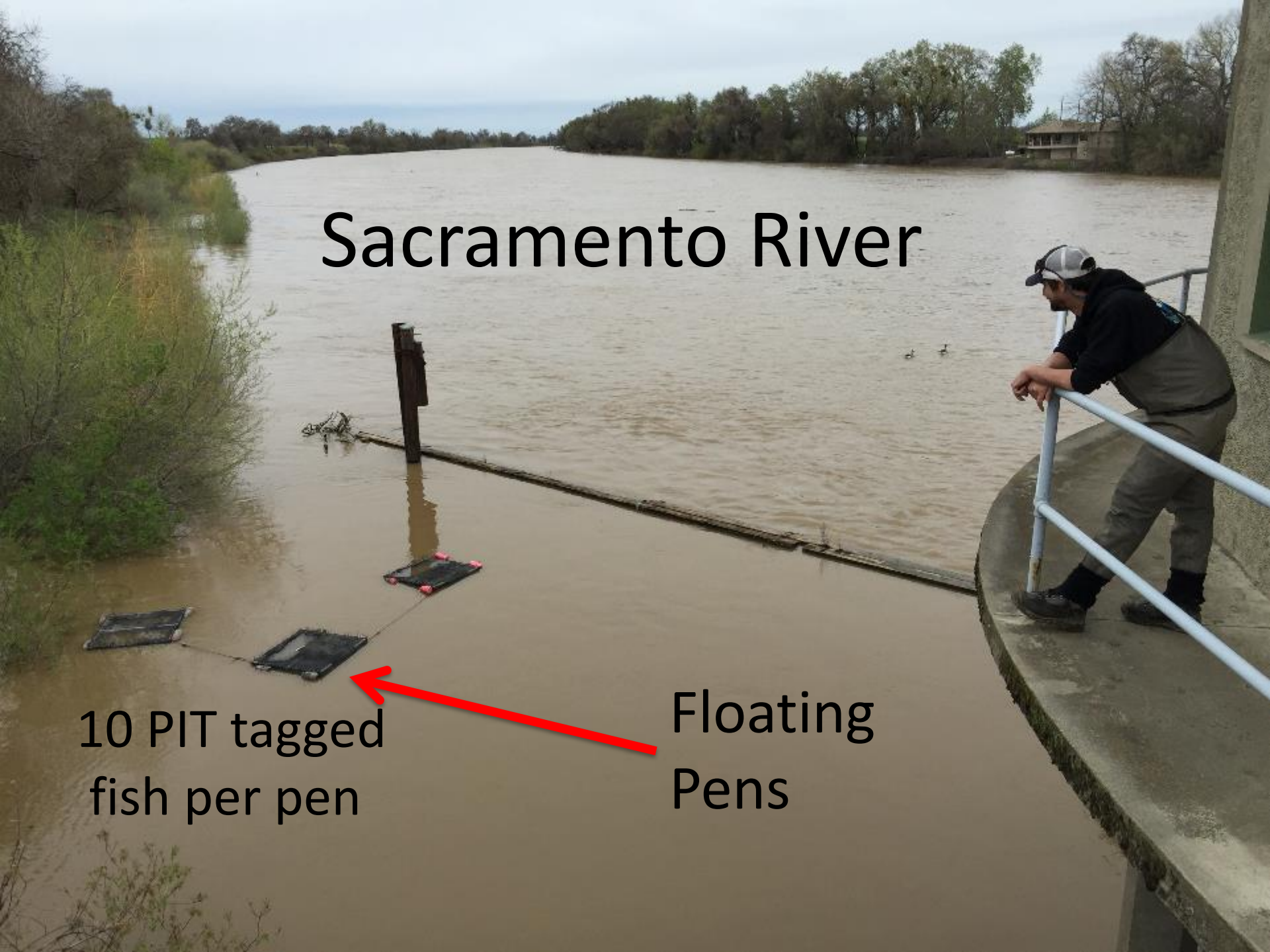
approximating natural flood patterns at the landscape scale to restore the aquatic ecosystem productivity that facilitates abundance

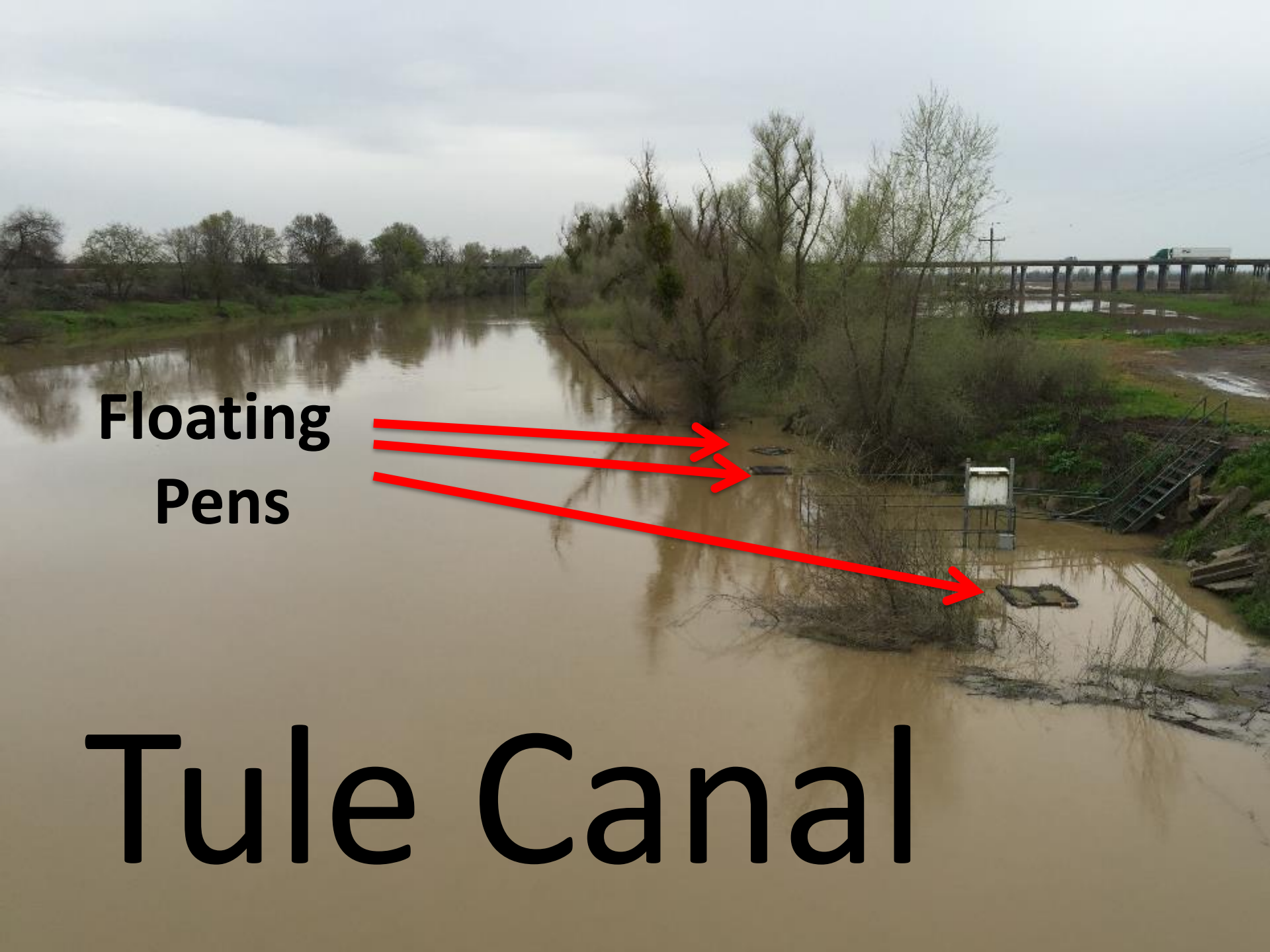
Mimicking natural floodplain processes in post-harvest floodplain rice fields on Yolo Bypass



