CLIMATE CHANGE(D): WEATHERING EXTREMES *TOGETHER*
MODULE 3

WATERSMART

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NBWA
NORTH BAY WATERSHED ASSOCIATION

Multi-benefit, sustainable management of California's forested headwaters

Roger Bales, UC Merced

- Multi-benefit pathway
  - Water balance
  - Other benefits
  - Data & tools

Center for Ecosystem Climate Solutions

https://california-ecosystem-climate.solutions

R. Bales photo

Courtright Reservoir, Jun 2021


Headwater forests are multi-benefit assets, our natural capital
We need a multi-benefit approach to forest restoration & to long-term sustainable management
R. Bales photo
Upper Yuba, July 2020

R. Bales photo

Greyhorse Valley, Oct 2018

Systems objective

Increase the pace & scale of transitioning from a destructive wildfire regime

Photo: USFS Region 5

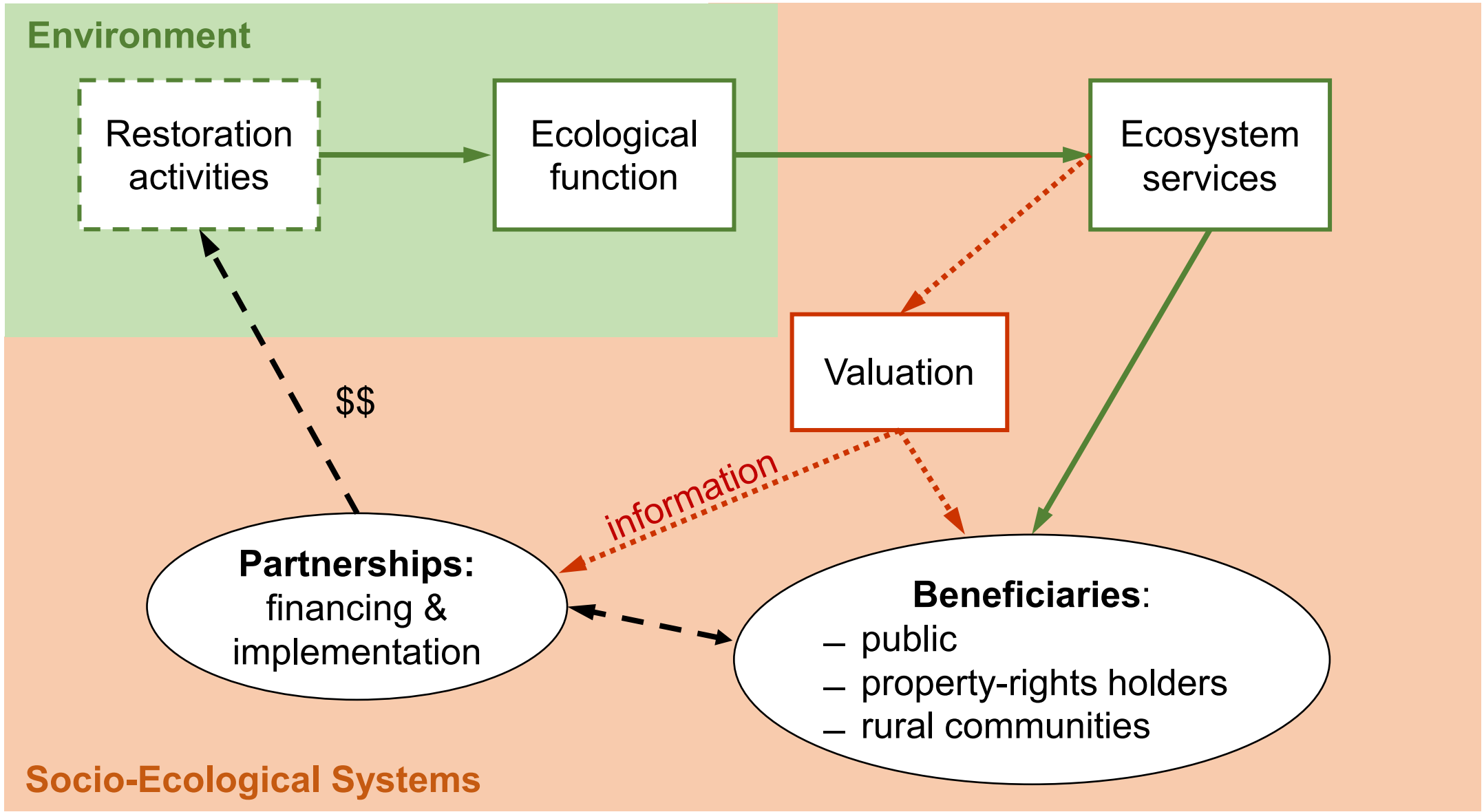
August Complex, 2020

to a beneficial, regenerative wildfire regime

Photo: NPS

Bluff Managed Wildland Fire, Lassen Volcanic NP, 2004

Valuing & monetizing ecosystem services can help




French Meadows partners:
USFS, county, water/hydropower agency, NGOs, UC, state
Photo: B AColeman, PCWA
Tahoe NF, Oct 2020

