What are (Northern California) **floodplains**?

- **Alluvial flats formed by stream flood deposition of sediment**
- Least frequently flooded part of river channel system.
- **Alluvium:**
  - **Fine sediment** (clay, silt, fine sand – suspended load, “muddy”, slow to settle, quiet backwaters.
  - **Coarse sediment** (cobble, gravel, coarse sand – mostly bedload (near-bed), high velocity channelized flows

North Coast (California) streams support mostly woodland and forest vegetation in floodplains. Gualala River, Wheatfield Fork

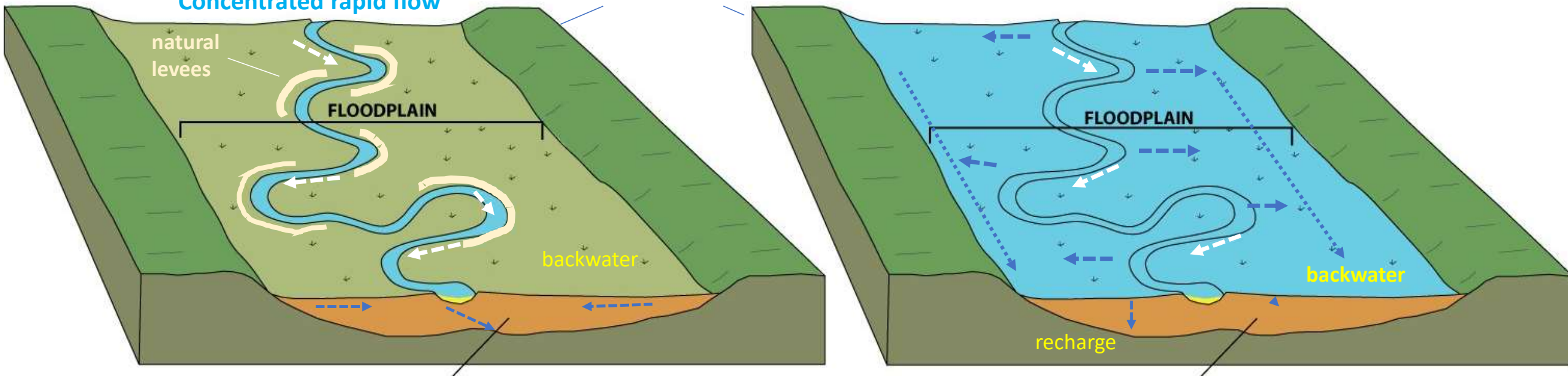
BELOW BANKFULL DISCHARGE
FLOODPLAIN EMERGENCE
(flows confined to channel)

OVERBANK FLOOD FLOWS
FLOODPLAIN SUBMERGENCE

VALLEY WALLS OR HILLSLOPES

Stream occupies channel
Concentrated rapid flow

Stream occupies whole floodplain
Spreading slower flow



ALLUVIUM
(river sediment with groundwater, hyporheic flow)

ALLUVIUM
(river sediment with groundwater, hyporheic flow)

What are floodplains?

Where are major floodplains in the Gualala River watershed?

