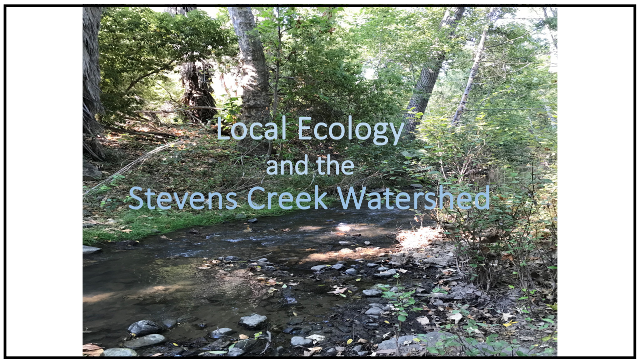
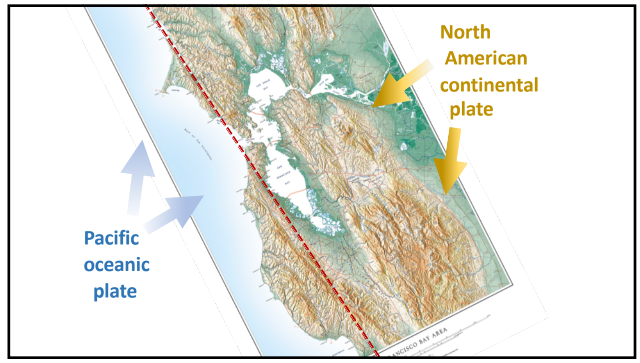
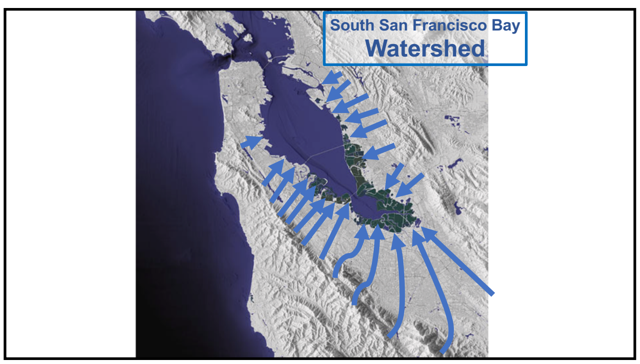
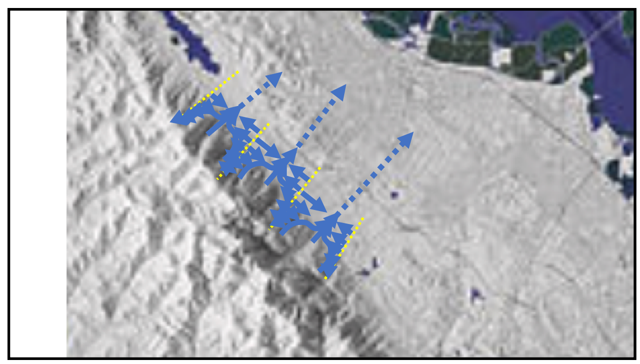
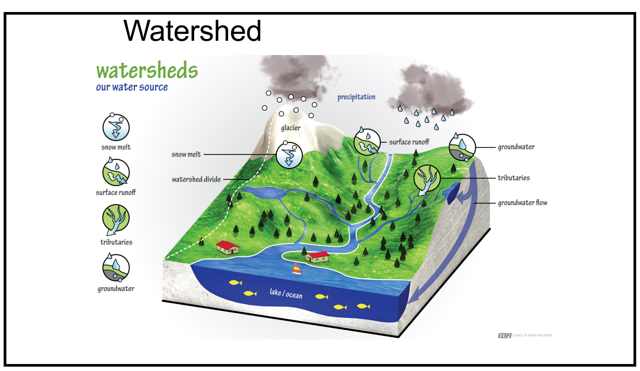
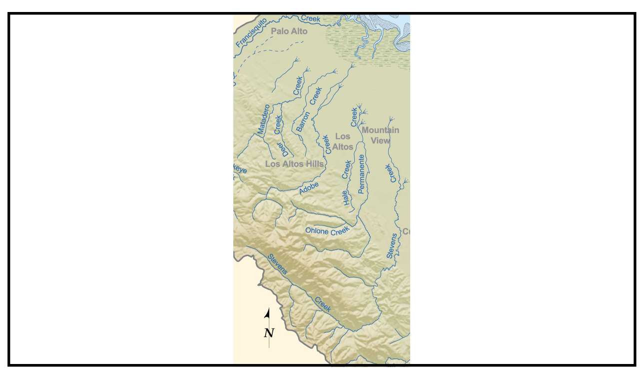