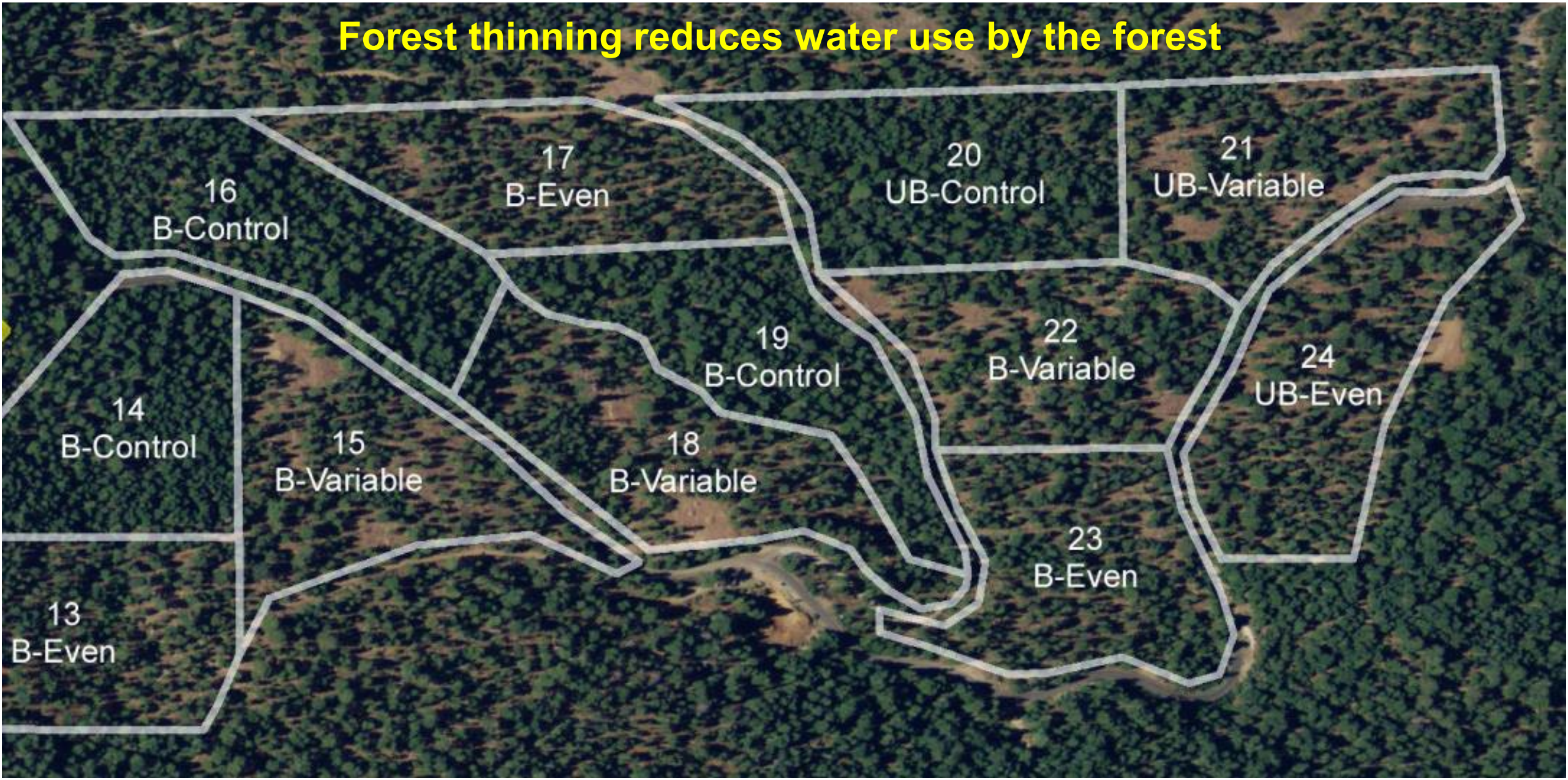

Monitoring & research are part of the adaptive-management cycle
We cannot just model our way to solutions, we need data!
French Meadows, Tahoe NF, Oct 2020
Photo: BA Coleman, PCWA

Forest restoration provides many benefits in addition to reducing the probability of high-severity wildfires, & the direct damage from fire & effects of smoke

Photo: NEON webcam

Creek Fire approaching Soaproot Saddle, Sept 2020

Forest thinning reduces water use by the forest