LOW GRADIENT, LOW ELEVATION RIVER AND TRIBUTARY REACHES

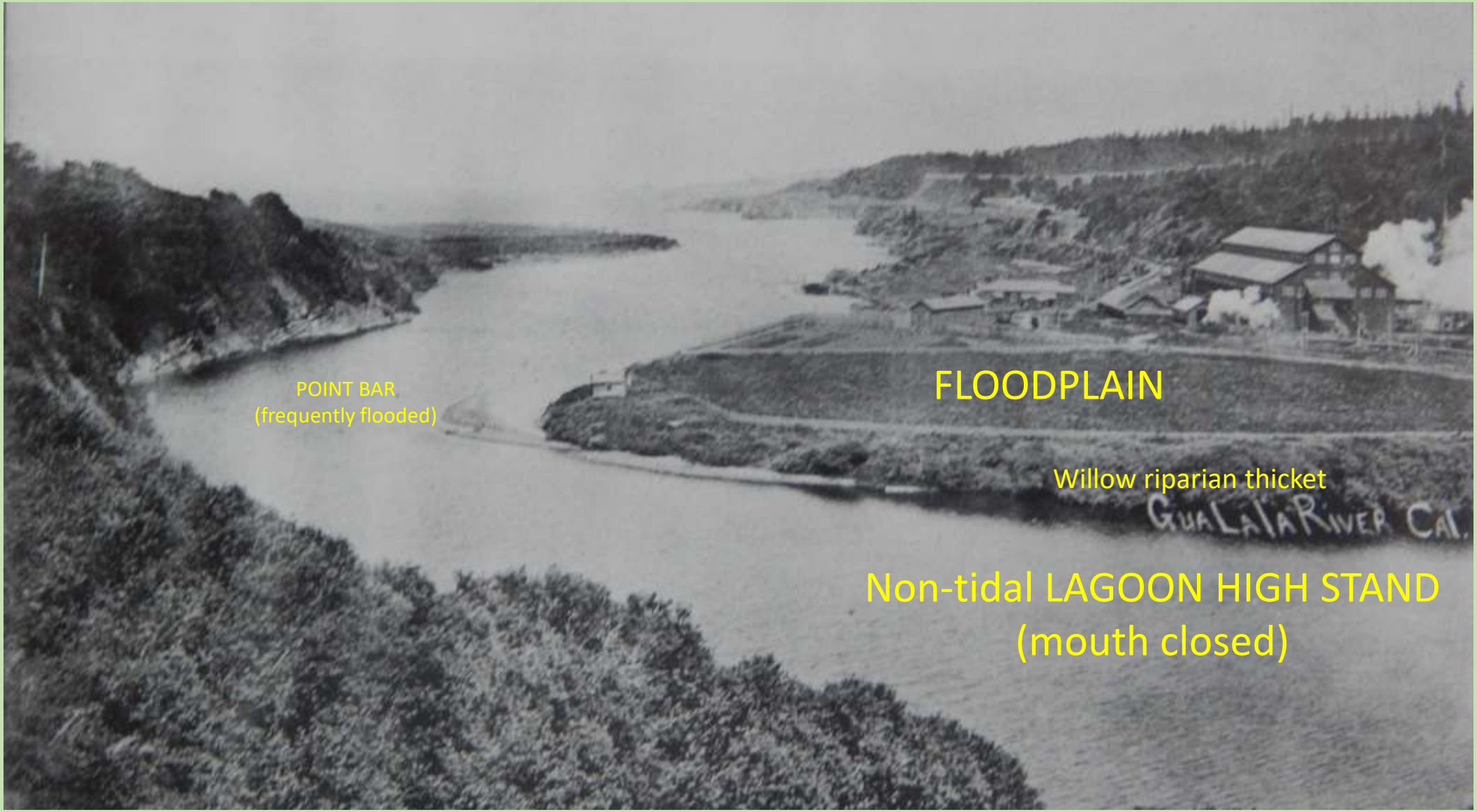
MOST **SEAWARD GUALALA FLOODPLAIN**:

GUALALA POINT MARSH

FRESHWATER MARSH ABOVE SEA LEVEL

FLOODED BY HIGHEST RIVER FLOWS AT HIGH TIDE, AND HIGH NON-TIDAL LAGOON STANDS

VEGETATION: TULE, RUSH, SEDGE, BULRUSH, SPIKERUSH



MILL BEND FLOODPLAIN
1872

Photo source:
Tammy Durston & Steve Oliff, 2010.
Annapolis and the Gualala River

MILL BEND FLOODPLAIN
Circa 1920

Low elevation close to aggraded channel bars

Photo source:
Susan M. Clark, 2009.
The Sea Ranch

Floodplains are infrequently occupied depositional channels.