Local Ecology
and the
Stevens Creek Watershed

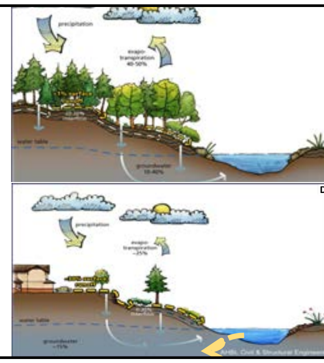

North
American
continental
plate
Pacific
oceanic
plate


South San Francisco Bay
Watershed




Watershed
watersheds
our water source
precipitation
glacier
snow melt
watershed divide
surface runoff
groundwater
tributaries
groundwater flow
lake / ocean
snow melt
surface runoff
tributaries
groundwater
COUNCIL OF FOREST INDUSTRIES


Francisquito
Creek
Palo Alto
Creek
Creek
Matadero
Creek
Barron
Deer
Creek
Los
Altos
Creek
Mountain
View
Los Altos Hills
Creek
Permanente
Hale
Creek
Adobe
Ohlone Creek
Stevens
Stevens
Creek
N



Impacted watersheds

Natural/Forested Ecosystem

- ↑permeability
  - → ↑percolation
- ↓surface runoff
- ↑interflow & retention
  - → ↑evapotranspiration
  - → ↑primary productivity
- ↑groundwater
  - → ↑aquifer pool
  - → "gaining stream"

Developed/Impacted Ecosystem

- ↓permeability
  - → ↓percolation
- ↑surface runoff
  - → ↑erosion
  - → ↑flooding
  - → ↑sedimentation
- ↓interflow& retention
  - → ↓evapotranspiration
  - → ↓primary productivity
- ↓groundwater
  - → ↓aquifer pool
  - → "losing stream"

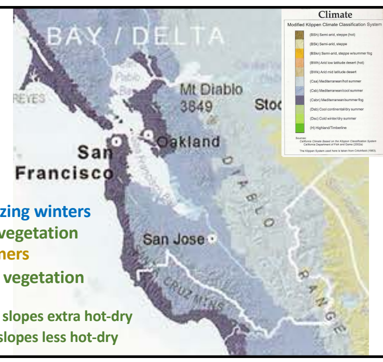
Climate

- Major climate types
  1. **Mediterranean**

a) **Wet, non-freezing winters**
   - **Evergreen vegetation**

b) **Hot, dry summers**
   - **Xerophytic vegetation**
     - **Small, thick, waxy leaves**
     - **Extensive root system**

Climate



a) **Wet, non-freezing winters**
   - **Evergreen vegetation**

b) **Hot, dry summers**
   - **Xerophytic vegetation**

- **Microclimates**
  - **South-facing slopes extra hot-dry**
  - **West-facing slopes less hot-dry**