E. Knapp photo

Stanislaus-Tuolumne Experimental Forest, Sept 2011


Removing small trees makes more water available for the remaining trees, for in-stream flows, & for food production & urban areas downstream
E. Knapp photo
Stanislaus-Tuolumne Experimental Forest, Sept, 2011

Basic water balance

Precipitation = Evapotranspiration + Runoff + ΔStorage

- Multi-benefit pathway
- → Water balance
- Other benefits
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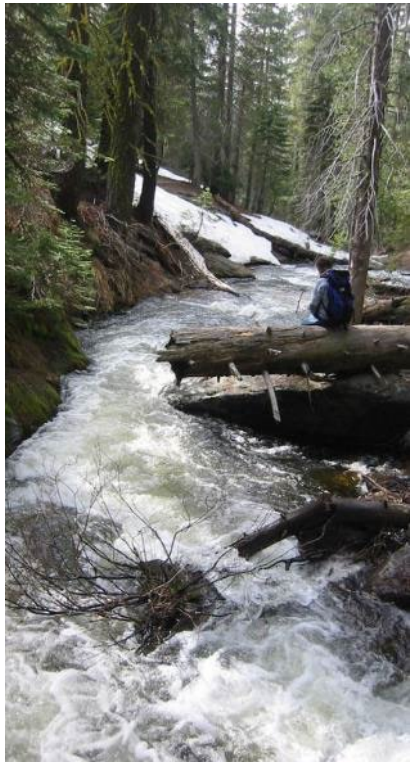