GROWTH

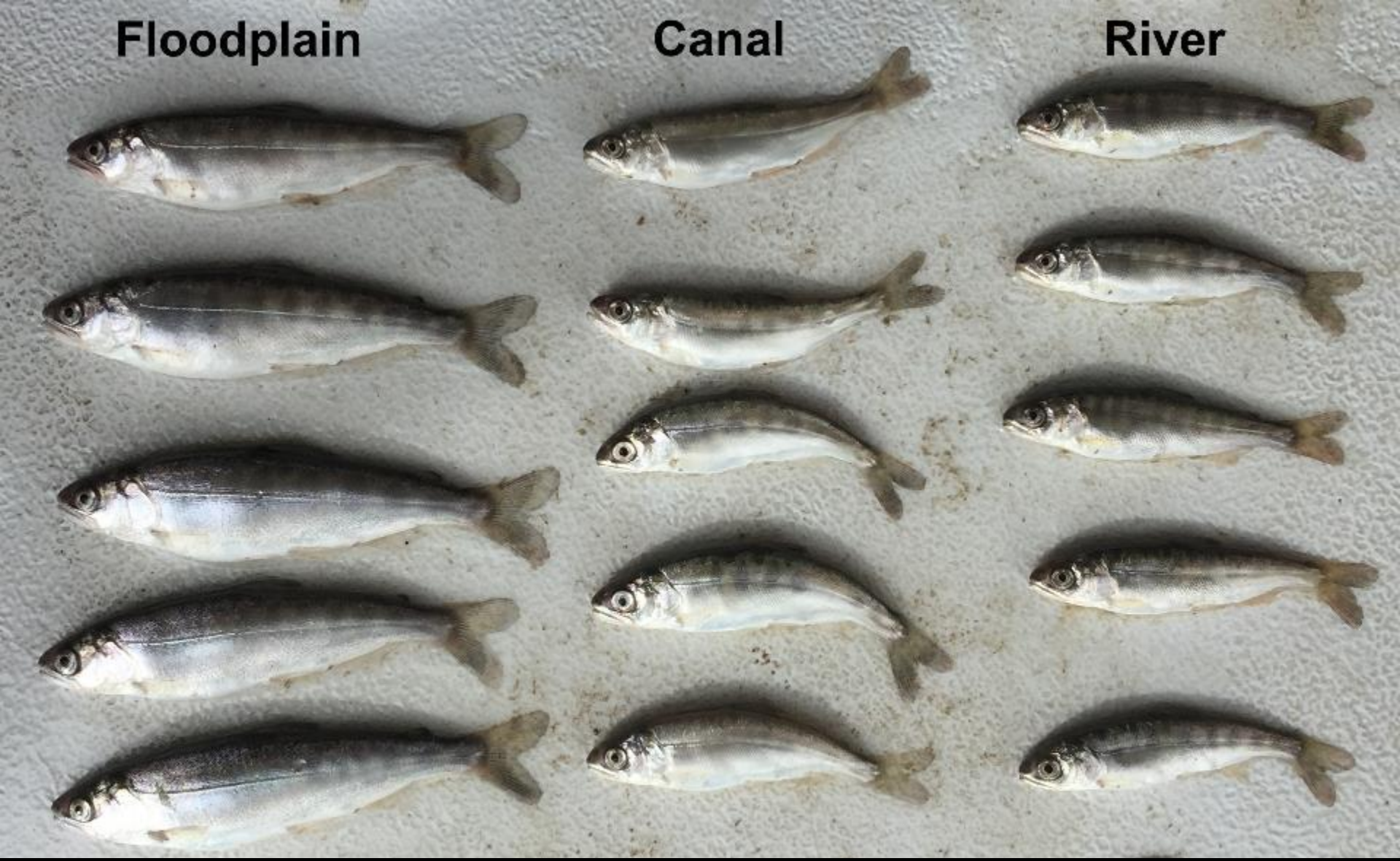
Katz et al. 2017


Sacramento River
10 PIT tagged fish per pen
Floating Pens

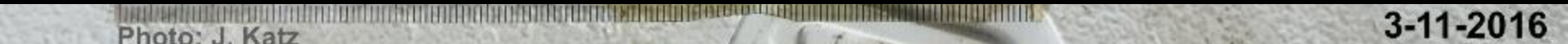


Tule Canal

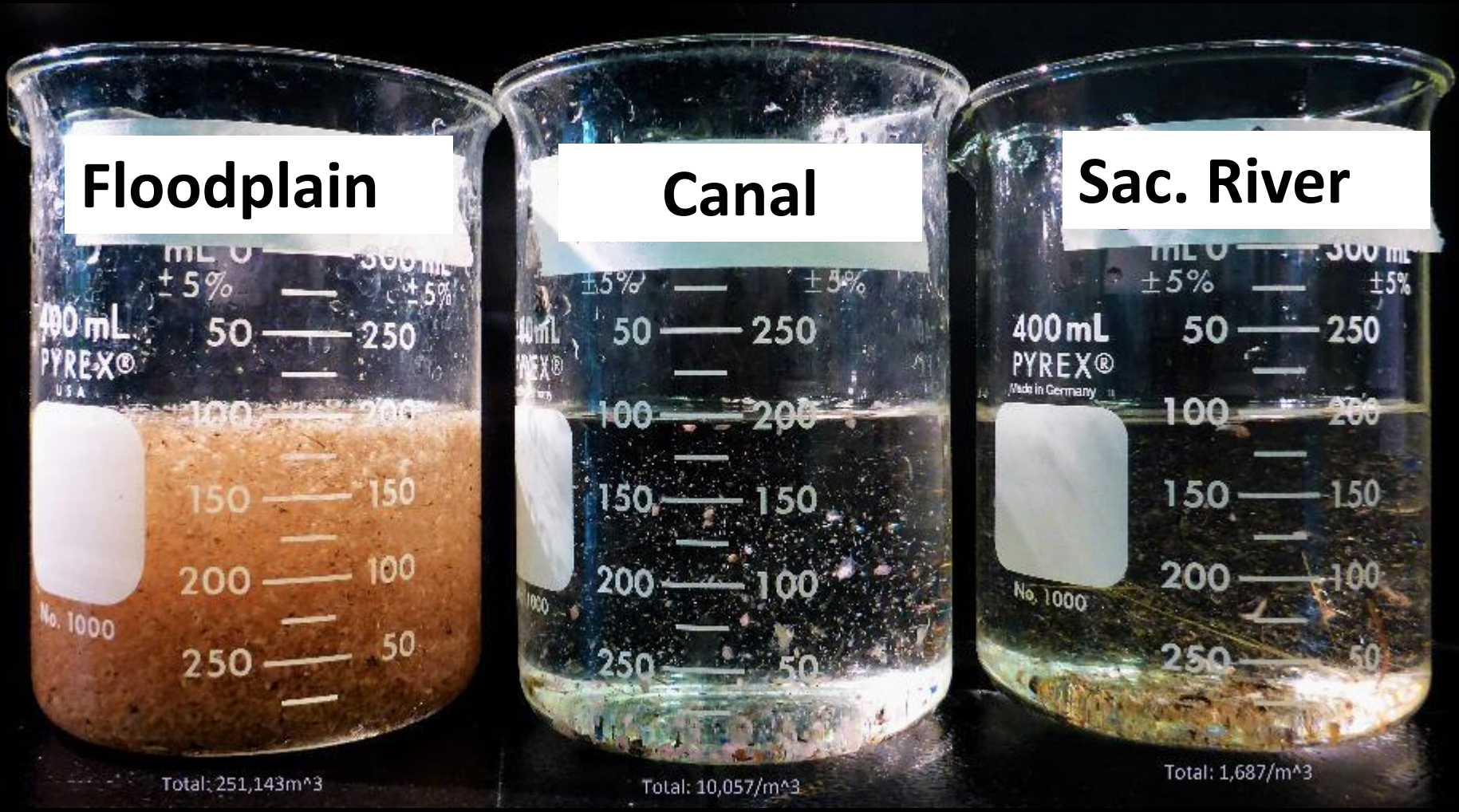
Managed Agricultural Floodplain



700% faster growth

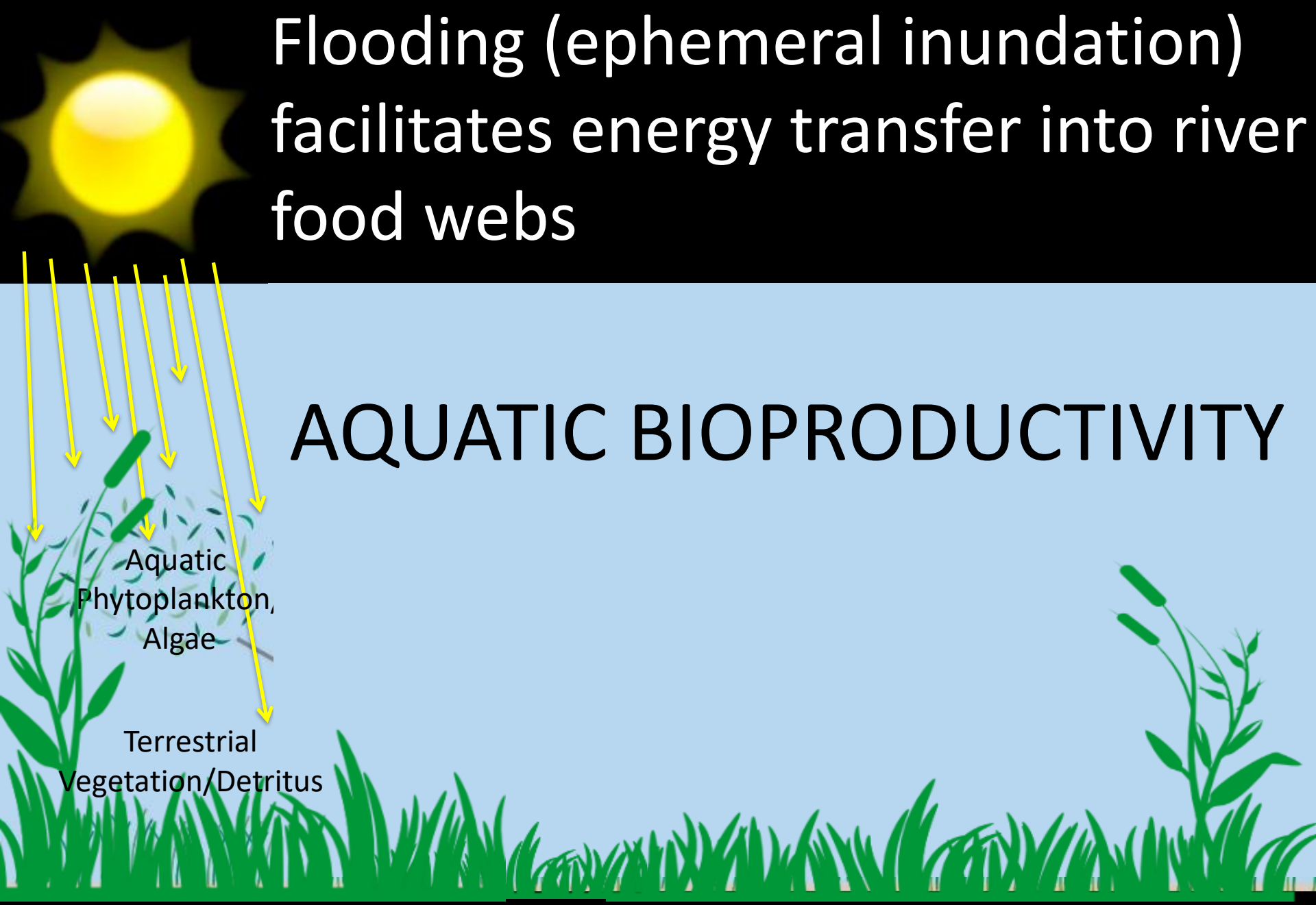


The Food is on the Floodplain

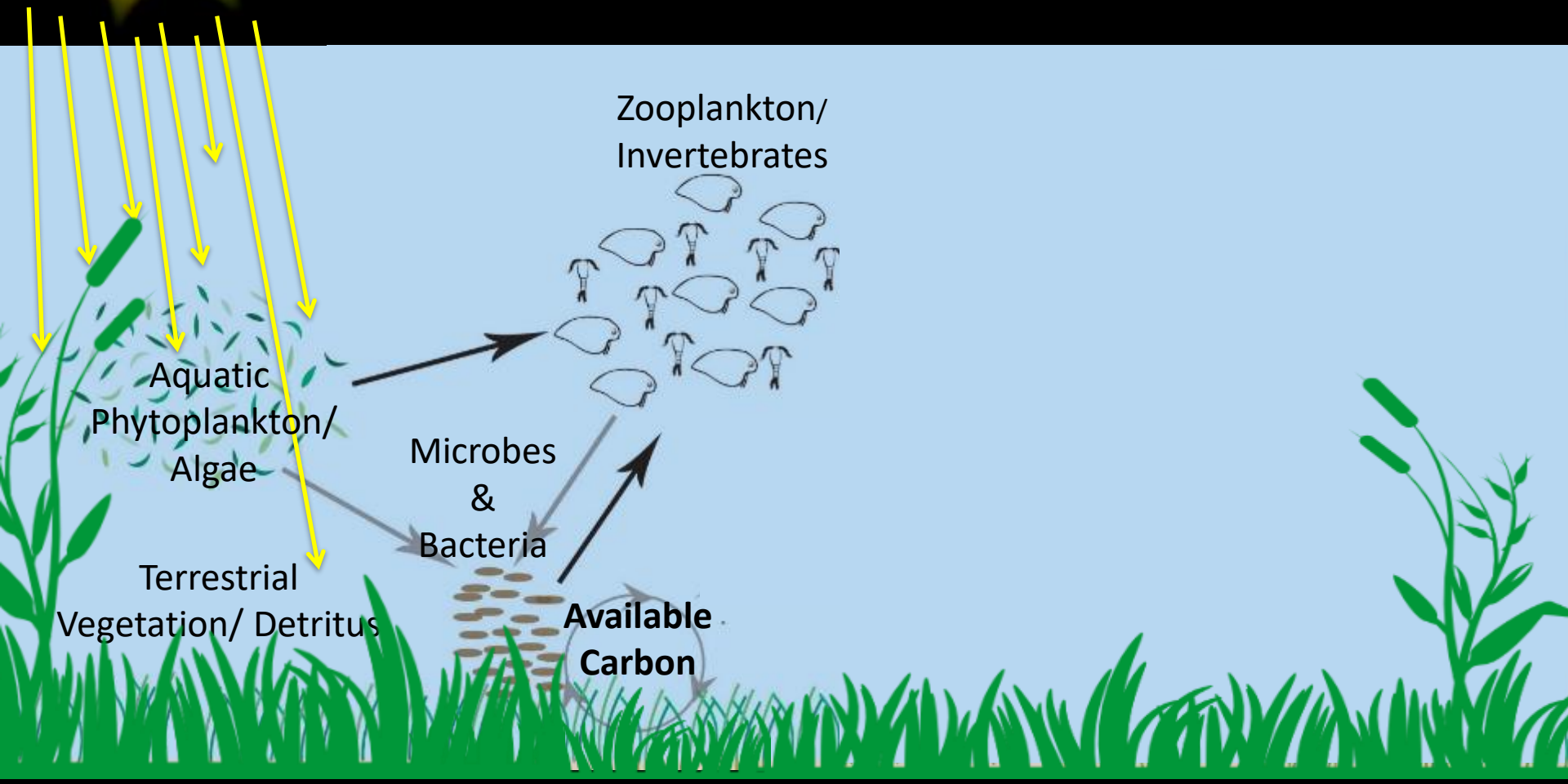


Bug Density	149x	6x	X

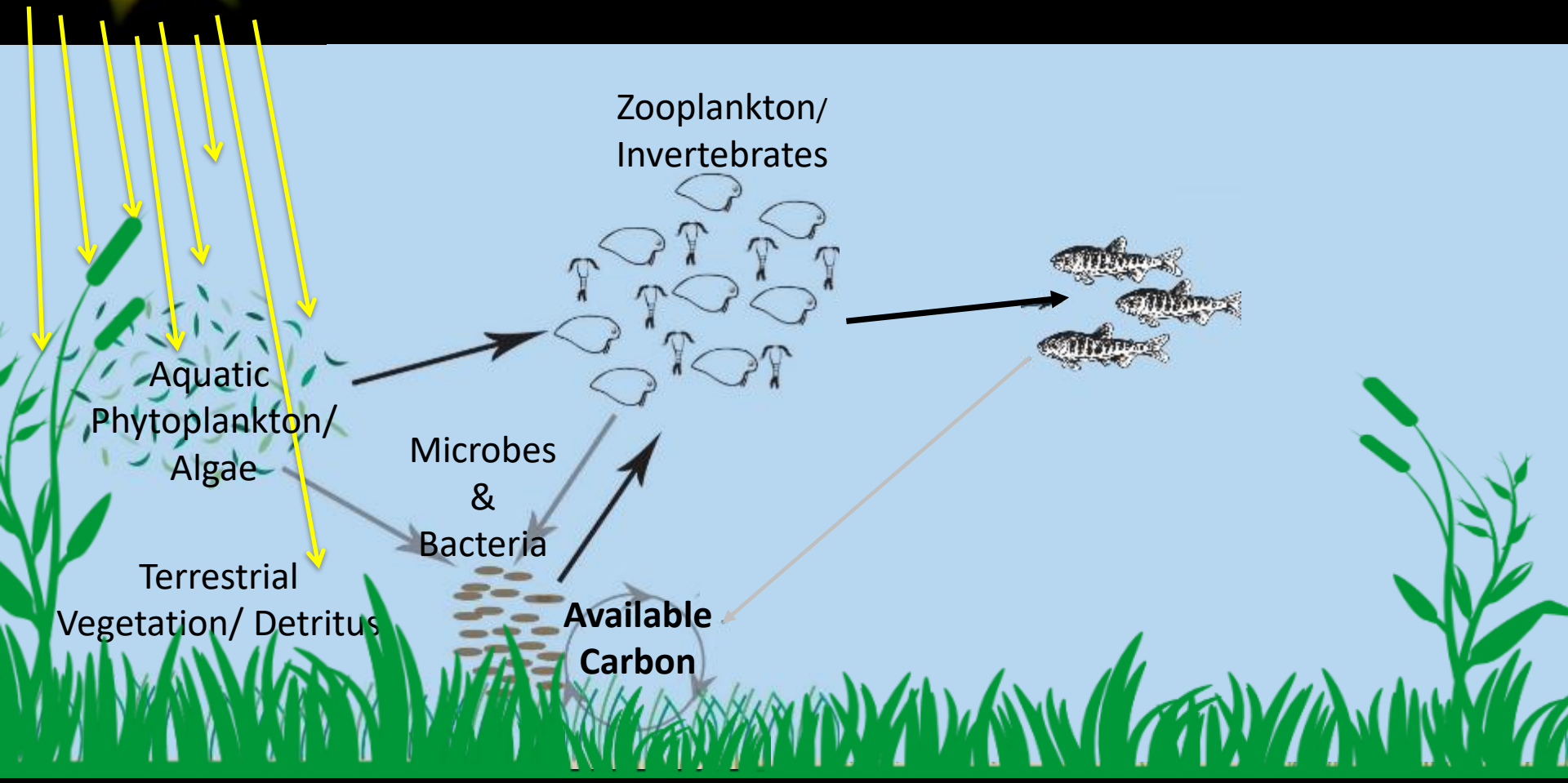
Flooding (ephemeral inundation) facilitates energy transfer into river food webs



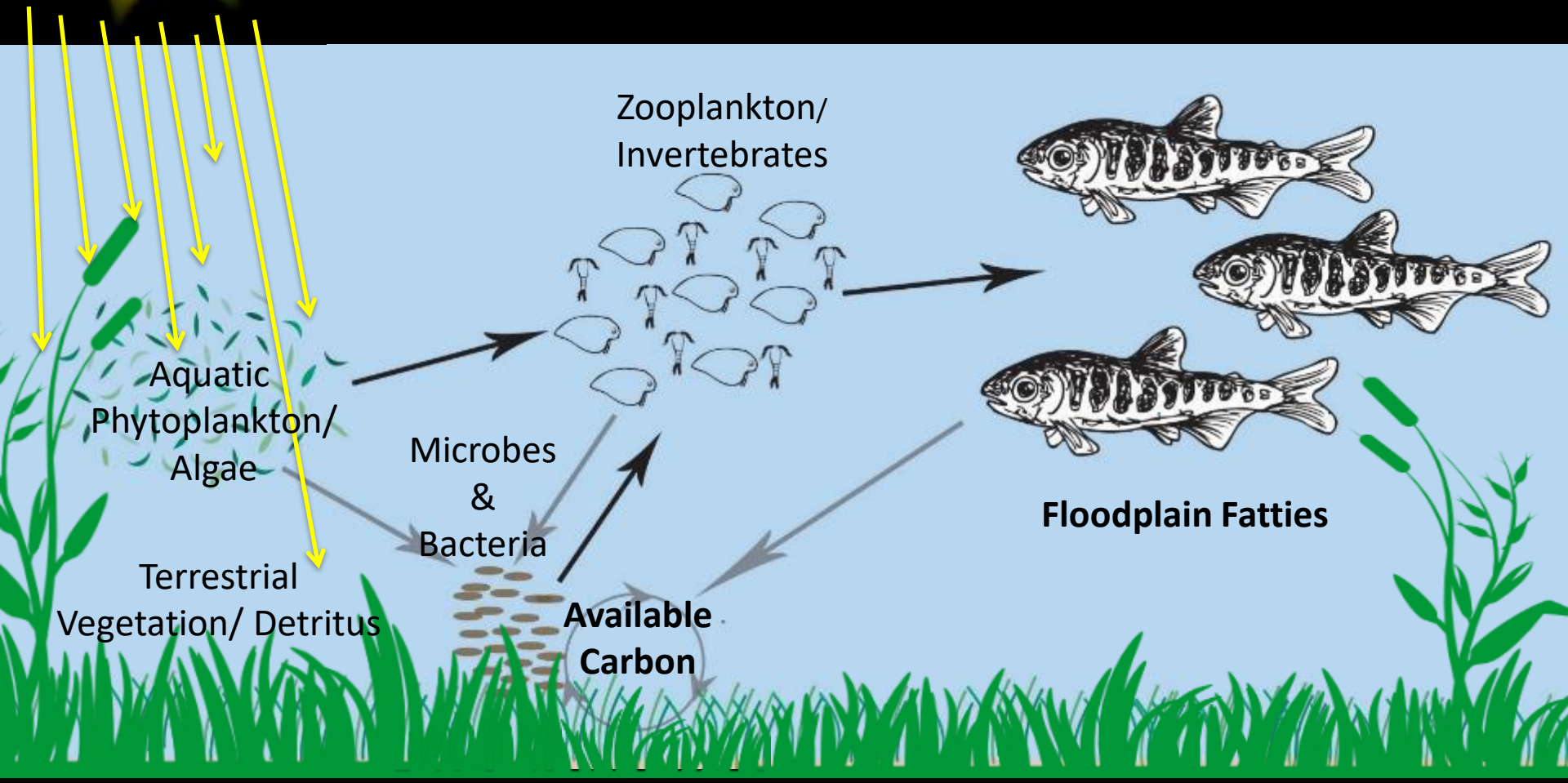
The Process Doesn't Happen Instantaneously



MAKING FISH

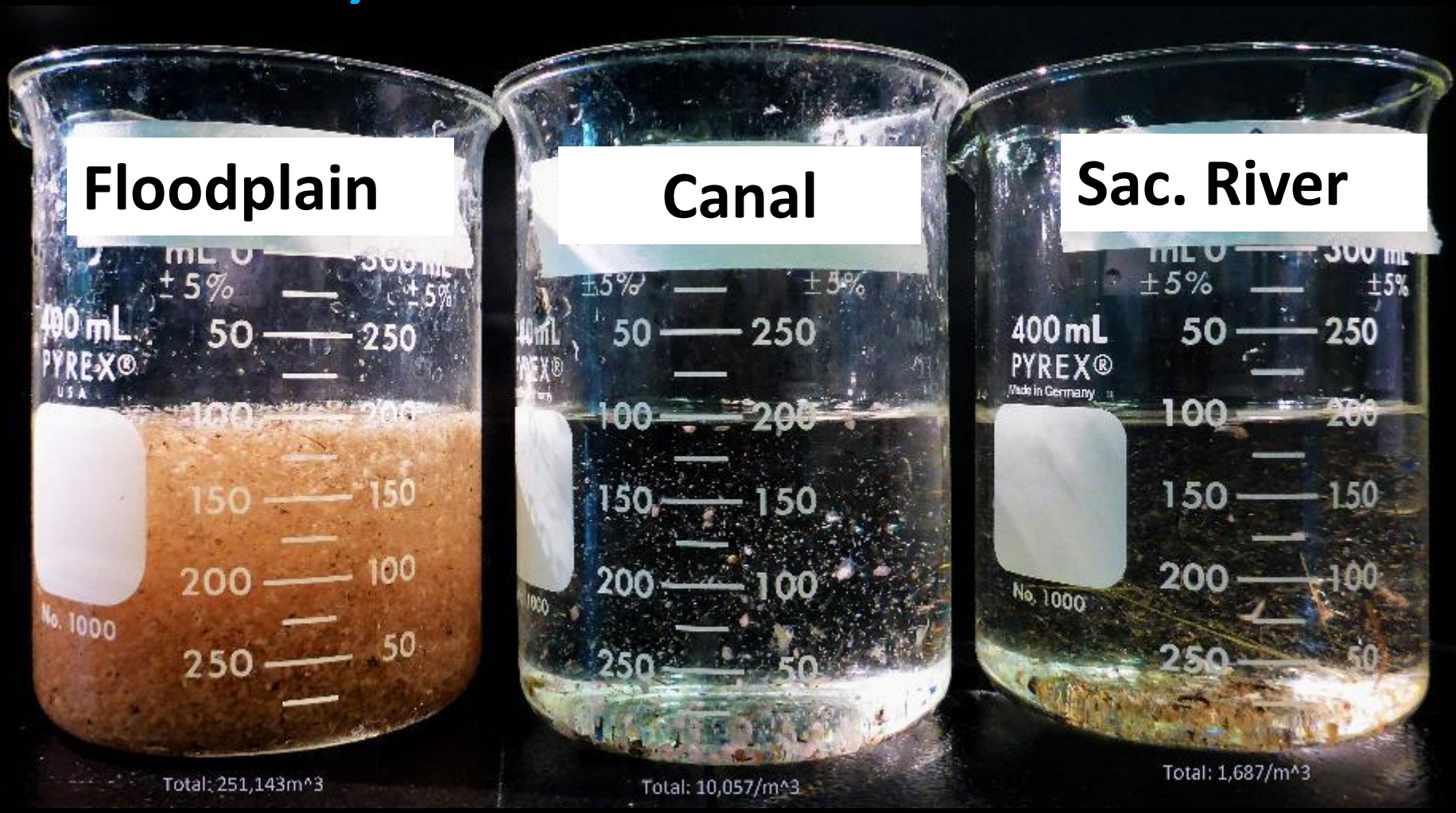

Zooplankton/
Invertebrates
Aquatic
Phytoplankton/
Algae
Microbes
&
Bacteria
Terrestrial
Vegetation/ Detritus
Available
Carbon

TAKES TIME!