Wheatfield Fork, alder riparian floodplain during flood, upstream of Annapolis Road bridge, Feb 21, 2019

BRAIDED CHANNEL BARS GROW AND COALESCE INTO ALDER RIPARIAN FLOODPLAIN WOODLAND

Wheatfield Fork, upstream of Annapolis Rd Bridge

Dec 31, 2005

Feb 21, 2019

ALDER RIPARIAN WOODLAND

SEDIMENT and DEBRIS TRAPPING IN FLOODPLAIN, VALLEY CROSSING

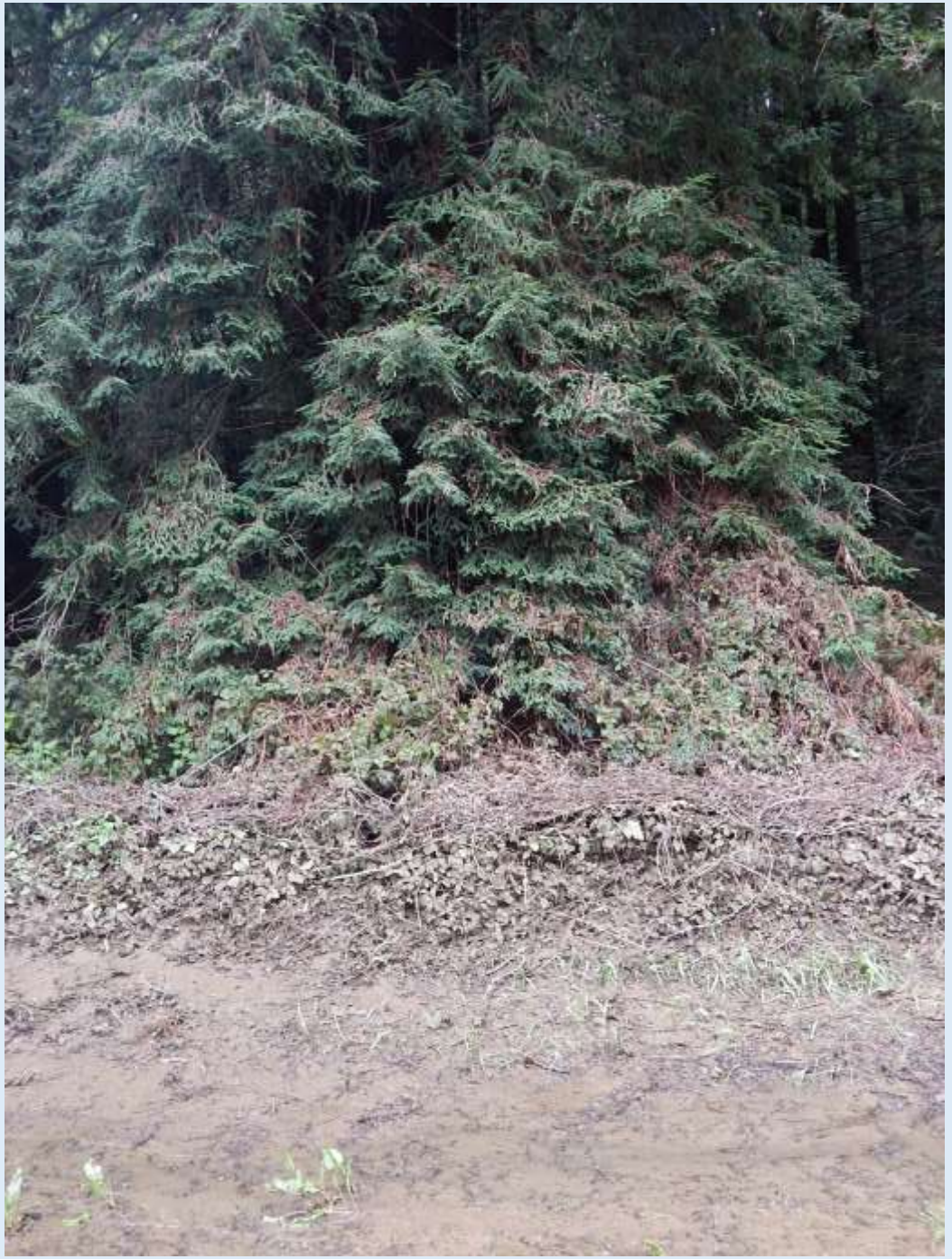
FEBRUARY 26-27 2019

FLOODPLAIN FORESTS TRAP FINE SEDIMENT THAT OTHERWISE WOULD BE TRANSPORTED AND DEPOSITED IN CHANNEL HABITATS

Thick storm flood deposits are trapped and stabilized by floodplain vegetation, improving water quality and salmonid spawning and rearing habitat in stream channels