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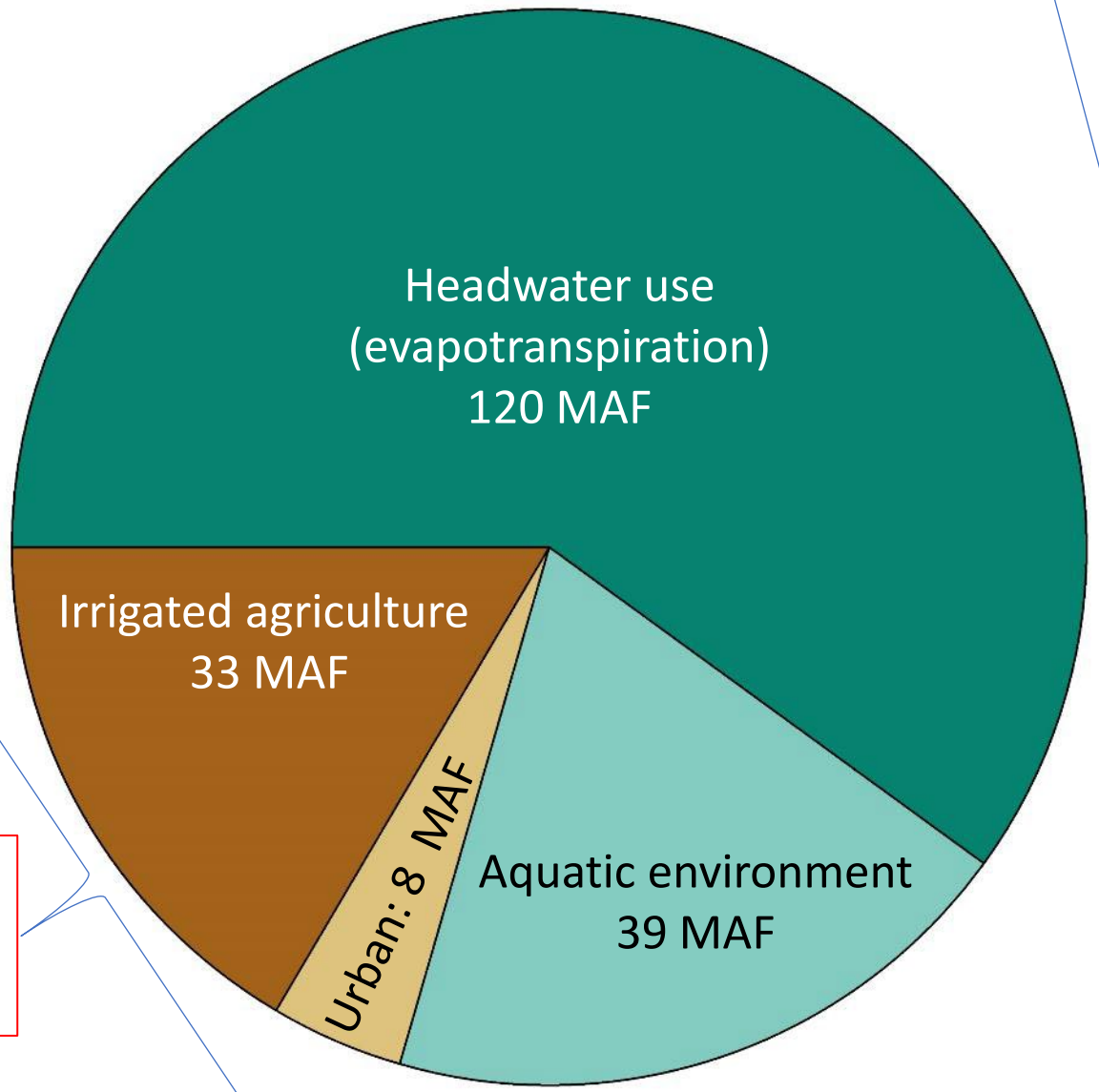
Evapotranspiration refers to evaporation, sublimation plus water use by vegetation

<u>Average</u> annual applied water use for California, million acre ft (MAF)