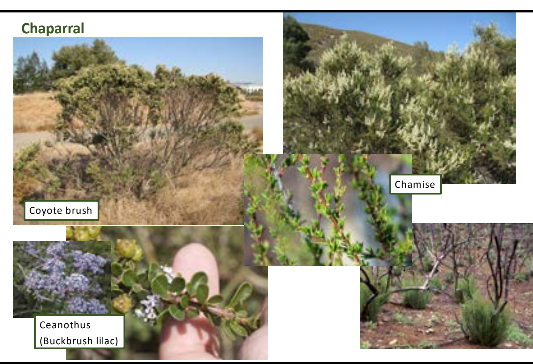
Mixed Evergreen Woodland

Coast live oak

Toyon (Holly)

Poison oak

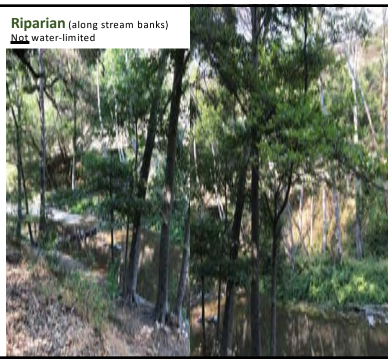
Chaparral



Coyote brush

Chamise

Ceanothus (Buckbrush lilac)



Deciduous broad-leaf trees:

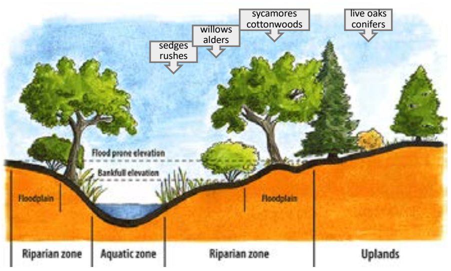
Dense canopy shades stream in summer
→ Keeps cool

Lose leaves in winter to allow direct sun
→ Keeps warm

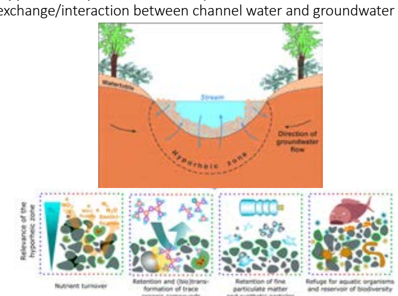
Upland: **mixed evergreen woodland**
Non-freezing winters → evergreen
Hot, dry summer → xerophytes

Riparian
Deep, water-saturated soil → broad, deciduous

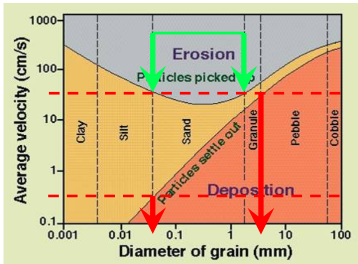
Riparian Communities



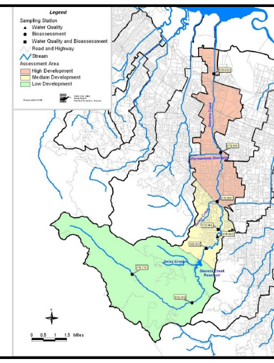
Creek Ecology
hyporheic ("under river") zone
exchange/interaction between channel water and groundwater

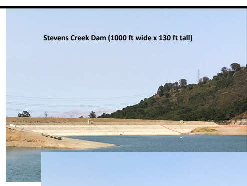


Stream flow rate vs hyporheic particle size



Deposited particles too small → poor interstitial hyporheic flow
Deposited particles too large → insufficient surface area





- Below reservoir:
  - Shallow slope
  - Most water input from dam and storm drains

Stevens Creek

- Above reservoir:
  - Steep slope
  - Most water input from groundwater percolating through carbonate-rich substrate
- Below reservoir:
  - Shallow slope
  - Most water input from dam and storm drains

Vegetation Tree Canopy
point-intercept transects

- <u>Cooley Park</u>
  - White alder 40%
  - Big-leaf maple 30%
  - Coast live oak 5%
- <u>McClellen Ranch</u>
  - Western sycamore 70%
  - Black cottonwood 20%
  - Box elder 15%
  - Willow spp. 10%
  - Blue elderberry 10%