Zooplankton/
Invertebrates
Aquatic
Phytoplankton/
Algae
Microbes
&
Bacteria
Terrestrial
Vegetation/ Detritus
Available
Carbon
Floodplain Fatties

Residence Time of Water

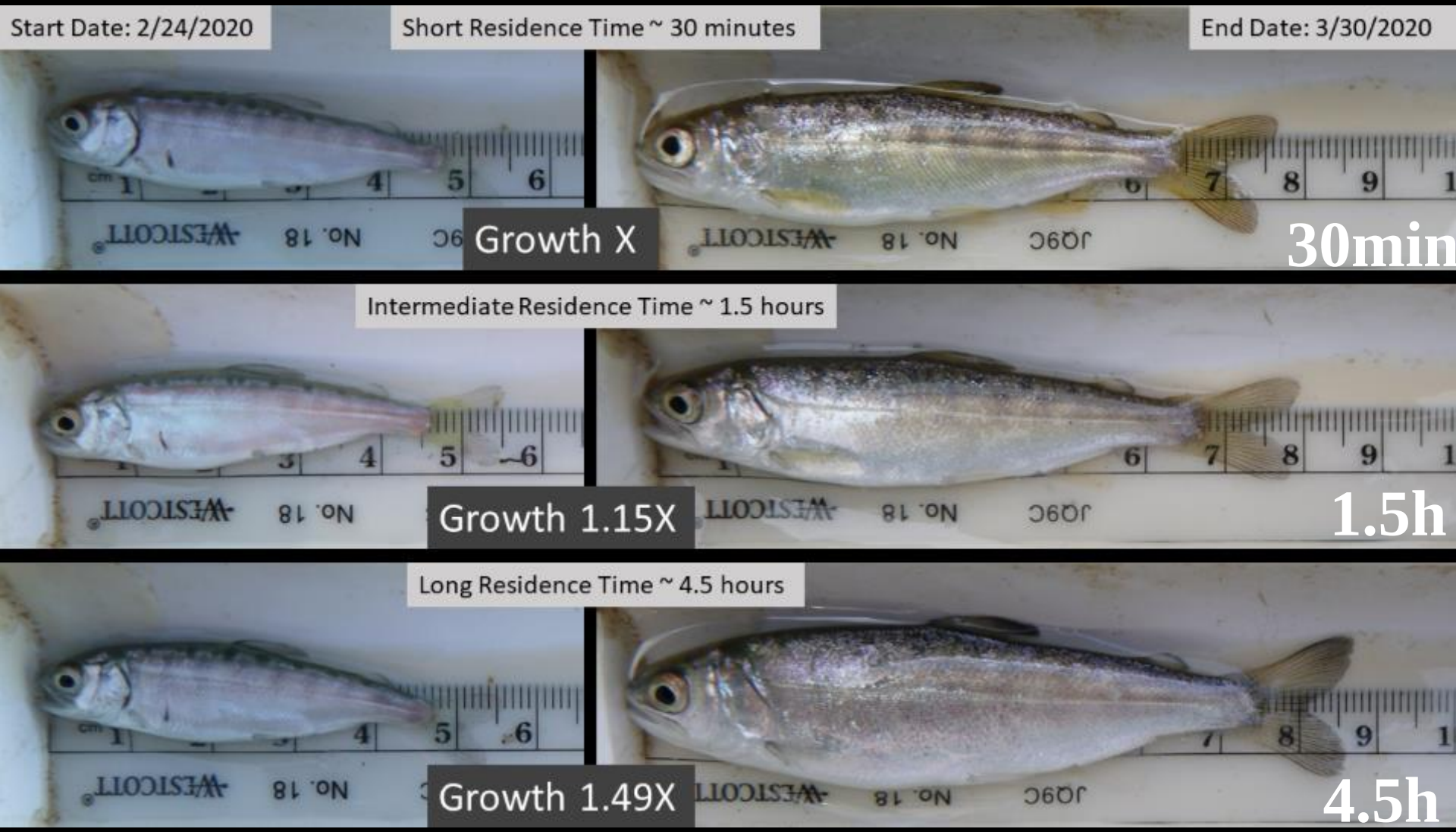
2.15 days 23.5 sec 1.7 sec



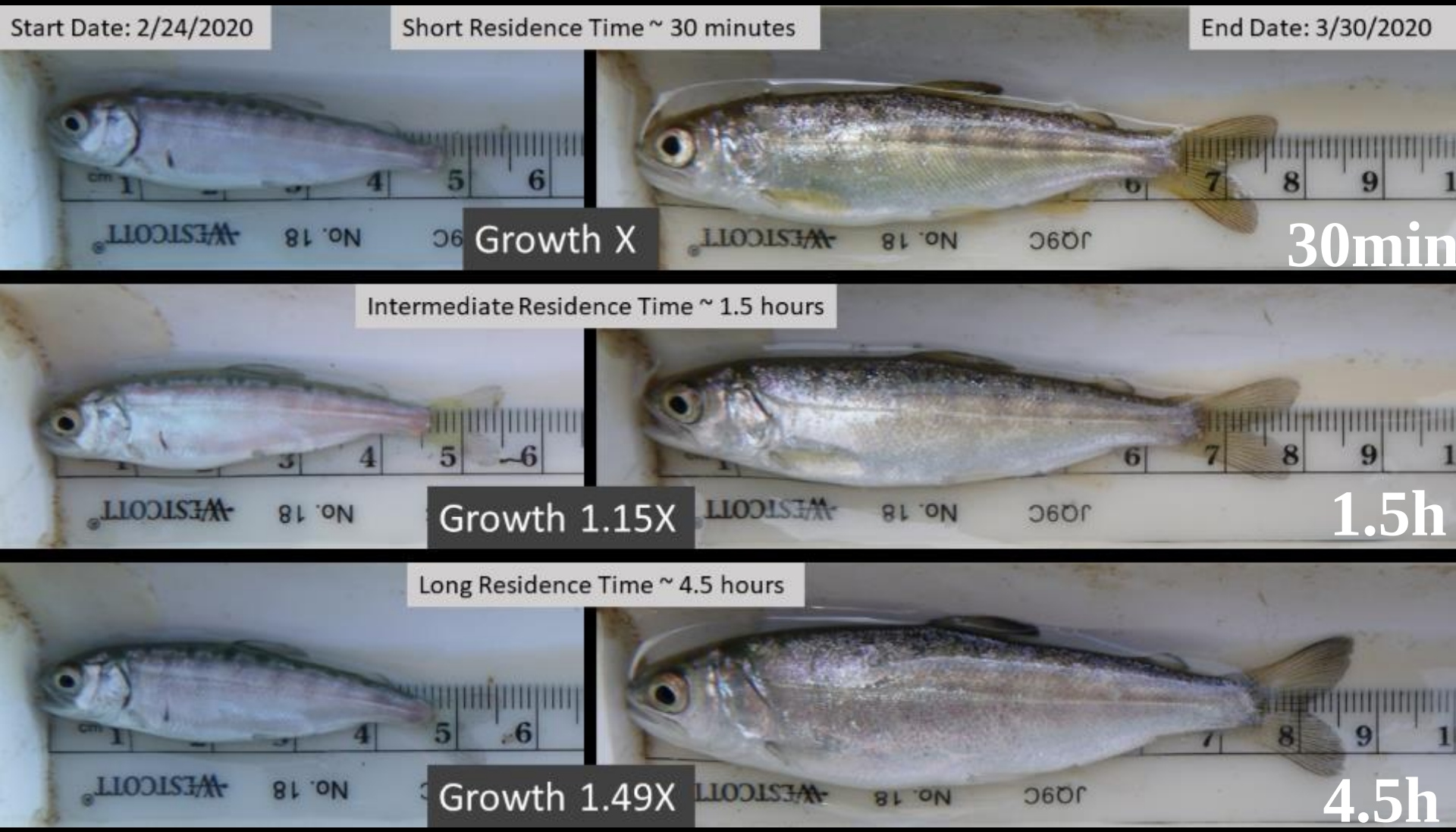
Spread it–Slow it–Sink it–Grow it

Harnessing Puddle Power

It’s about Time!