Precipitation
200 MAF

Ag plus urban: 41 MAF

Agriculture: 80%
Urban 20%

CA Water Plan, 2013

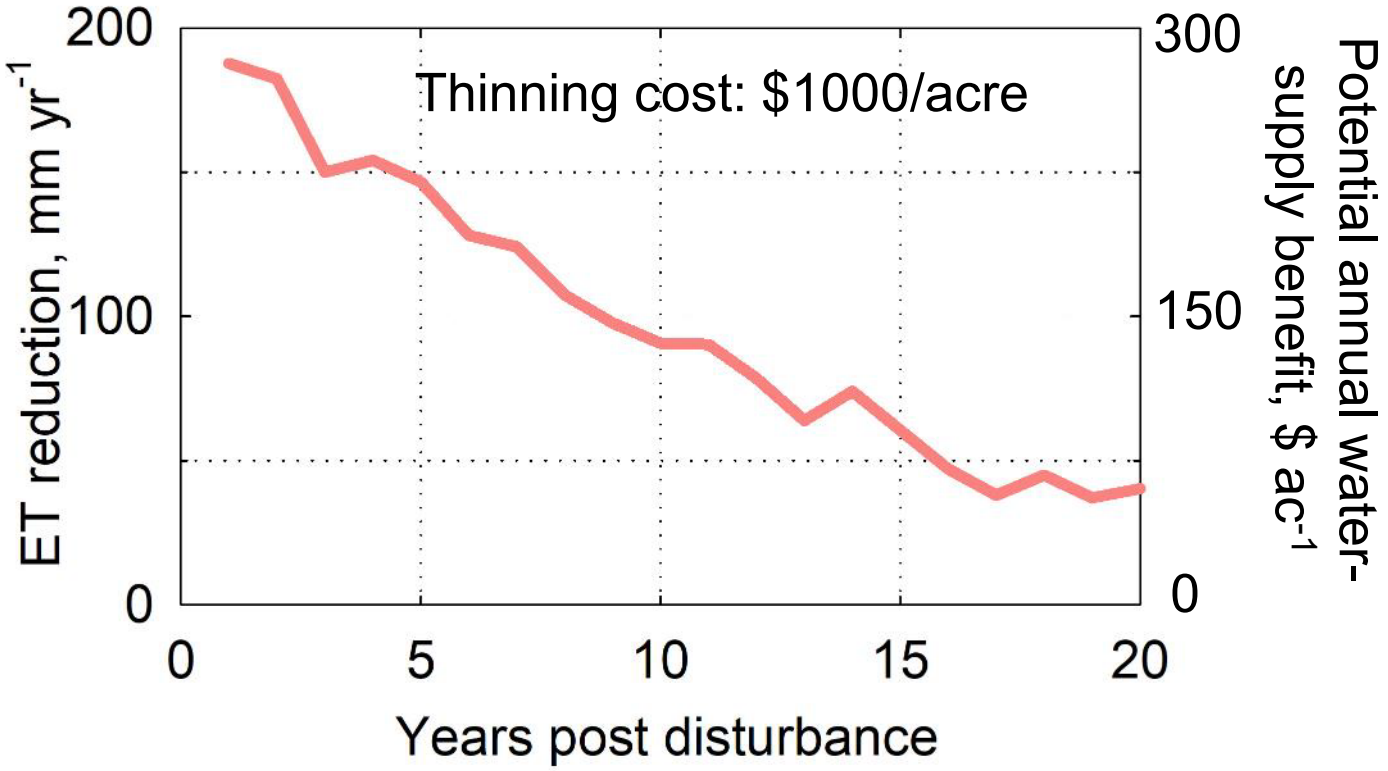
R. Bales photo

Greyhorse Valley, Oct 2018

Vegetation grows back, so future prescribed fire, managed wildfire, or mechanical thinning are needed to maintain forest health

Example: American R basin water supply, using historical data

Medium-severity wildfire, or equivalent mechanical thinning, reduces forest evapotranspiration (ET)



This is just one of several co-benefits of restoration.

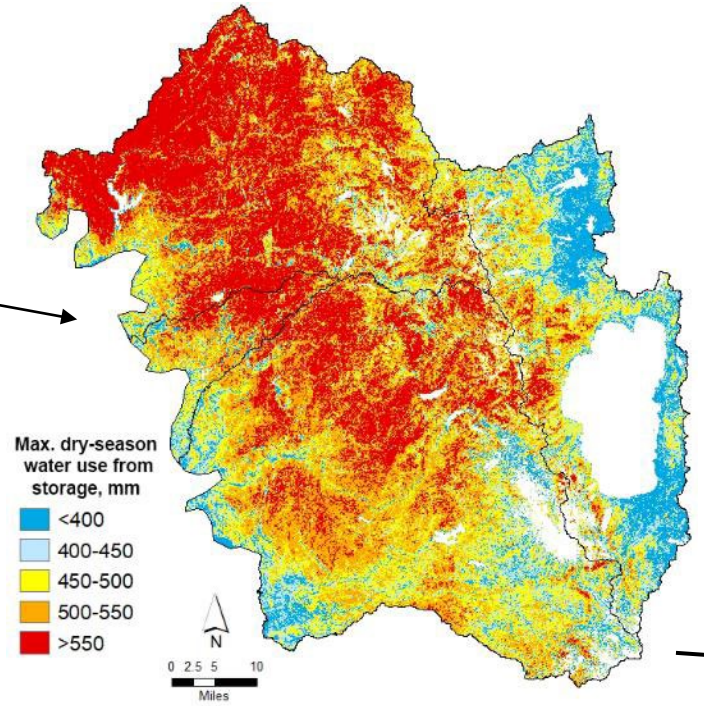
We & others have developed metrics & data for these benefits, which are used to inform decision making