FLOOD-TOLERANT AND BURIAL-TOLERANT VEGETATION DOMINATES GUALALA RIVER FORESTED FLOODPLAINS

Redwood, pepperwood, alder, willow, blackberry – woody dominant vegetation
Horsetail, sedge, rush, ferns – herbaceous dominant vegetation



Jan 2, 2006 Valley Crossing

FLOOD-TOLERANT AND BURIAL-TOLERANT VEGETATION DOMINATES GUALALA FLOODPLAINS

FLOODPLAINS STORE AND RELEASE DEADWOOD

CHANNEL-FORMING HABITAT STRUCTURE ELEMENTS TRANSPORTED DURING FLOODS

Floodplains trap, stabilize, store, and release sediment

IDENTIFYING THE FLOODPLAIN

Look for persistent, recurrent **high water mark indicators.**

Flood sediment-stained high water lines, 2016, 2019.

SUSPENDED FLOOD DEBRIS in floodplain shrub, woodland, or forest canopy

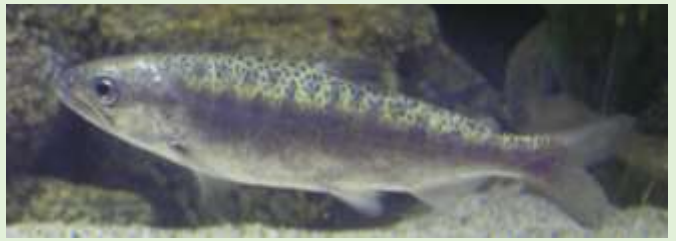
Why are floodplains important, compared with uplands or channels? What ecosystem services do they provide?

- **Juvenile salmonid growth & rearing habitat:** abundant invertebrate food for steelhead, Coho salmon available during intensive feeding periods while floodplains are submerged.

- **Wetlands** - extensive
- **Redwood Forest** – fastest growth and development to mature forest, largest trees
- **Water Quality** – major trap (sink) and stabilization capacity for fine sediment
- **Wildlife and Rare Plant Habitat** –
  Beaver dam and pond habitat = salmonid rearing habitat (extirpated)
  Rare floodplain plants = wetland plants

NEW FISHERIES SCIENCE CONSENSUS (ca. 2001-present):
HIGH IMPORTANCE OF FLOODPLAIN REARING HABITATS FOR RAPID JUVENILE SALMONID GROWTH TO CRITICAL SIZE

IN-CHANNEL VERSUS **OFF-CHANNEL**
COHO AND STEELHEAD REARING HABITAT



KEY FACTOR: INVERTEBRATE PREY (FOOD) AVAILABILITY IN FLOODPLAINS, REDISTRIBUTED BY FLOODING OF WETLANDS AND TERRESTRIAL HABITATS; FOOD WEB STRUCTURE DISTINCT FROM CHANNEL AQUATIC HABITATS (favors salmonids over competitor fish)