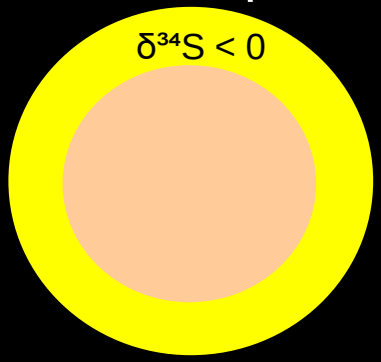


Slow it = Grow it

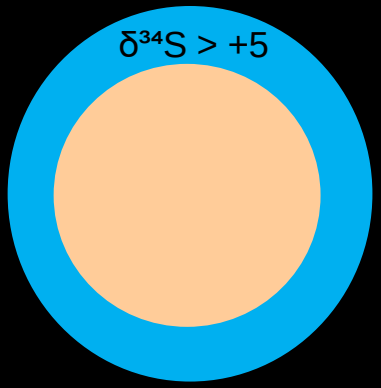


Eye lens diet reconstructions

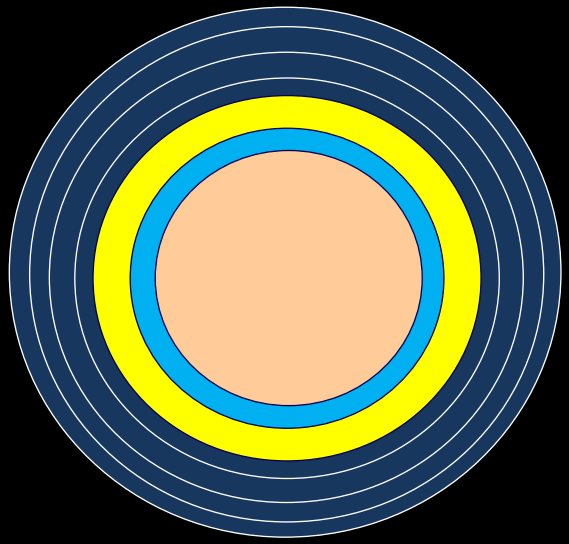
Floodplain

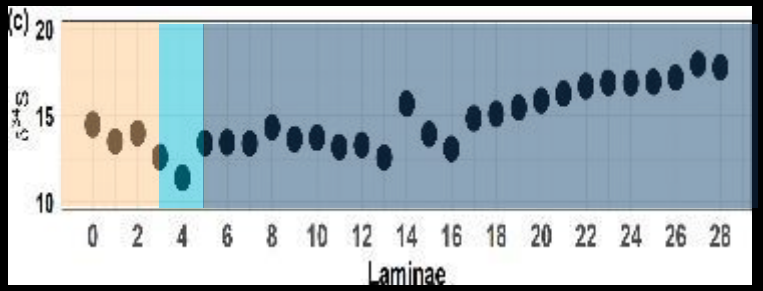


River



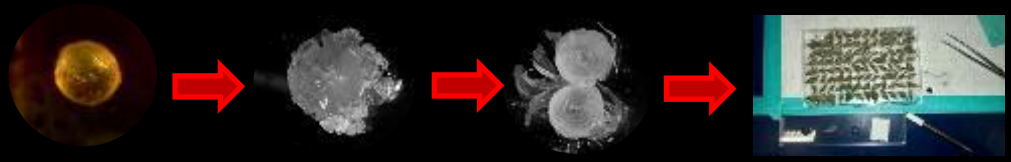
Multiple habitats



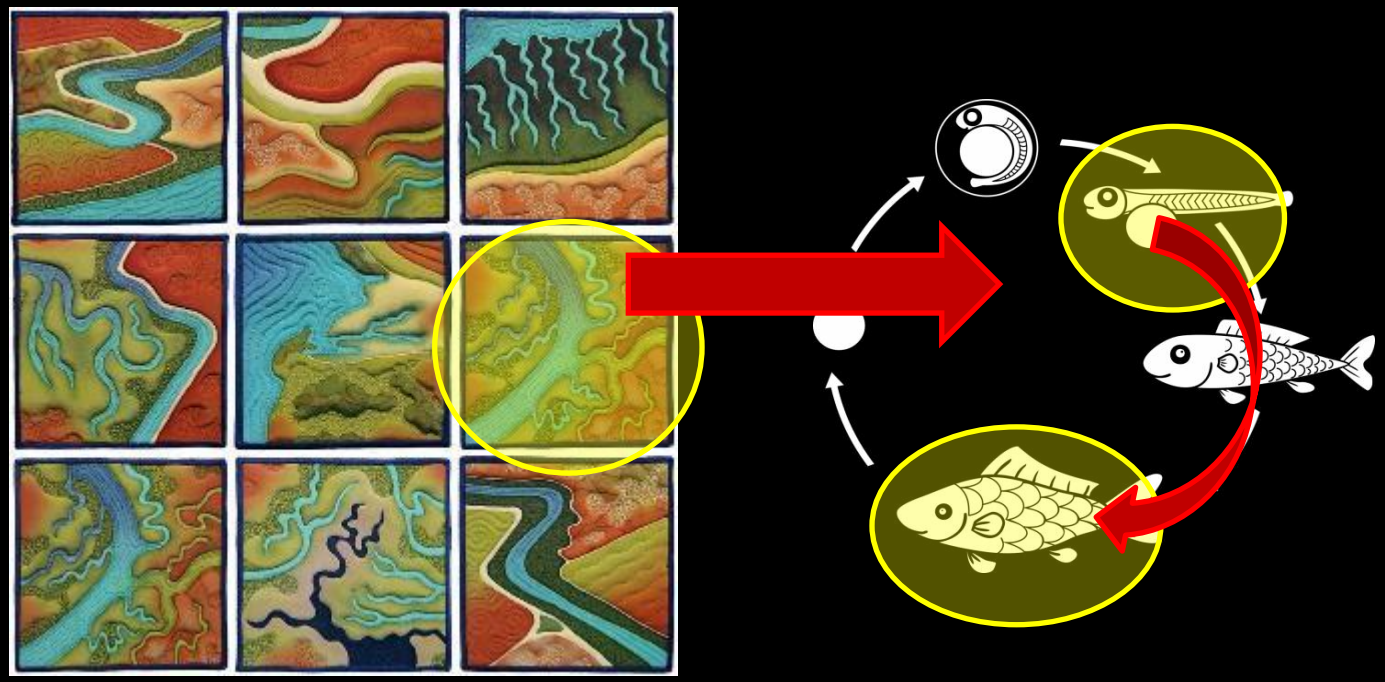


Bell-Tilcock et al. 2021

Delamination

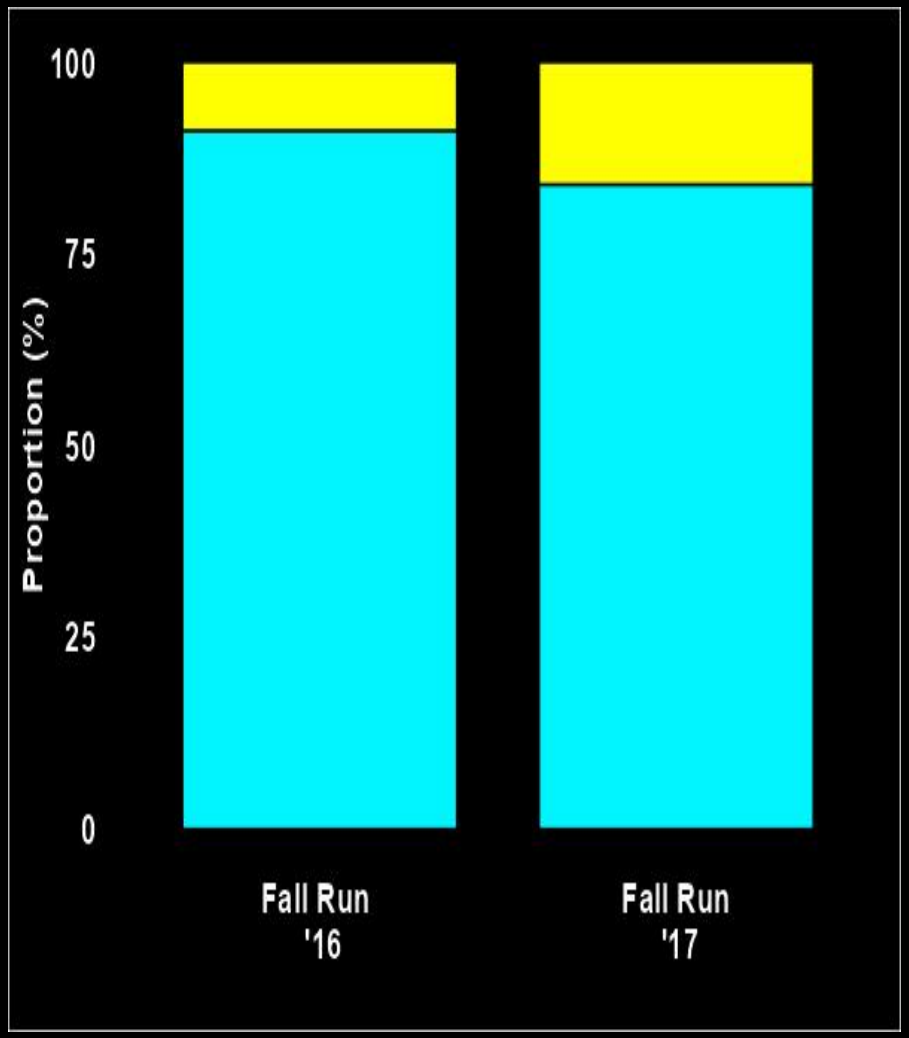


Quantifying the role of floodplains as nursery habitats for salmon populations

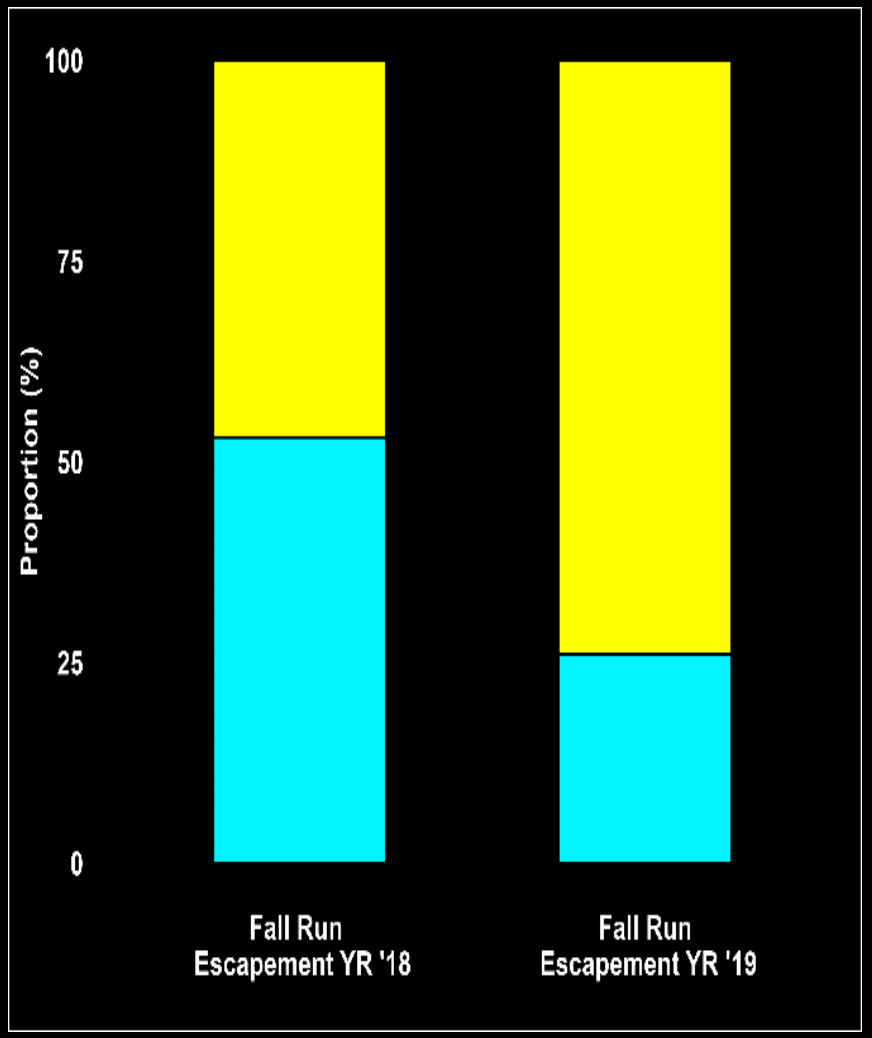


Who leaves? Who comes back?

Juvenile Outmigrants

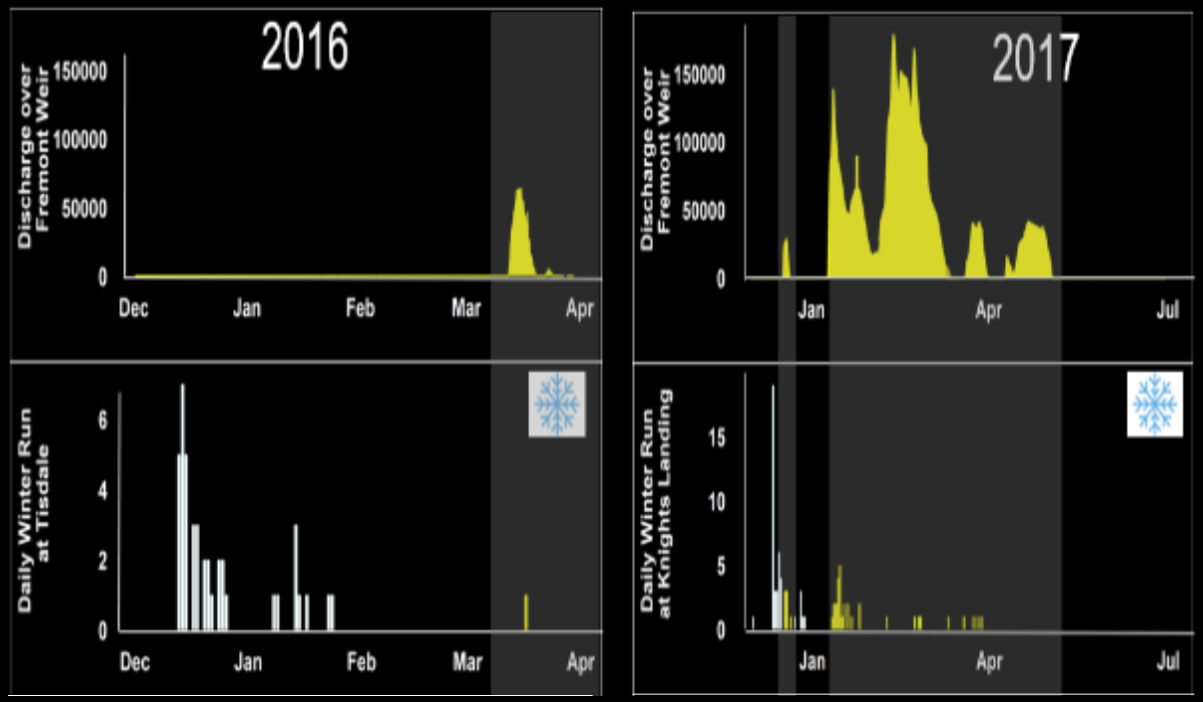


Adult survivors

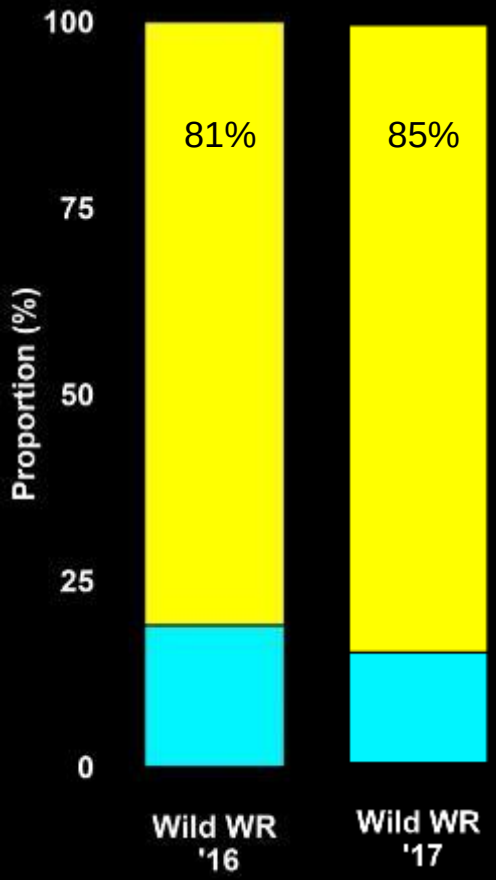


Fall-run Chinook

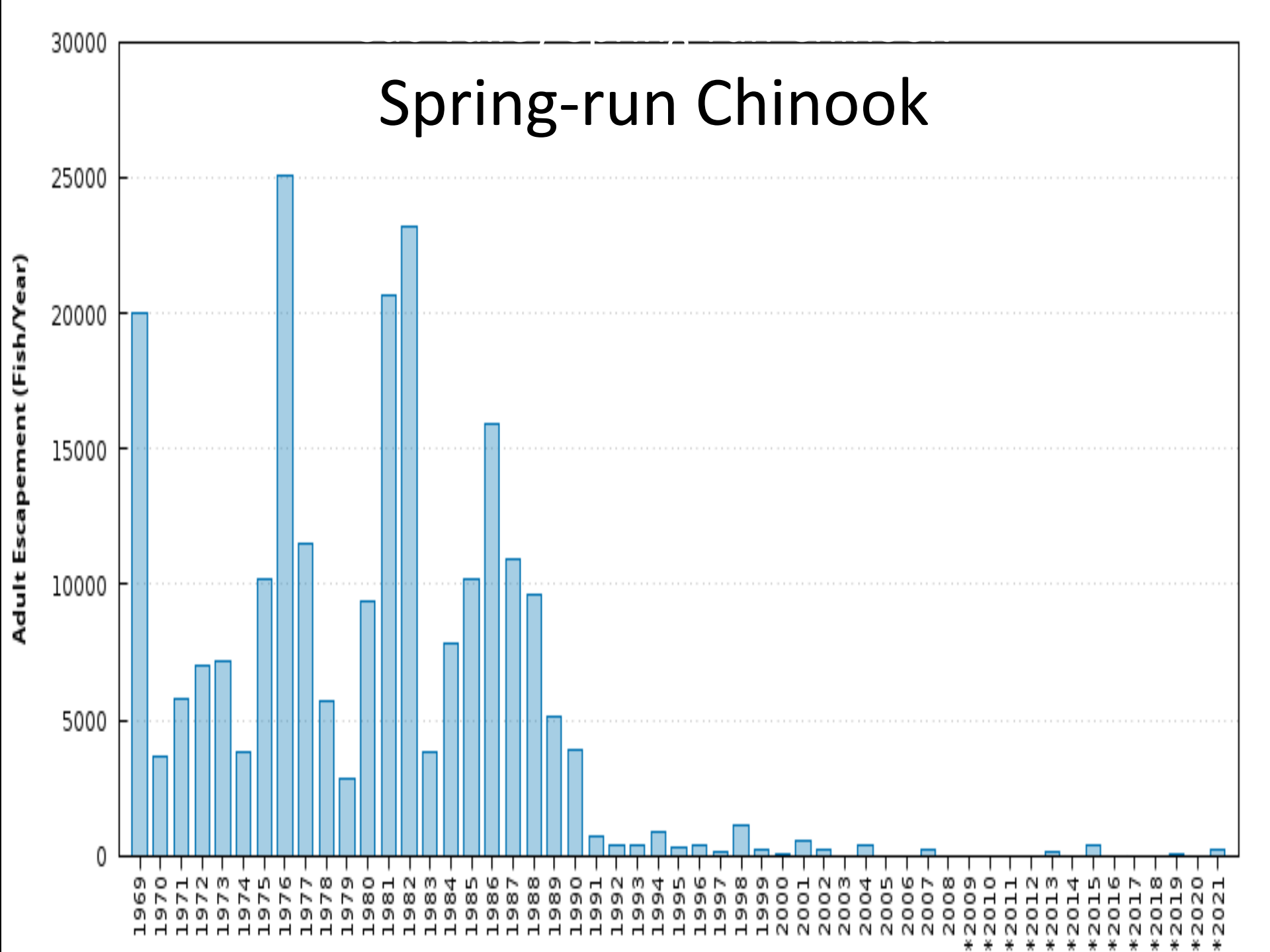
Floodplain opportunity



Survivors



Winter-run Chinook


Spring-run Chinook
Adult Escapement (Fish/Year)
30000
25000
20000
15000
10000
5000
0
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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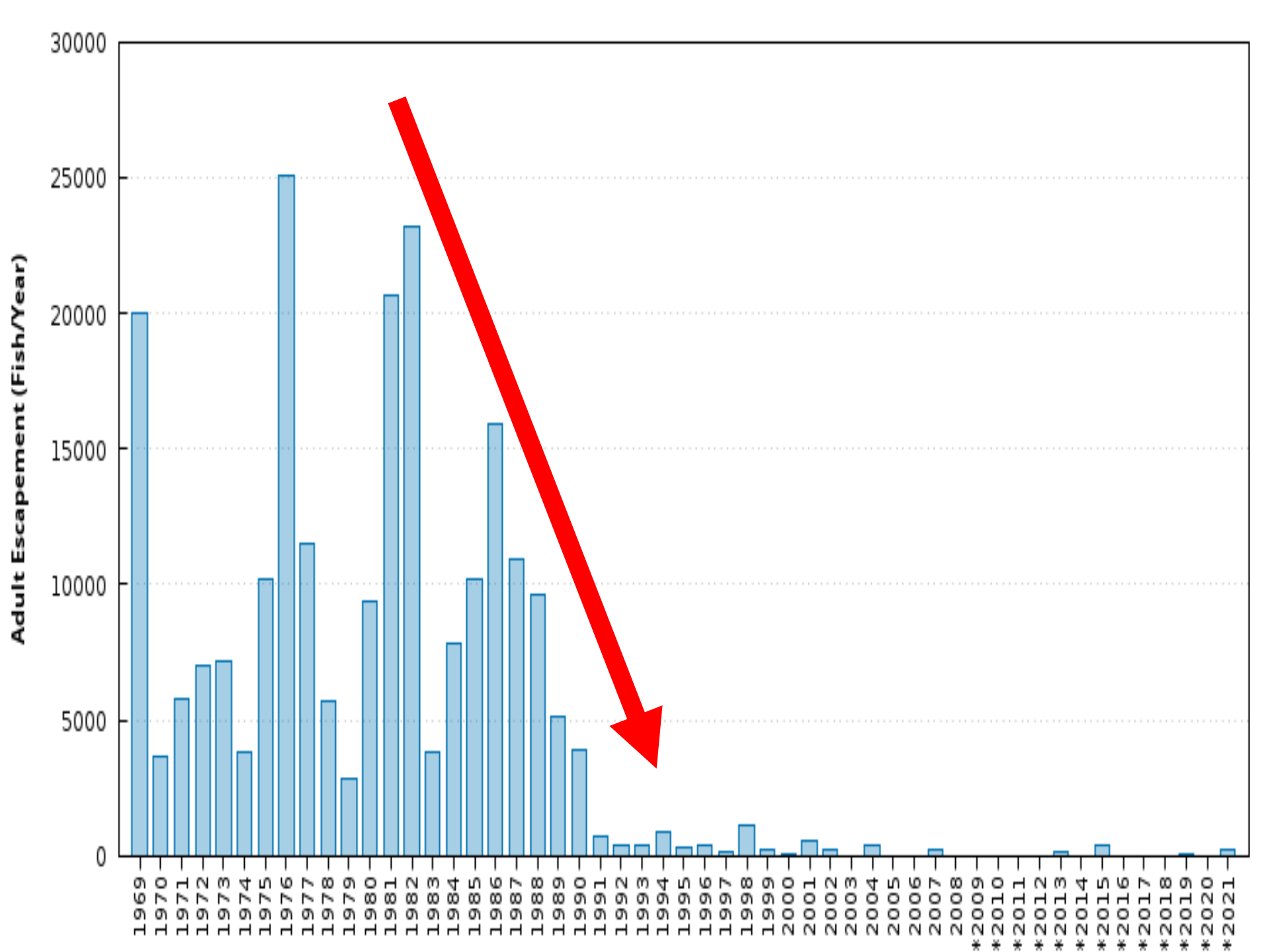
*2020
*2021