Metrics & data must reflect our warming climate

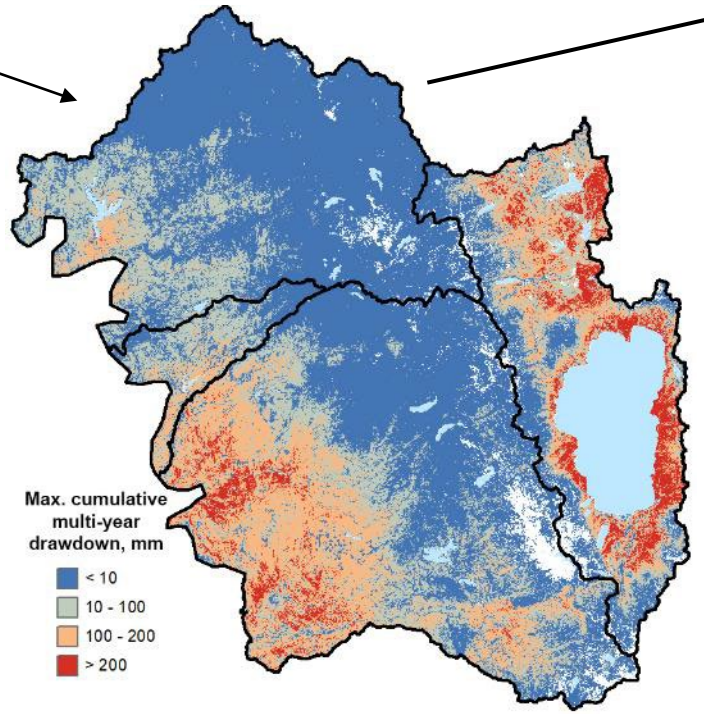

Forest thinning reduces drought-induced tree deaths & stores carbon in trees & soil – ecological integrity & resilience
– Multi-benefit pathway
– Water balance
Other benefits
– Data & tools
Sierra NF, Dec 2015
M. Wholey photo