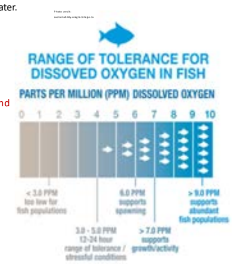
Water chemistry

- Multimeter
  - Temperture
  - Conductivity
  - pH
  - Dissolved oxygen (mg/L) = ppm
  - Dissolved oxygen (% saturation)

Water Chemistry: Dissolved Oxygen (DO_2)

Definition: Amount of oxygen (O_2) mixed in the water.

- From mixing with air
  ↑surface area/depth → ↑DO_2
  ↑ flow rate, turbulence → ↑DO_2
  (may become supersaturated)
- From photosynthesis by phytoplankton and aquatic plants
- Solubility is temperature-dependent:
  ↑temp → ↓DO_2



Water Chemistry: pH

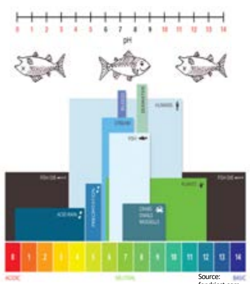
Definition: How basic or acidic a body of water is on a logarithmic scale of 0 (acidic) to 14 (basic).

Why measure pH?

- Most aquatic organisms can only live within a certain pH range
- pH can vary from creek to creek based on the underlying geology of the landscape

Pollutants or human influences that alter pH:

- Acid rain caused by car emissions, fossil fuel burning
- Chemical runoff from human activities (agriculture, mining)
- Raw sewage (soaps, detergents)



Source: fondriest.com

Water Chemistry: Conductivity

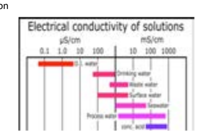
Definition: How easily the solution can conduct electricity.
— the inverse of electrical resistance
Indicates how "salty" the water is (aka the amount of dissolved ions).
Dependent on total dissolved solids (TDS) and temperature.
Measure in mho or Siemens per cm (E.g., mS/cm or µS/cm)

Why measure conductivity?

- Most aquatic animals can only tolerate a specific range.
- Most water bodies maintain a constant conductivity, giving us a baseline
- Changes in conductivity can indicate natural flooding, human-made pollution, or evaporation

Pollutants or human influences:

- Erosion
- Chemical spills
- Urban runoff
- Salt water intrusion



Water Chemistry

2019 Summer (drought year) average of three readings each

- Cooley Park
  - Temp 19.6 °C
  - Conductivity 0.639 mS/cm
  - pH 8.37
  - DO_2 9.27 mg/L
  - DO_2 102 %
- McClellen Ranch
  - Temp 14.2 °C
  - Conductivity 0.471 mS/cm
  - pH 7.99
  - DO_2 10.04 mg/L
  - DO_2 98.2 %

2023 Spring (wet year) average of six readings each

- Cooley Park
  - Temp 11.0 °C
  - Conductivity 0.528 mS/cm
  - pH 8.39
  - DO_2 15.71 mg/L
  - DO_2 143 %
- McClellen Ranch
  - Temp 12.9 °C
  - Conductivity 0.442 mS/cm
  - pH 8.21
  - DO_2 15.52 mg/L
  - DO_2 148 %

Water Quality: Turbidity

Definition: Murkiness of water caused by particles mixing with the water.

Caused by
- Suspended/resuspended sediment
- Detritus & particulate organic matter (POM)
- Phytoplankton
- Precipitates (rarely)

Measure with Turbiditimeter — light scatter
nephelometric turbidity units (**NTU**)

Why measure turbidity?

- High turbidity blocks out the light aquatic plants need for photosynthesis, can clog fish gills, decrease fish navigation abilities, and increase water temperature.