Adult Escapement (Fish/Year)
30000
25000
20000
15000
10000
5000
0
1969
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1977
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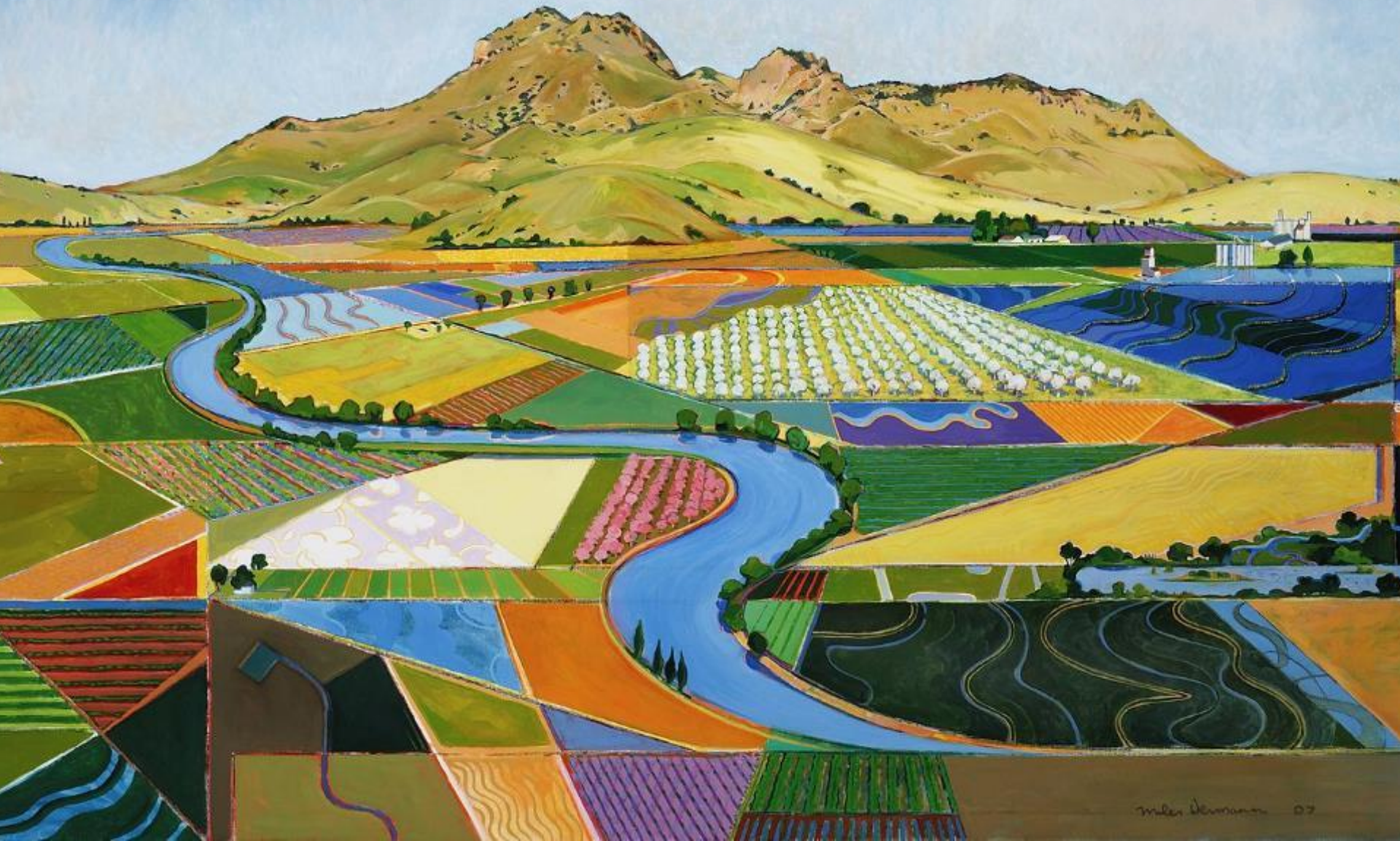
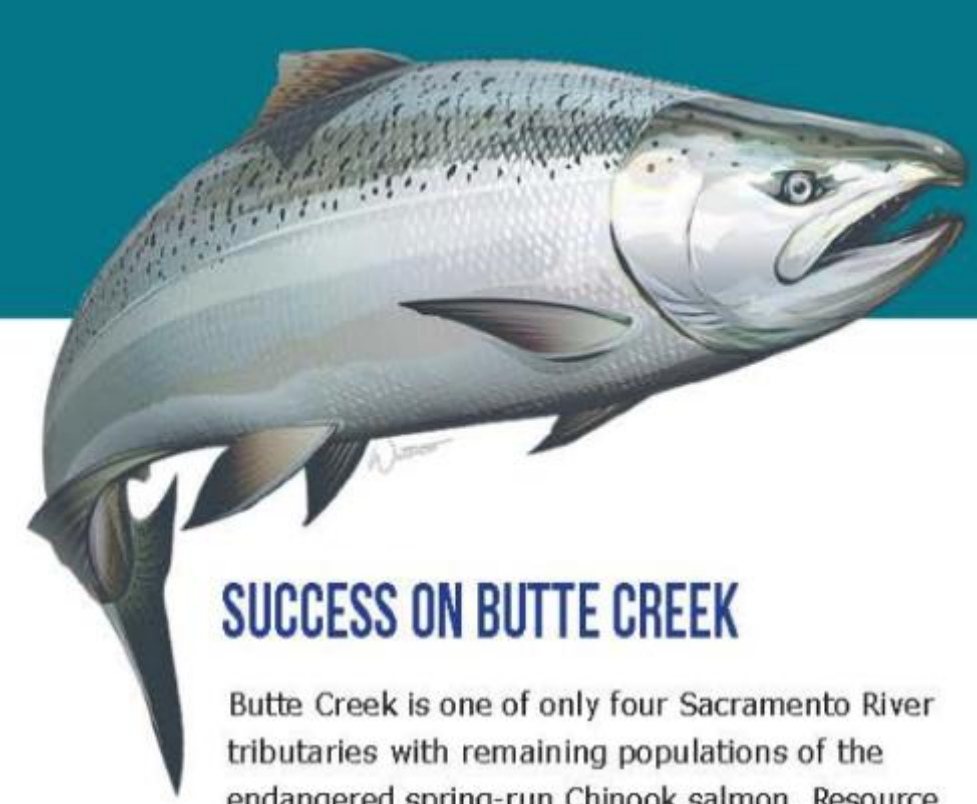
*2021

Sutter Buttes



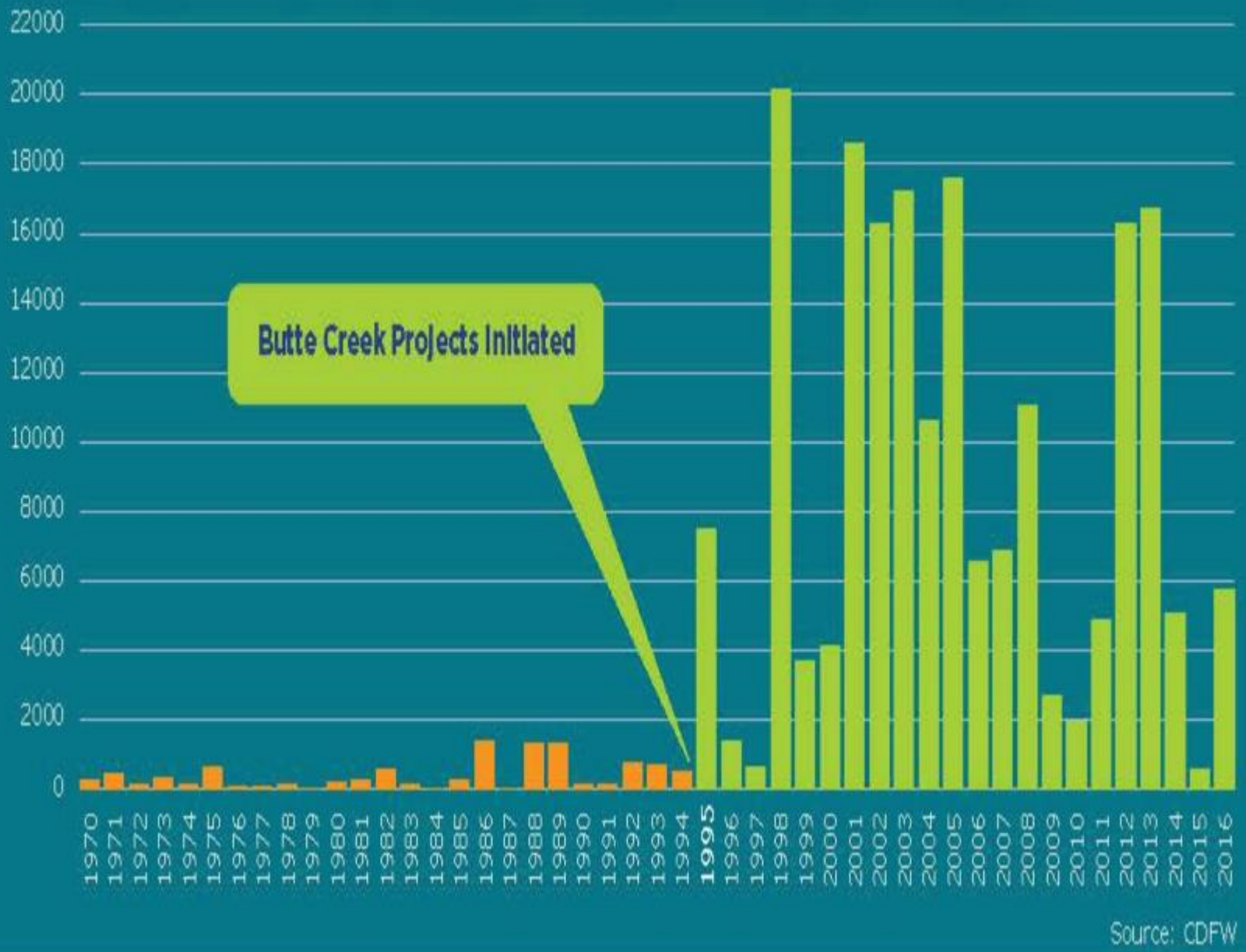
SUTTER BUTTES AND ORCHARDS IN BLOOM



SUCCESS ON BUTTE CREEK

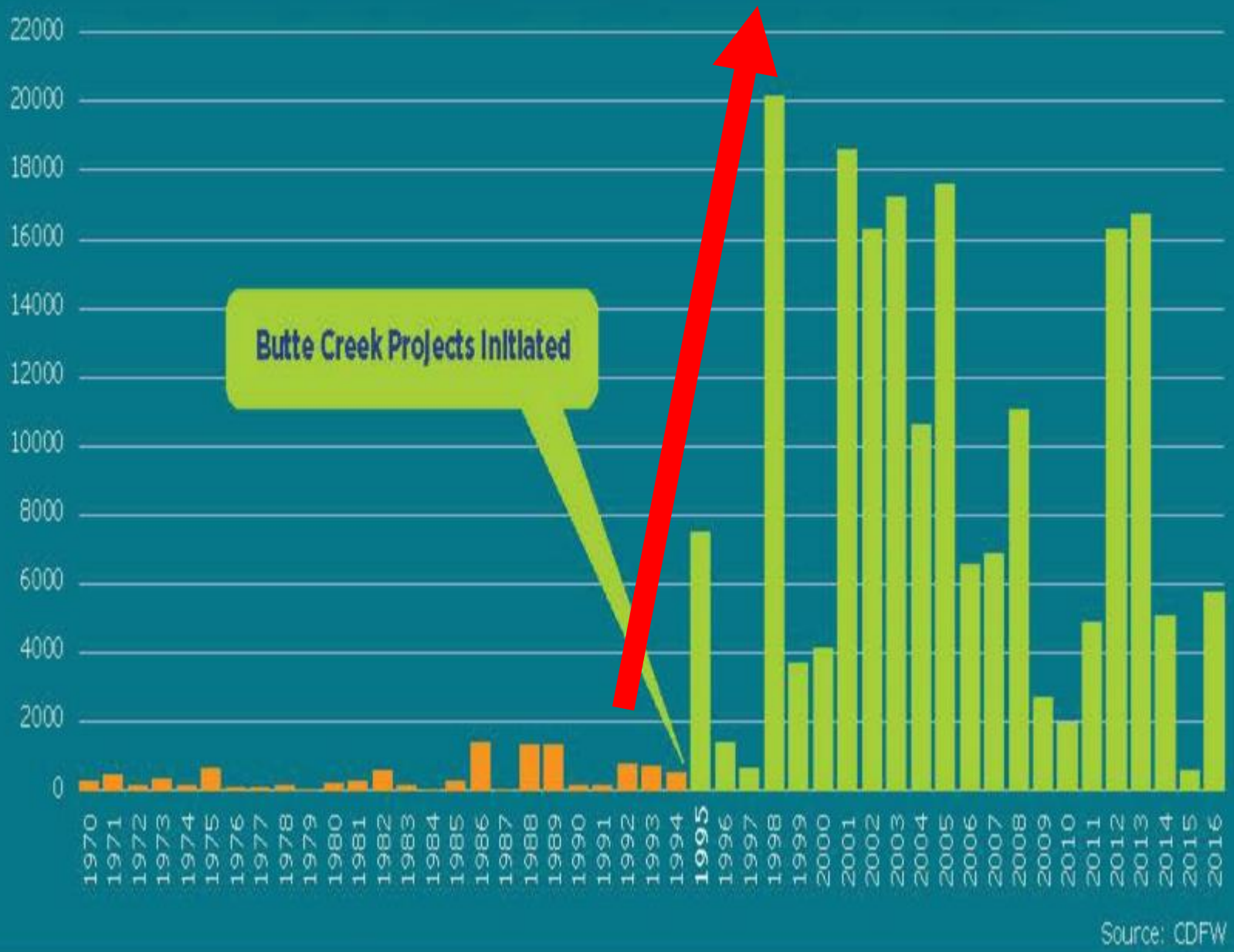
Butte Creek is one of only four Sacramento River tributaries with remaining populations of the endangered spring-run Chinook salmon. Resource agencies and conservation groups value Butte Creek as a keystone in preserving and recovering spring-run salmon, which in some years had dwindled to less than a 100 returning adults from 1970 to the early 1990s. Today, as a result of the Butte Creek Fish Passage Improvement projects, in tandem with a valuable food supply and safe rearing habitat in the Sutter Bypass wetlands, more than 10,000 spring-run salmon return on average to Butte Creek. These projects all provide multiple beneficial uses, serving water for fish, farms, birds and various other species.

BUTTE CREEK SPRING-RUN CHINOOK SALMON POPULATION ESTIMATES



Source: CDFW

BUTTE CREEK SPRING-RUN CHINOOK SALMON POPULATION ESTIMATES



Source: CDFW

Butte Sink & Sutter Bypass

Butte Creek Spring run smolts: Floodplain Fatties

FLOODPLAIN FORWARD

2025

FLOODPLAIN FORWARD

A 31-member organization representing landowners, irrigation districts, higher education, and conservation groups. The coalition, and the collaborative model of dynamic conservation, has resulted in farms, refuges, and managed wetlands providing essential habitat for waterfowl and shorebirds as well as potential food production for endangered fish species.

The Nigiri Project
CAL MARSH & FARM VENTURES

Conaway
PRESERVATION GROUP

LUNDBERG
FAMILY FARMS

MONTNA
FARMS

DAVIS RANCHES
SYCAMORE · CALIFORNIA

River Garden Farms

Est. 1861
Llano Seco
Chico, CA

108
RECLAMATION DISTRICT

GCID
GLENN-COLUSA IRRIGATION DISTRICT

Ecosystem
Investment
Partners

Sutter Mutual
Water Company

UCDAVIS
CENTER FOR
WATERSHED SCIENCES

sacramento
river
forum

CALIFORNIA TROUT
FISH · WATER · PEOPLE

The Nature
Conservancy
Protecting nature. Preserving life.