TCSI – Water security

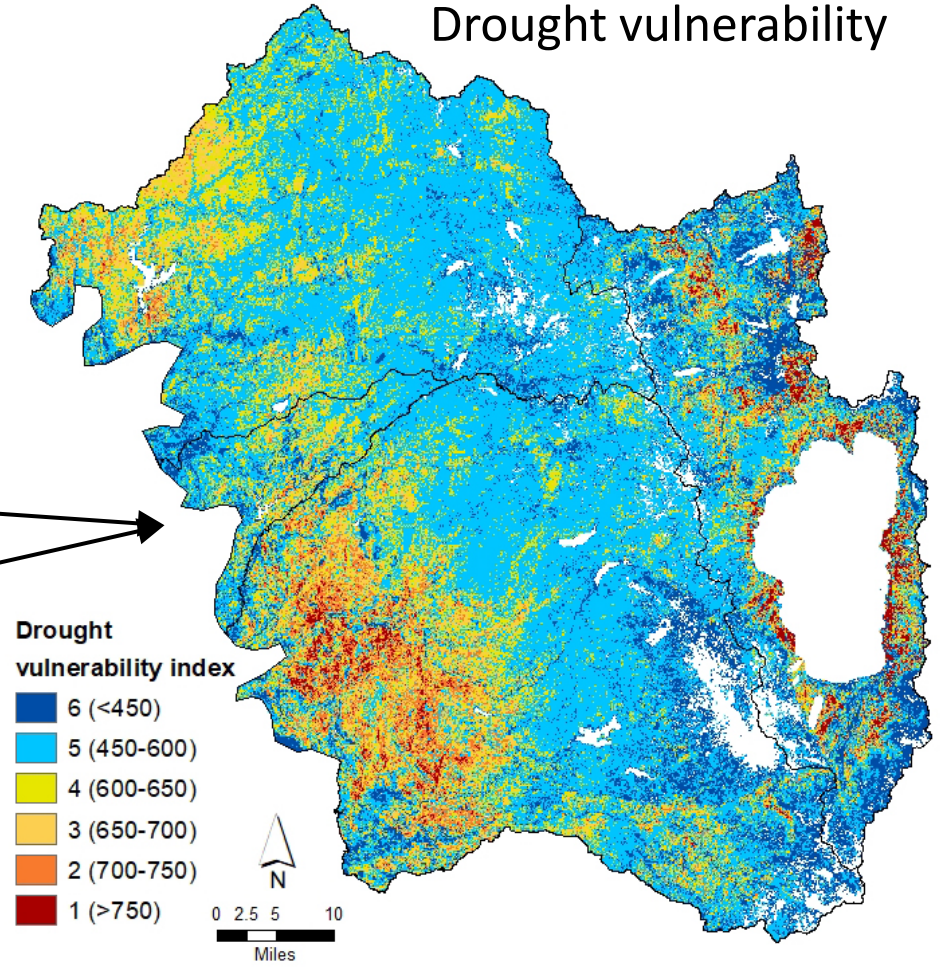
Maximum
dry-season water use



Maximum
multi-year water deficit



Drought vulnerability



Overstocked areas where tree roots may not be able to draw enough water from the ground during summer to satisfy all trees are most susceptible to drought & beetle-caused mortality.

Drought-vulnerable areas are higher priority for thinning, to maintain forest health & thus biodiversity

TCSI report, 2021

Hydropower benefits are also important

Recreation benefits – high public demand

El Dorado NF, 2020


Photo: Region 5 USFS

Klamath, Jul 2011

Photo: K. Greene

El Dorado NF, 2007

Reducing high-severity wildfire reduces erosion & risk to built infrastructure

NEON webcam

Tahoe NF, May 2017

Air Quality

French Gulch, 2004 French Fire, Whiskeytown NRA

NPS photo


Making more use of forest products, including waste biomass, provides jobs, renewable energy, carbon sequestration
R. Bales photo
Upper Yuba, Jul 2020

Rural communities are part of what makes California – and are vulnerable

R. Bales photo

Downieville, Jul 2020


Some capacity issues have been overcome & other severe limits remain.
– Multi-benefit pathway
– Water balance
– Other benefits
→ Data & tools
French Meadows, Oct 2019
M. Conklin photo

What are you exploring?

- ◉ Current and recent conditions
- ○ Vulnerabilities
- ○ Expected effects of management

What conditions do you want to see?

▲ Overview of Ecosystem Issues

- ◉ Fuel, biomass and water composite

▲ Vegetation Type

- ○ Overview of vegetation type
- ○ Fraction herbaceous
- ○ Fraction tree
- ○ Fraction shrub

▼ Management / Disturbance History

▲ Carbon Fluxes

- ○ GPP
- ○ NPP tree
- ○ NPP shrub
- ○ NPP herb

▲ Water Fluxes and Supply

- ○ Actual evapotranspiration
- ○ Runoff amount
- ○ Water shortfall
- ○ Soil moisture