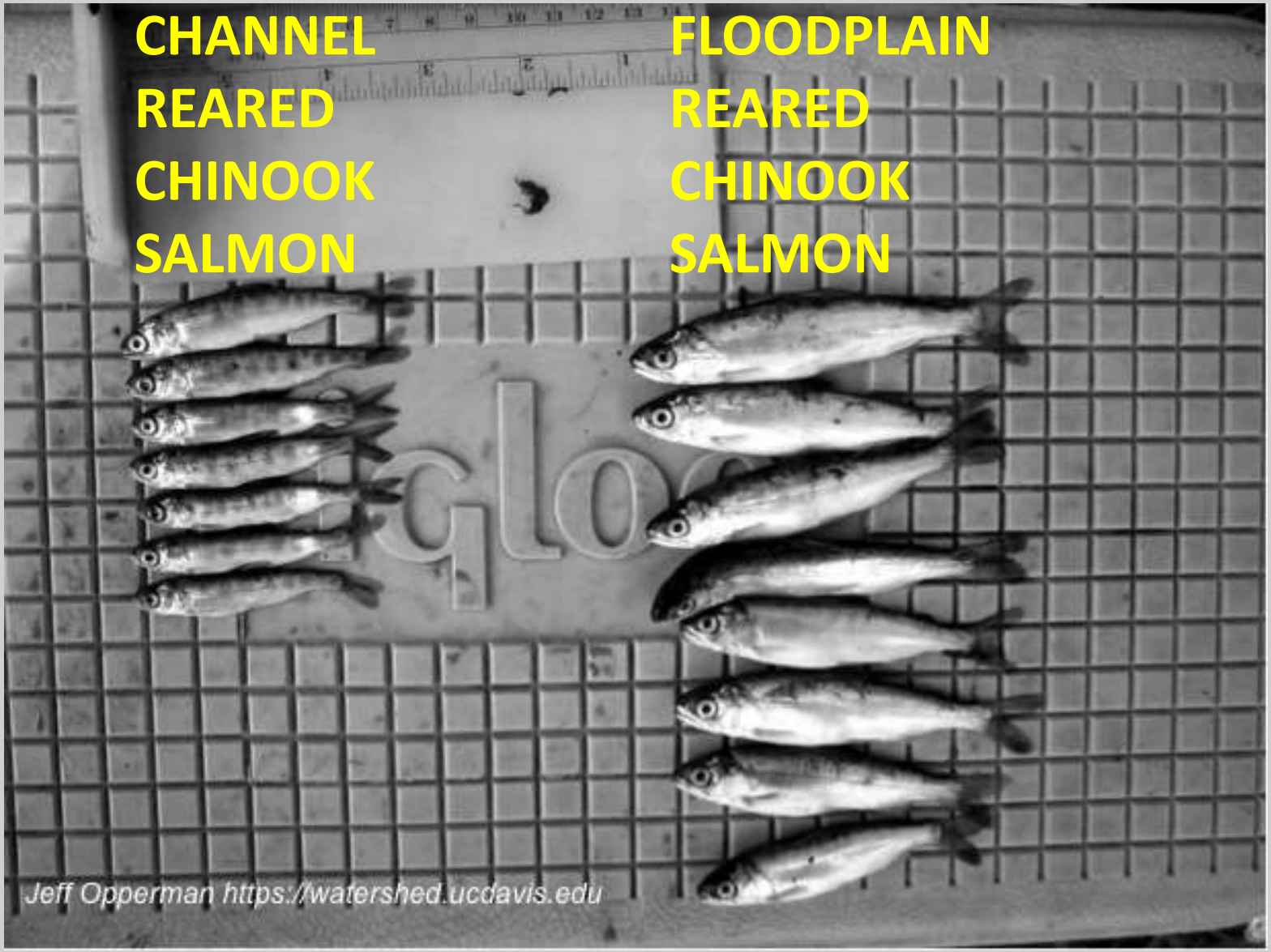
Juvenile salmonids migrate into floodplains during or following high flows…to seek **winter rearing habitat** and **refuge from flow events**

Significantly higher growth rates for juvenile salmonids rearing in the floodplain as opposed to those rearing in riverine habitats

Today, **restoration of floodplain habitat is regarded as especially important for juvenile salmon growth and survival** (Sommer et al. 2001, Jeffres et al. 2008).

Jeffres, C. A., J. J. **Opperman**, and P. B. **Moyle**. 2008. Ephemeral **floodplain habitats provide best growth conditions for juvenile Chinook salmon in a California River.** Environmental Biology of Fishes 83:449–458.