Point Blue
Conservation
Science

RIVER
PARTNERS

DUCKS
UNLIMITED

CSAC

AMERICAN
RIVERS

YOLO BASIN
FOUNDATION

Sustainable Conservation

TROUT
UNLIMITED

Environmental
Defense
Fund

NCWA
Northern California Water Association

RECLAMATION
DISTRICT 1500

RCRC
RURAL COUNTY REPRESENTATIVES
OF CALIFORNIA

BLACK FOX BRAND
ROBBINS RICE

Audubon
CALIFORNIA

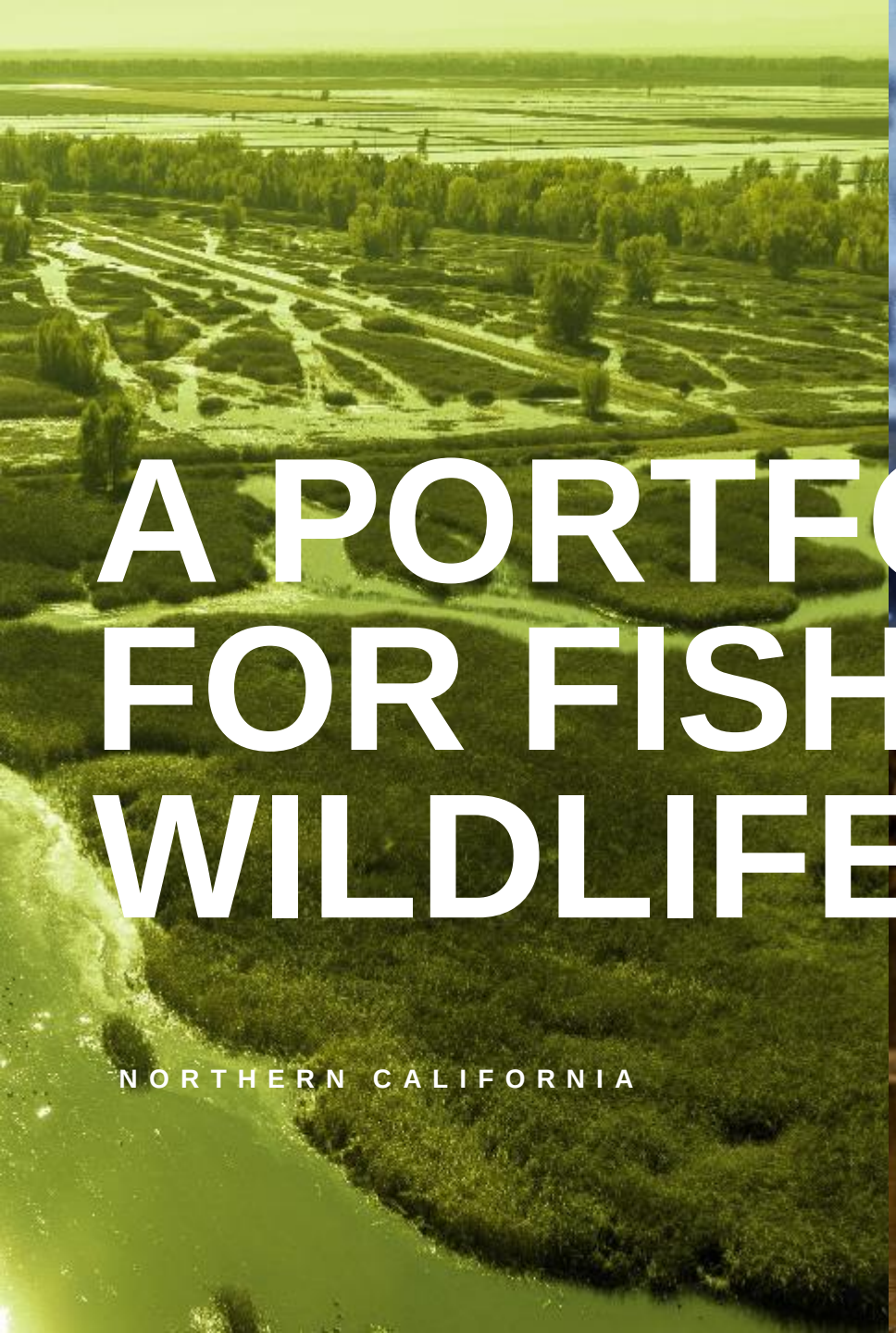
California Rice
THE ENVIRONMENTAL CROP

CALIFORNIA
WATERFOWL

Ridgetop to River Mouth

A Functional Sacramento Valley Depends on Healthy Rivers, Landscapes and Communities.

The floodplains are at the epicenter of our *ridgetop to river mouth* approach – a nature-based solution to protect and restore our biodiversity while increasing the reliability of our water supply for cities, farms, fish, wildlife, hydropower production, and recreation.



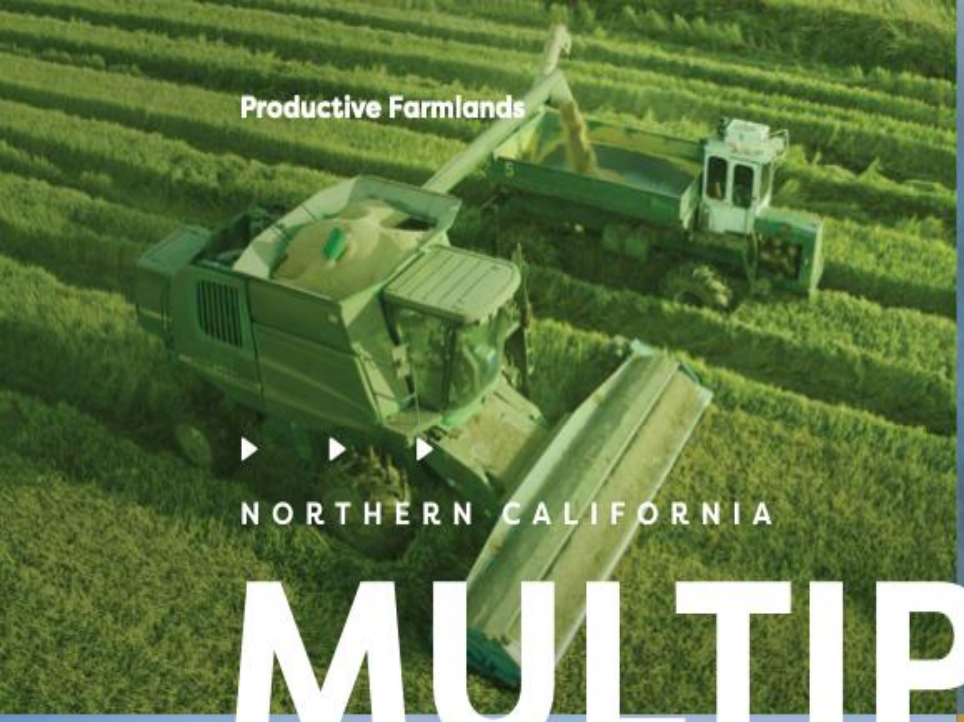
A PORTFOLIO FOR FISH & WILDLIFE

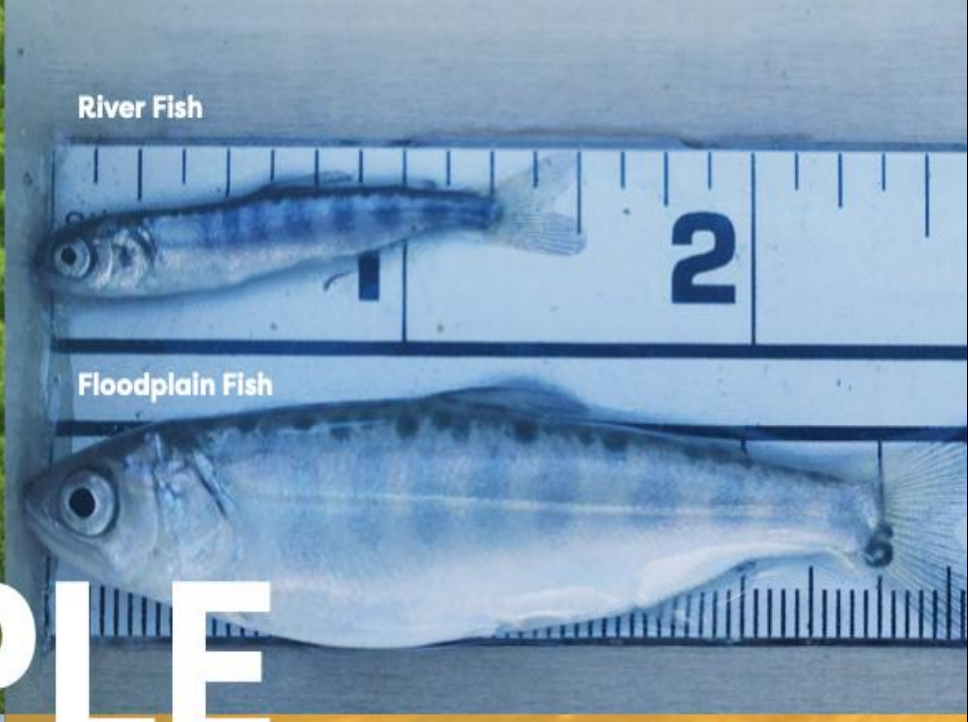
NORTHERN CALIFORNIA

ADVANCING FLOODPLAIN REACTIVATION

In the Sacramento River Basin

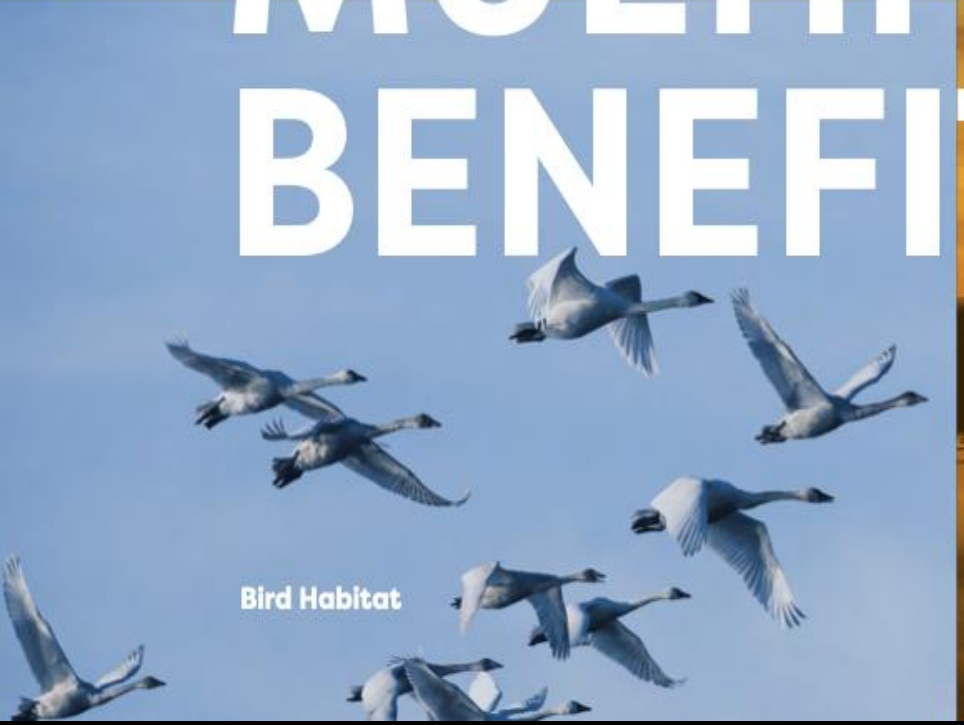
FLOODPLAIN FORWARD





NORTHERN CALIFORNIA

MULTIPLE BENEFITS



FARMING & CONSERVATION

How leading *landowners* and *conservationists* are united in using scientific solutions for fish and wildlife management on our floodplains

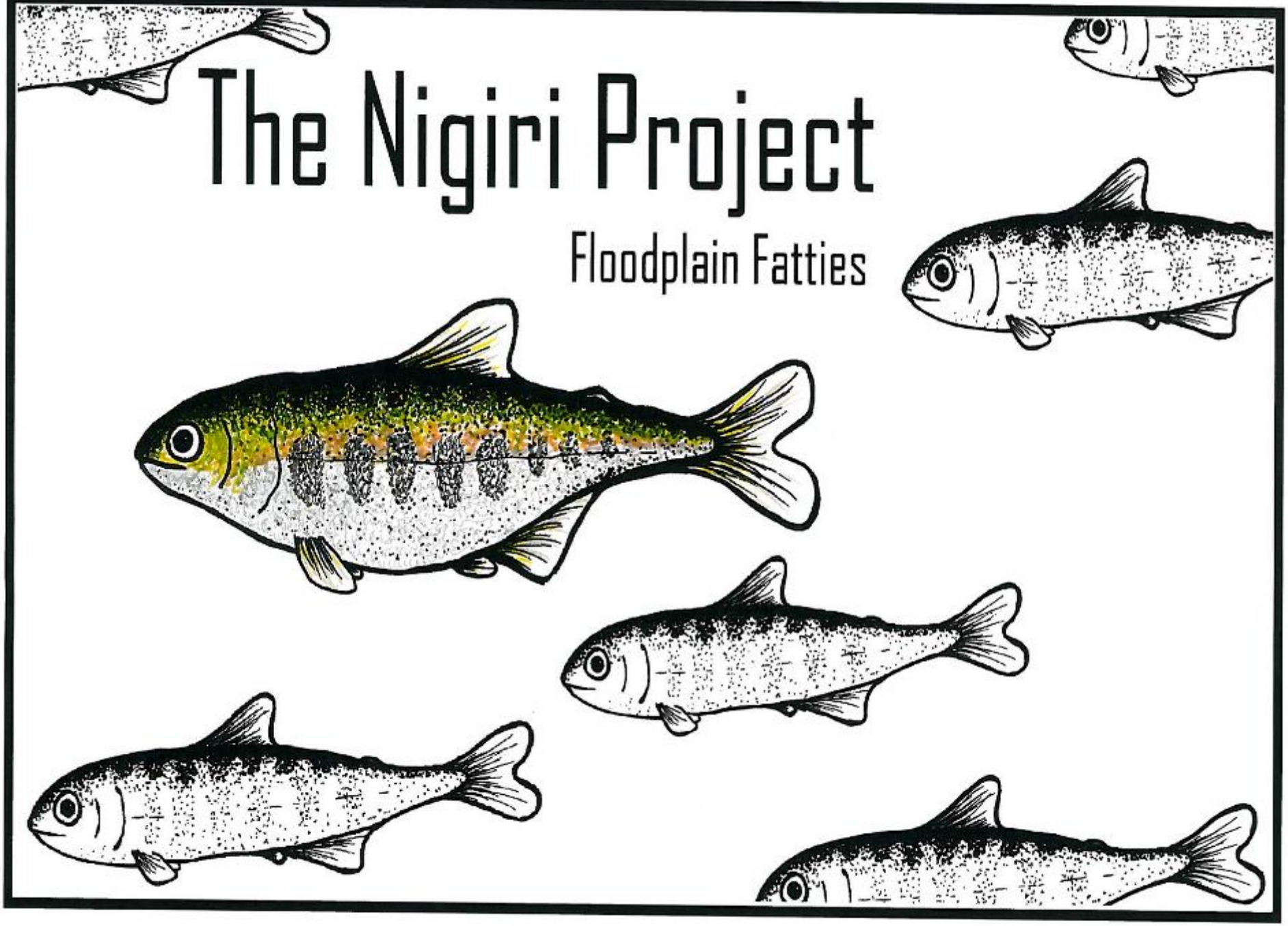
Conservation groups are teaming up with landowners throughout the Sacramento River Basin to help boost wildlife populations on working farmlands year-round. Fields, wildlife refuges, and the bypasses that are designed for food protection are being managed to work together for dynamic conservation efforts. Spreading out and slowing down water across the landscape mimics natural flows and provides multiple benefits year-round by allowing farmers to cultivate rice and other crops for humans during the spring and summer, habitat for wild birds, reptiles, and other fauna in the fall, and food for migratory birds and native fish species in the winter.

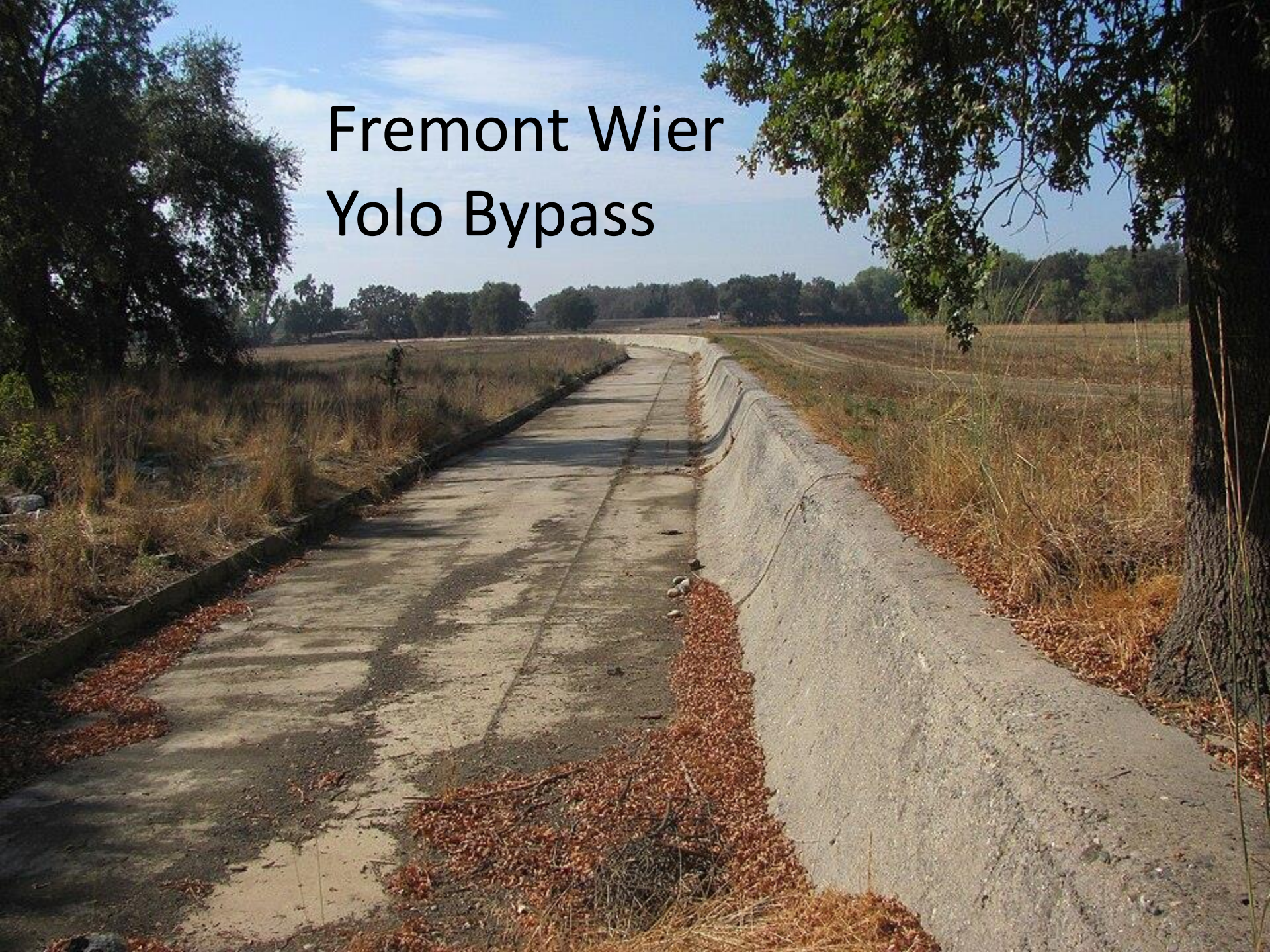
Reactivating Floodplains in the Sacramento River Basin