Pollutants or human influences that alter turbidity:

- Run-off and Erosion
- Disturbance of stream bottom
- Contamination (e.g. chemical spill)
- Eutrophication (algal blooms)

Water Turbidity

2019 Summer (drought year) average of three readings each

- Cooley Park
  - 0.9 NTU
- McClellen Ranch
  - 19.6 NTU

2023 Spring (wet year) average of six readings each

- Cooley Park
  - 1.8 NTU
- McClellen Ranch
  - 21.4 NTU

Aquatic Macroinvertebrates

Definition: small, but visible, invertebrates associated with the stream benthic community.

- Insect larvae and nymphs (naiads) and a few adults
- Other arthropods — arachnids and crustaceans
- Worms
- Molluscs

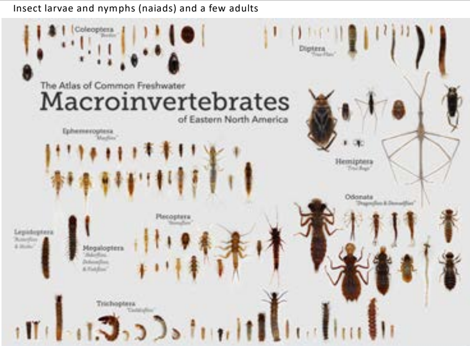
Why examine macroinverts?

- Stream community diversity and productivity
- Pollution sensitive vs. tolerant species to assay toxicity
- Monitor invasive species

How to examine macroinverts?

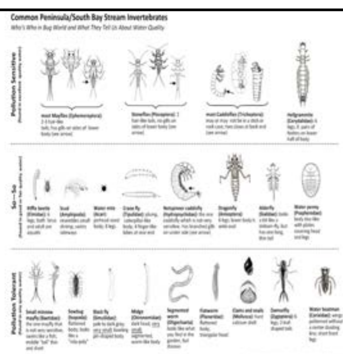
- Place D-net downstream of quadrats
- Stir sediment and rub rocks in quadrat for defined time to allow dislodges bugs to sweep into net by current
- Transfer to tray for identification and tally using hand lenses
- Return to site

Insect larvae and nymphs (naiads) and a few adults



Identify taxa, count individuals, categorize sensitivity.

- Group 1 Taxa: Pollution-sensitive;
- Group 2 Taxa: moderately tolerant;
- Group 3 Taxa: very tolerant



Aquatic Macroinvertebrates [total of three samples each site]

- Cooley Park
  - Group 1
    - Trichoptera caddisfly larva (Ryacophilae)
    - Trichoptera caddisfly larva (Uenoidae)
    - Trichoptera caddisfly larva (Glossosomatidae)
    - Plecoptera stonefly larva (Perlidae)
    - Ephemeroptera mayfly larva (Heptageniidae
    - Ephemeroptera mayfly larva (Ephemerillidae)
    - Coleoptera riffle beetle adult
  - Group 2
    - Zygoptera damselfly larva
    - Ephemeroptera mayfly (Baetidae)
    - Trichoptera caddisfly (Hydropsychidae)
    - Sialid alderfly larva
    - Odonata dragonfly larva
    - Coleoptera beetle larva
    - Crusacea crayfish (molt)
  - Group 3
    - Blackfly larva (Simuliidae)
    - Platyheminthes flatworm
    - Oligochaete worm
    - Midgefly larva (Chironomidae)
- McClellen Ranch
  - Group 1
    - Trichoptera caddisfly larva (Brachycentridae)
  - Group 2
    - Zygoptera damselfly larva
    - Ephemeroptera mayfly (Baetidae)
    - Trichoptera caddisfly (Hydropsychidae)
  - Group 3
    - Blackfly larva (Simuliidae)
    - Platyheminthes flatworm
    - Water mite
    - New Zealand mud snail *

- Group 1 Taxa: Pollution-sensitive;
- Group 2 Taxa: moderately tolerant;
- Group 3 Taxa: very tolerant

  * invasive