Sommer TR, Nobriga ML, Harrell WC, Batham W, Kimmerer WJ. **2001. Floodplain rearing of juvenile Chinook salmon: evidence of enhanced growth and survival.** Can J Fish Aquat Sci 58:325–333



*Comparison of juvenile Chinook salmon reared on a restored **Cosumnes River floodplain** (right) and in the river's main channel. Photo by Jeff Opperman, 2006*

- **Ephemeral floodplain habitats** supported **higher growth rates** for juvenile Chinook salmon **than more permanent habitats** in either the floodplain or river
- When **flows and turbidity were high, there was little growth and high mortality**
- As river stage falls, floodplain water velocity decreases, water warms, and clarity increases (fine sediment deposited)
- **Importance of terrestrial and wetland vegetative structure** for promoting primary and secondary production
- Jeffres *et al*. 2008

Valley Crossing, confluence Wheatfield and South Forks Gualala River, December 2014. Steelhead parr in floodplain pool.

Large floodplain surface area relative to channel, **abundant vegetation**, high productivity, **low velocity**: submerged floodplain = refuge for juvenile salmonids.

Risk/reward – growth versus stranding mortality

Mature Redwood Floodplain Forest

Roots grow near shallow groundwater

Reduced competition with flood-intolerant trees

Fastest recovery of old growth structure, size in floodplain forest

Widespread floodplain seasonal wetlands

Thick sedge canopy roughness traps sediment

Dense roots stabilize deposited sediment

Moist organic matter, detritus produce abundant terrestrial insect prey of salmonids, available during floods

Rare obligate wetland plants (99% occurrence in wetlands) in floodplain forest

Fringed corn-lily (*Veratrum fimbriatum*)

Conservation of Gualala River Floodplain Redwood Forest: What should we do? **Top 3 actions**

1. AVOID AND MINIMIZE DISTURBANCE BY TIMBER HARVEST OPERATIONS, just as the Forest Practice Rules prescribe.

- **Let recovering floodplain redwood refuges mature**; minimize logging areas near wetlands and stands of largest redwoods
- **Minimize ground disturbance** of seasonal wetlands
- **Don't mine permanent gravel pits in evolving floodplains**
- **Don't drain floodplain wetlands** for road use in the name of sediment management
- **ACCEPT NO SUBSTITUTES**: "IN LIEU" PRACTICES inferior and incomplete protection, unsuitable for seasonal wetlands

Large slough sedge meadow (sward) *Carex obnupta*. Special-status wetland plant community, CDFW

NO DISCLOSURE OR IMPACT ASSESSMENT IN GRT FLOOD PRONE THPs; CAL FIRE DENIED EXISTENCE OF SEASONAL WETLANDS

Ground disturbance impacts

- Draining “wet spots” for logging operation
- Log skidding,
- Heavy wheeled or tracked equipment operation

Reduces flood sediment trapping capacity

Reduces food web support for salmonids

- Don’t drain floodplain wetlands for road use in the name of sediment management

- Don’t mine permanent gravel pits in evolving floodplains

- Mining mechanically removes riparian vegetation that builds floodplains
- Prevents floodplain forest from forming, maintains hot, dry “holes” in floodplain

2. PROPERLY INVENTORY, ASSESS and PROTECT IMPORTANT BIOLOGICAL RESOURCES IN THE FLOODPLAIN, including

- seasonal wetlands, rare plants
- seasonal salmonid rearing (ephemeral flood pulse feeding)
- sediment trapping capacity

Fringed corn-lily

Slough sedge SEASONAL WETLANDS

California harebell

STEELHEAD REARING

SEDIMENT TRAPPING VEGETATION

Floodplain haul road erosion control using invasive non-native ryegrass

3. RECONNECT AND RESTORE FLOODPLAINS.

- **North Coast: Restore estuarine marshes and floodplains** and **improve lower river riparian corridors** to increase juvenile-to-smolt survival of salmonids. (Moyle et al. 2008)
- **Help deeply incised creeks and side-channels recover**: jam with woody debris and sediment, dropped trees
- **Reintroduce beavers** as ecological engineers of floodplain and side-channel ponds, perennial wetland, to recover productive salmonid habitat
- **Restore or enhance side-channels, alcoves** in floodplains