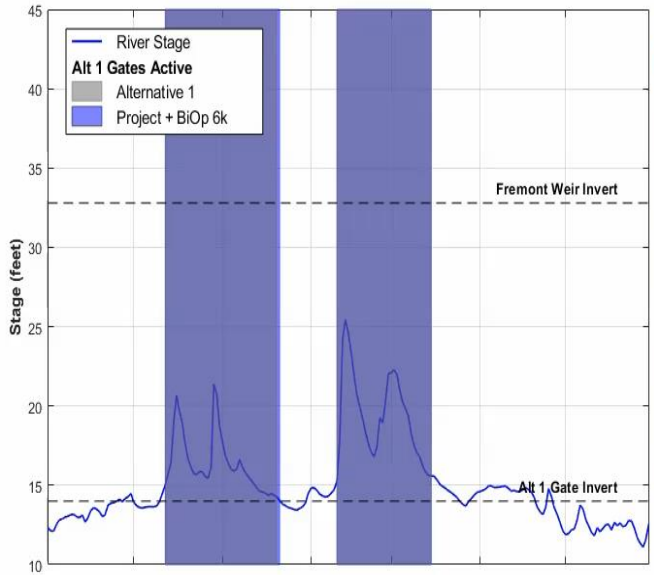
Wet Side

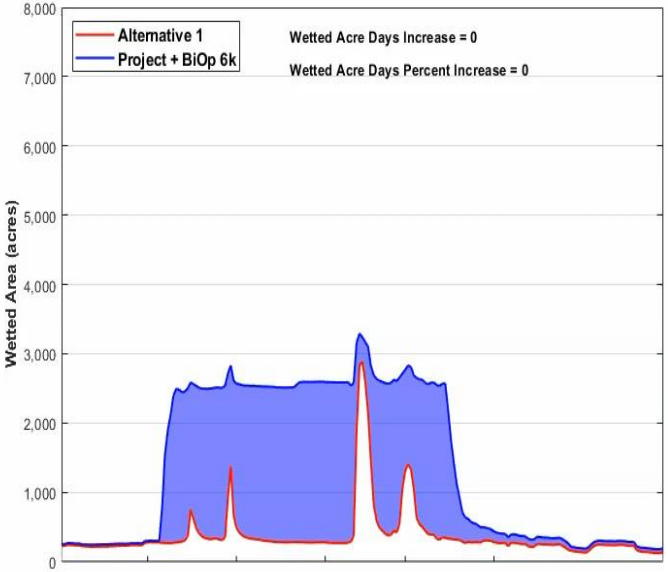
The Nigiri Project

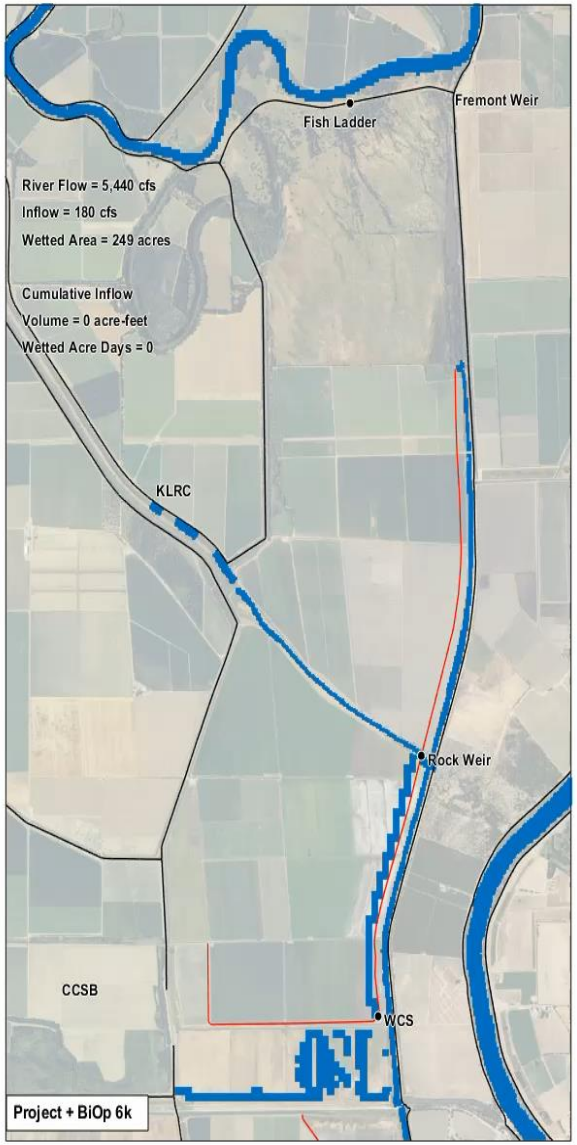
Floodplain Fatties



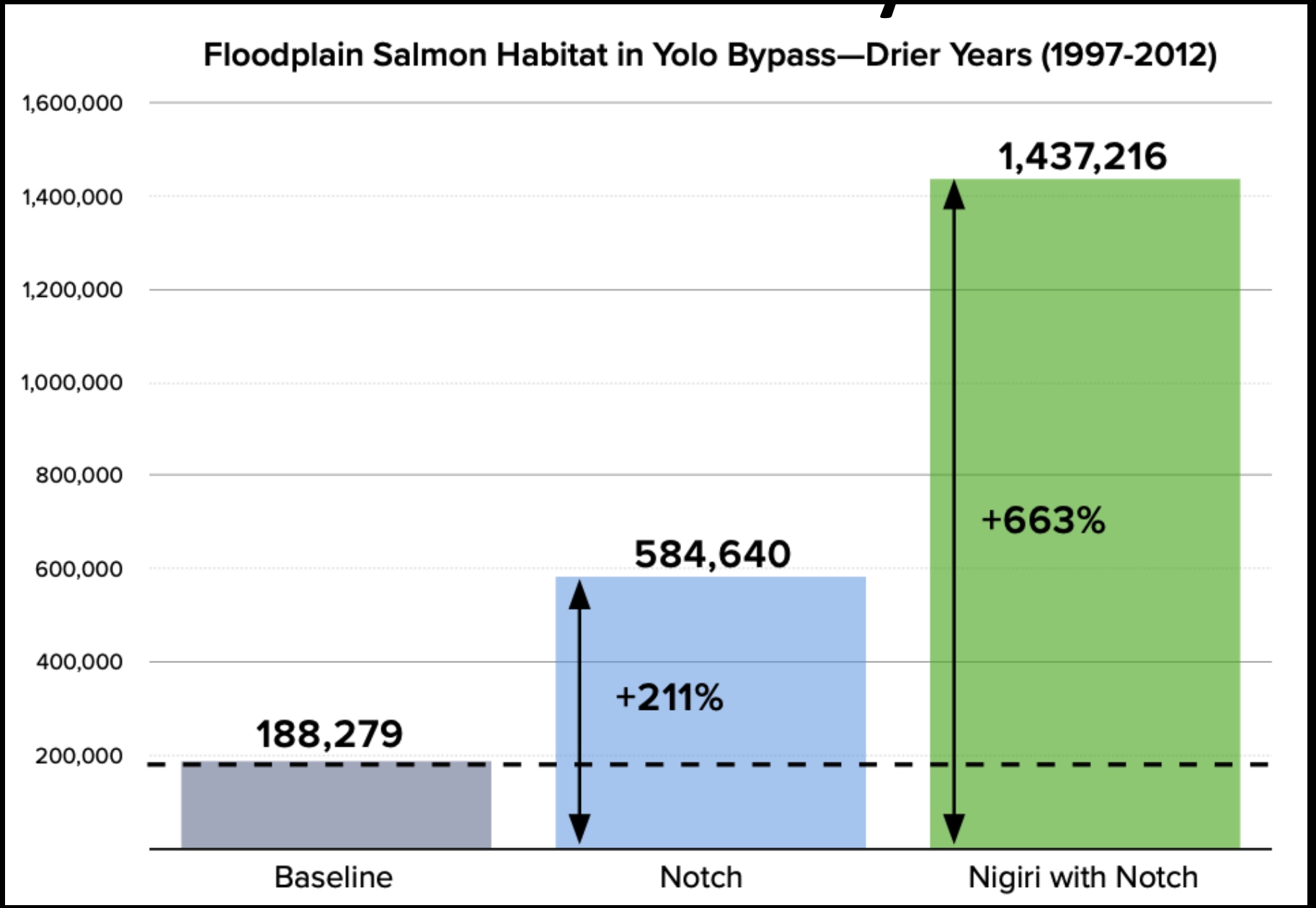

Fremont Wier
Yolo Bypass



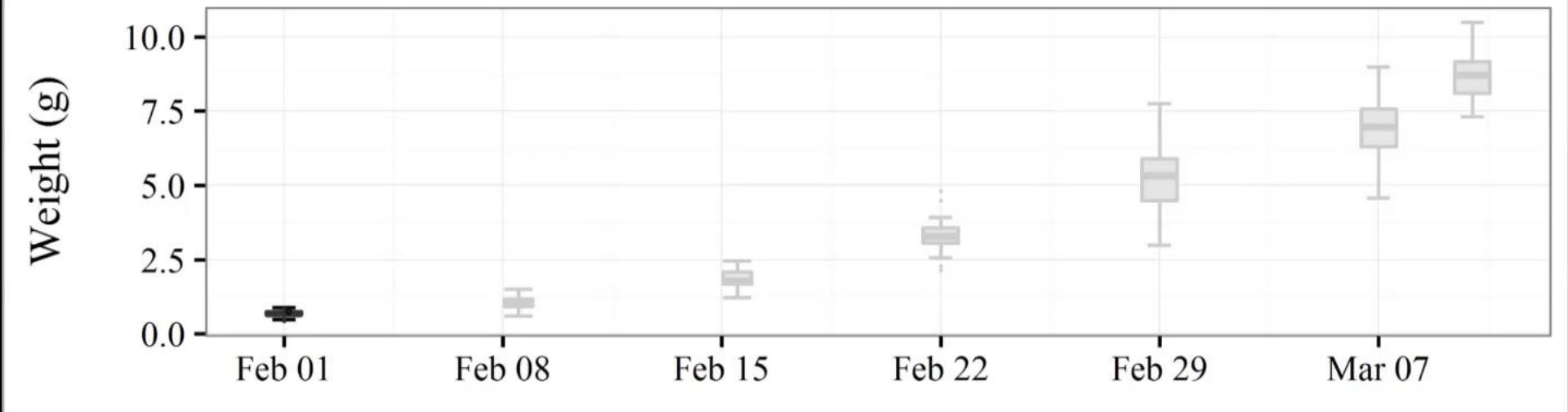




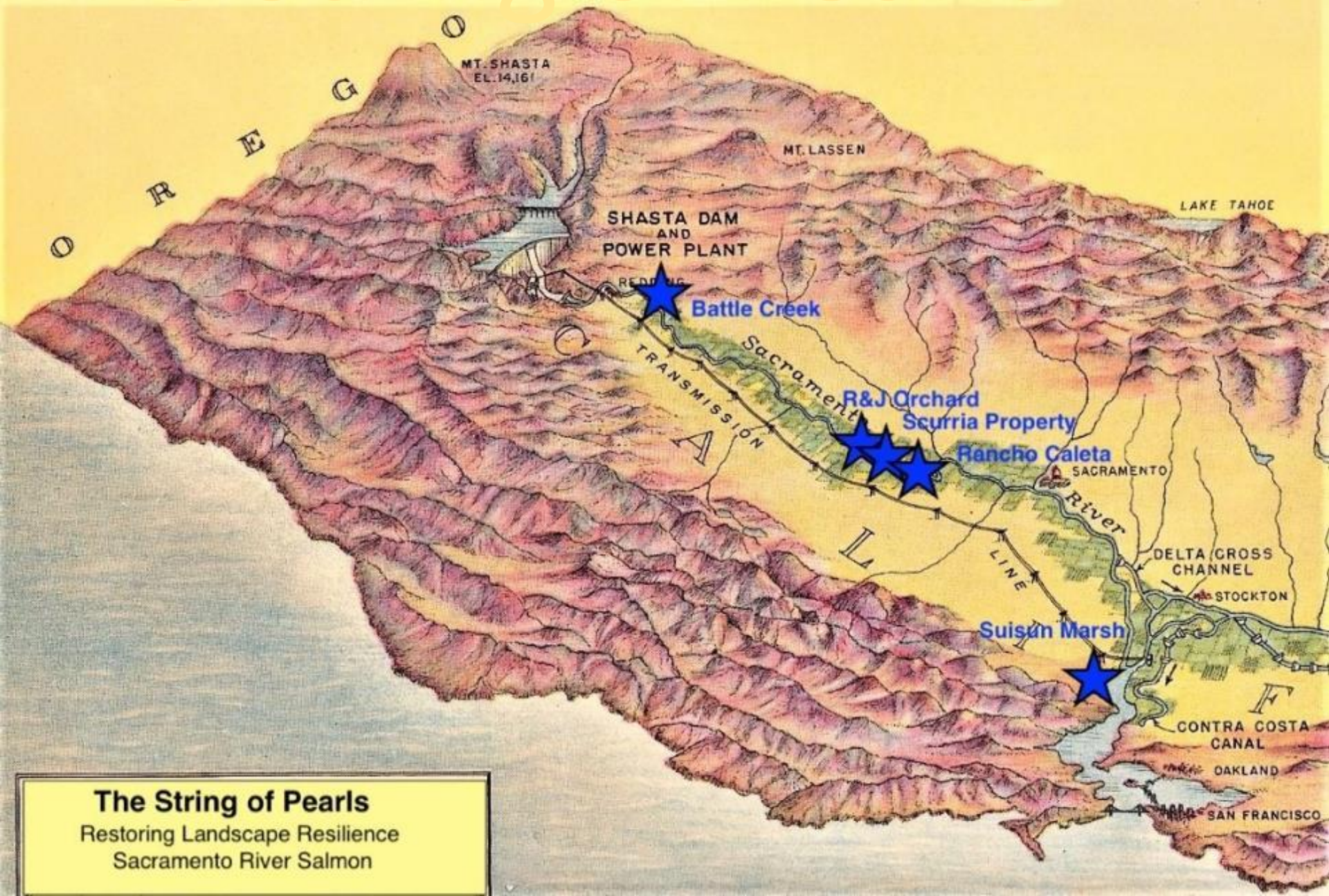
Nov 01, 2006 00:00

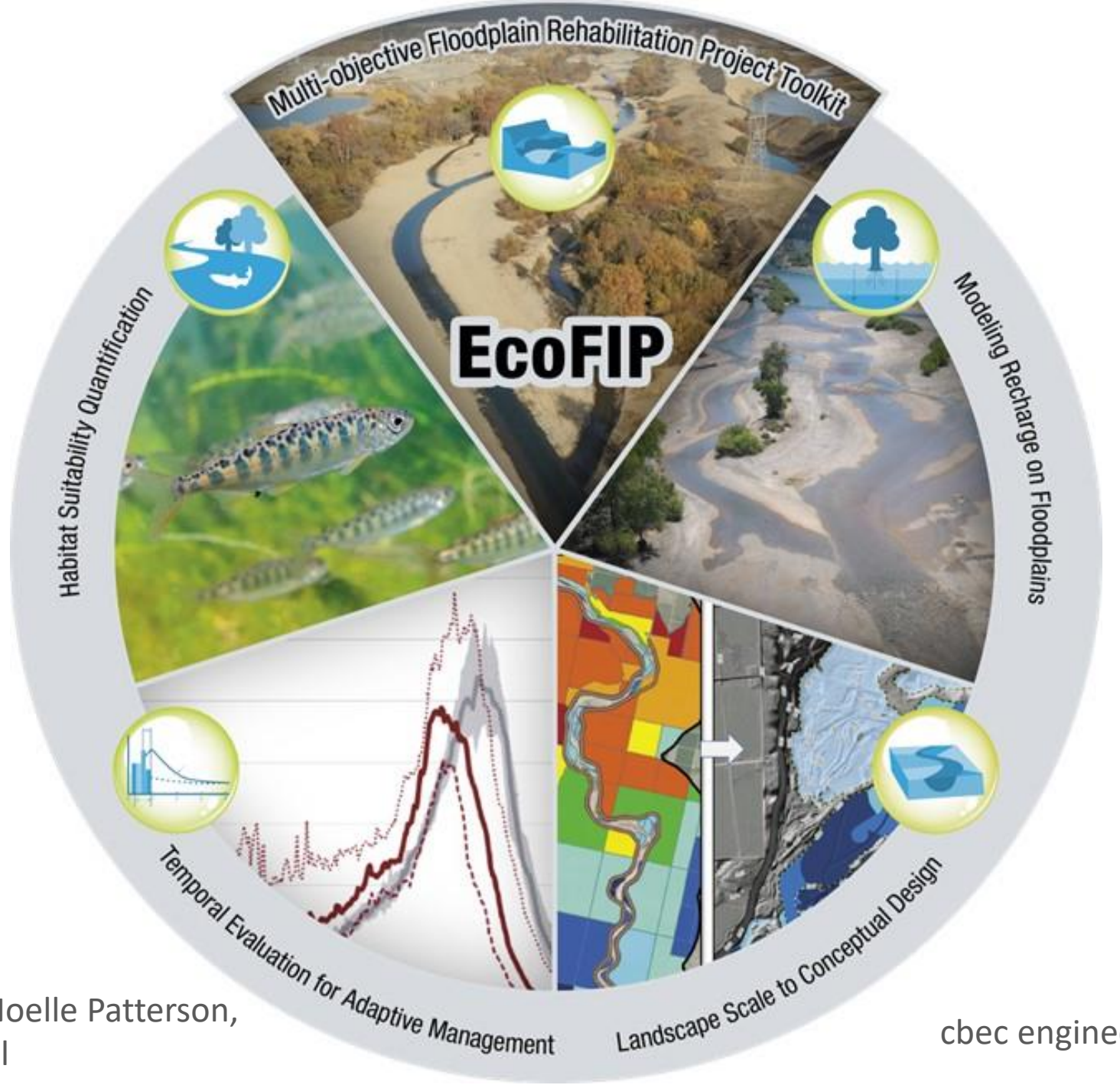

Floodplain Salmon Habitat in Yolo Bypass—Drier Years (1997-2012)
Suitable floodplain habitat equals number of acres inundated to a depth of .3' to 6.6' for a duration of one day between 11/1 to 3/15
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
188,279
584,640
+211%
1,437,216
+663%
Baseline
Notch
Nigiri with Notch

Stocking day



The String of Pearls

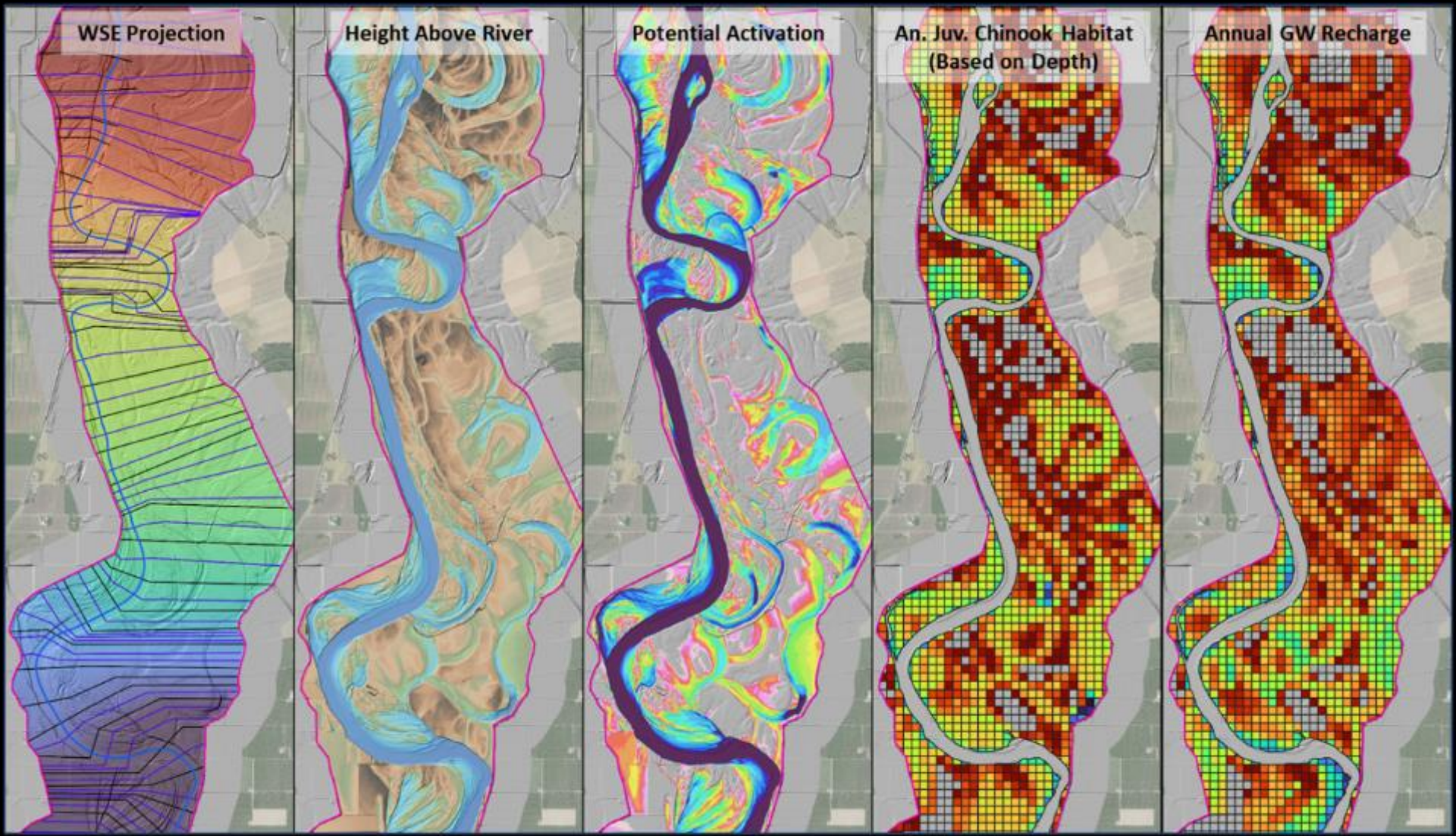




Luke Tillman, Noelle Patterson,
Chris Campbell

cbec engineering

Ecological Floodplain Inundation Potential




Dry Side


Fish Food
For Thought

Fish Food From Floodplain Farm Fields

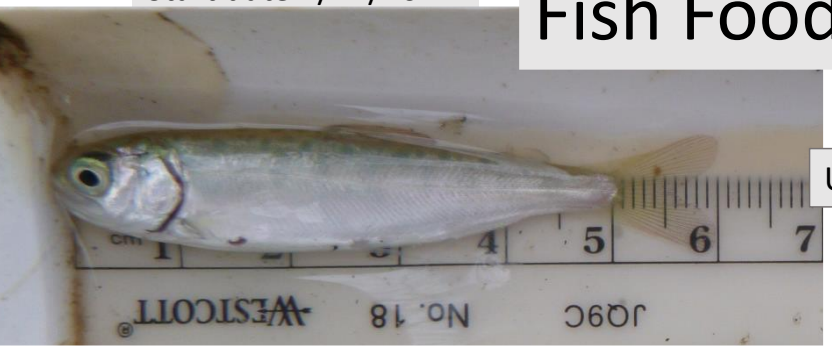

Landscape
Scale

Floodplain-derived food web subsidy to River channel habitats

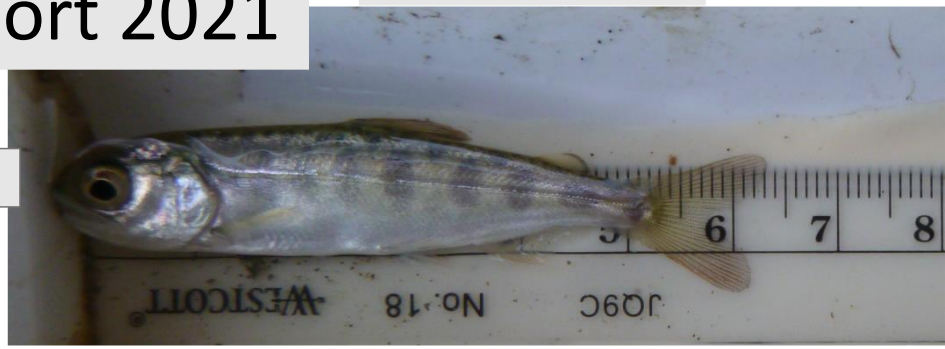
Start date 2/12/2021

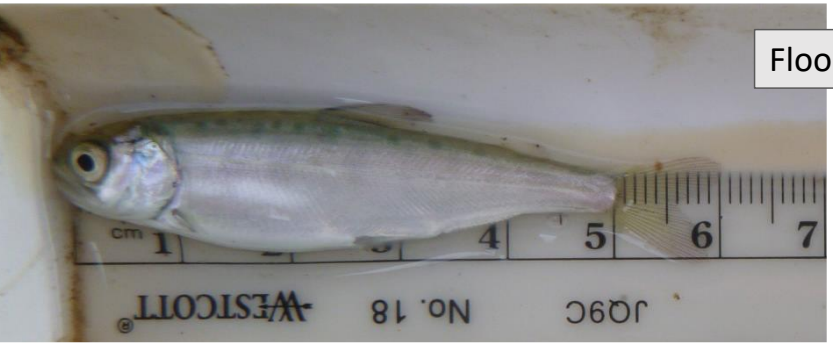
Fish Food Export 2021

End date 3/8/2021



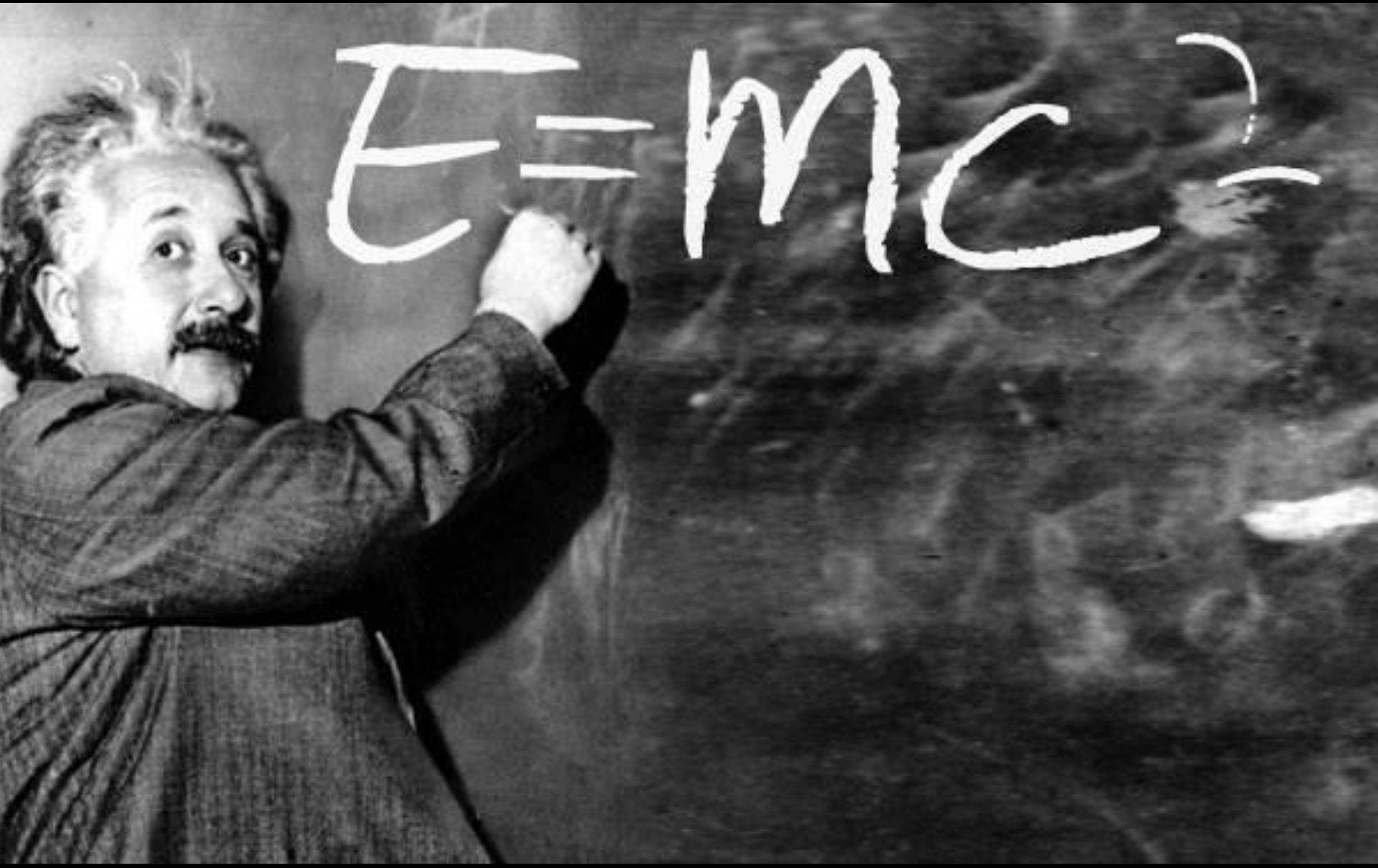
Upstream





Floodplain Outlet

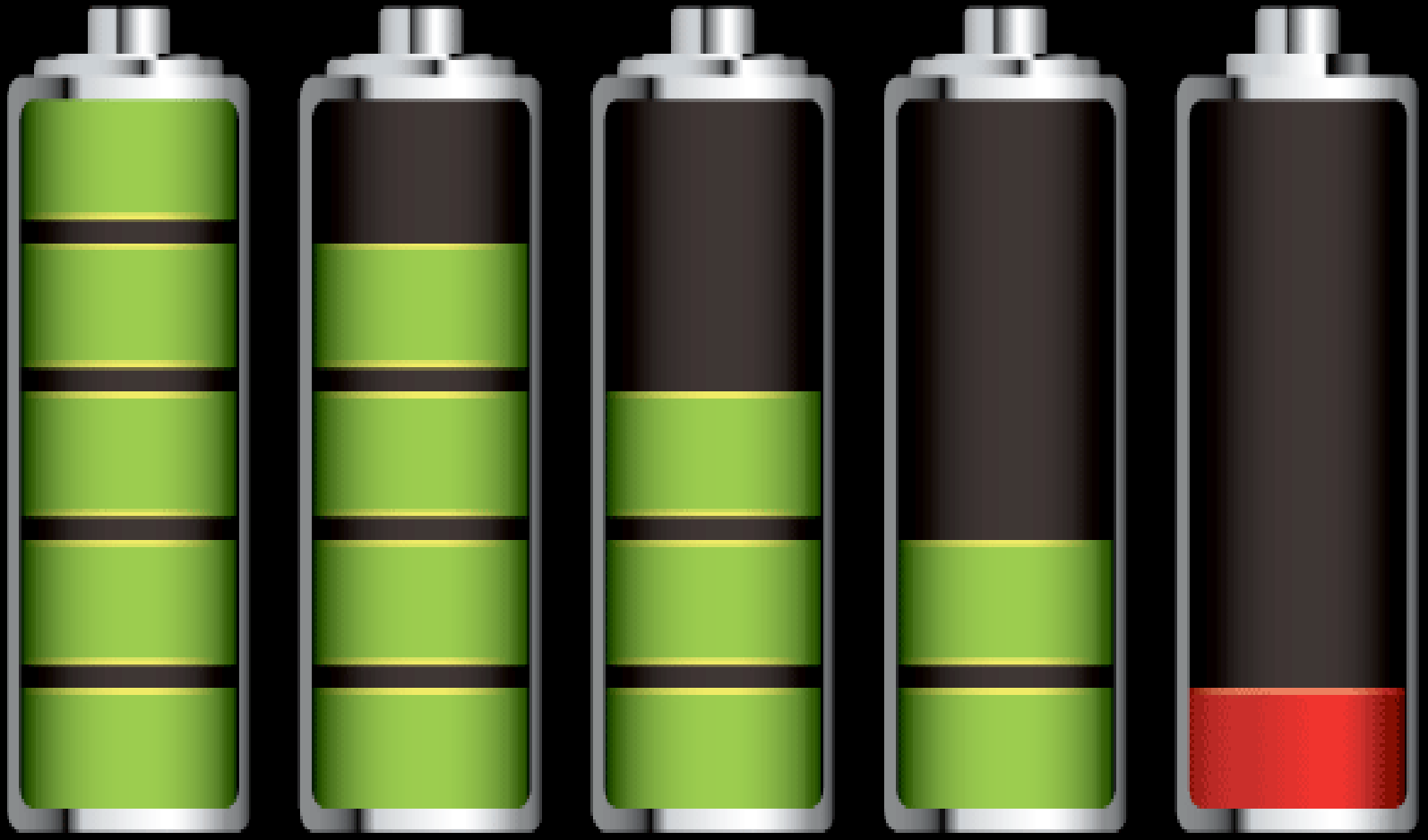
6 miles downstream



The mathematics of recovery

Energy in

Biomass out



Pre-development

Today

Loss of Seasonally Inundated Floodplain

Puddle Power = Residence Time

A Return to Abundance

Questions?

Carson Jeffres