▲ Carbon Stocks

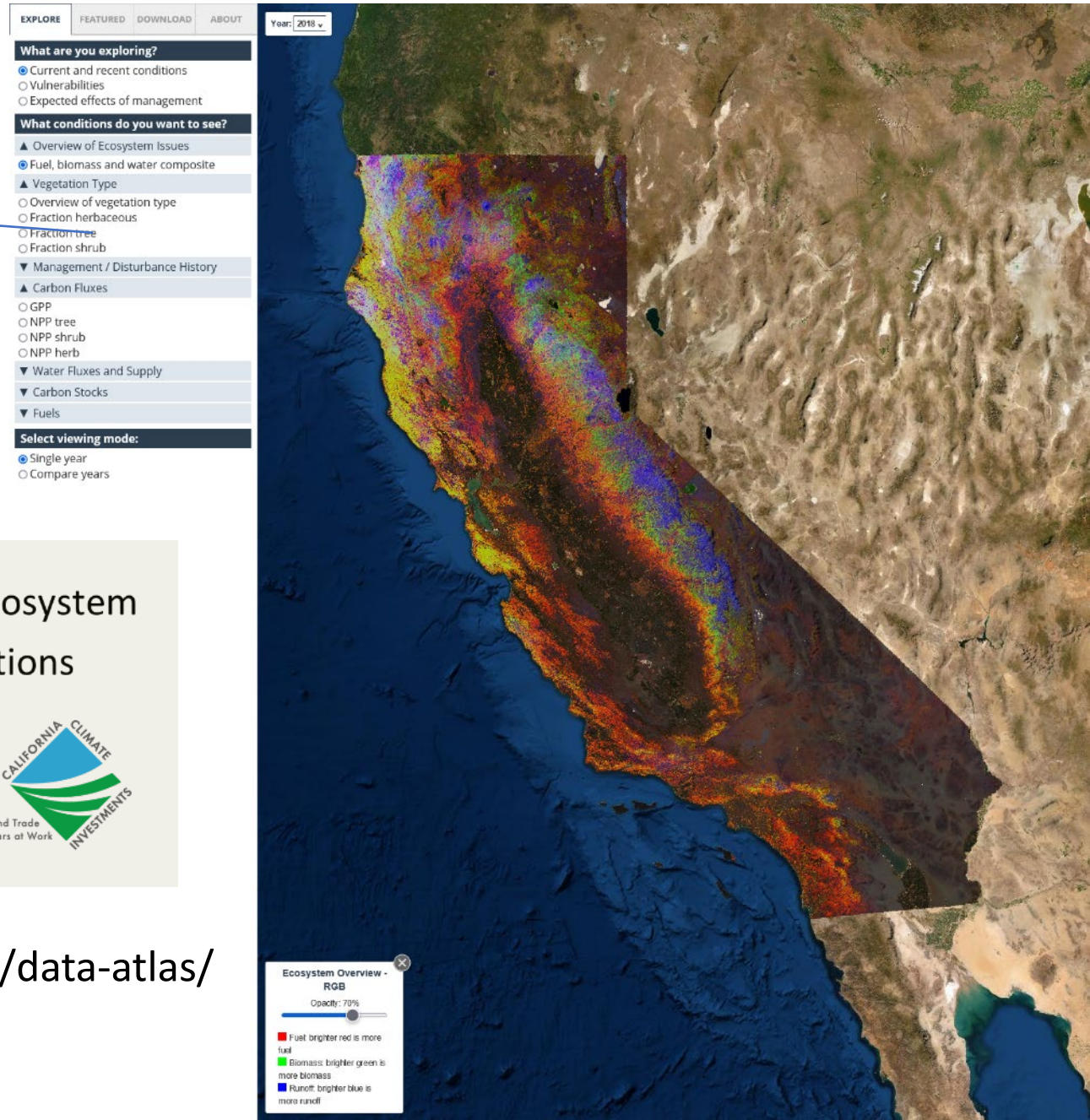
- ○ Live
- ○ Dead
- ○ Tree Biomass
- ○ Shrub Biomass
- ○ Standing Snags
- ○ Fine Woody Detritus
- ○ Coarse Woody Detritus

▲ Fuels

- ○ Fuel type and amount
- ○ Coarse
- ○ Fine
- ○ Herbaceous

Select viewing mode:

- ◉ Single year
- ○ Compare years



Center for Ecosystem Climate Solutions

CALIFORNIA STRATEGIC GROWTH COUNCIL

CALIFORNIA CLIMATE INVESTMENTS
Cap and Trade Dollars at Work

https://cecs.ess.uci.edu/data-atlas/

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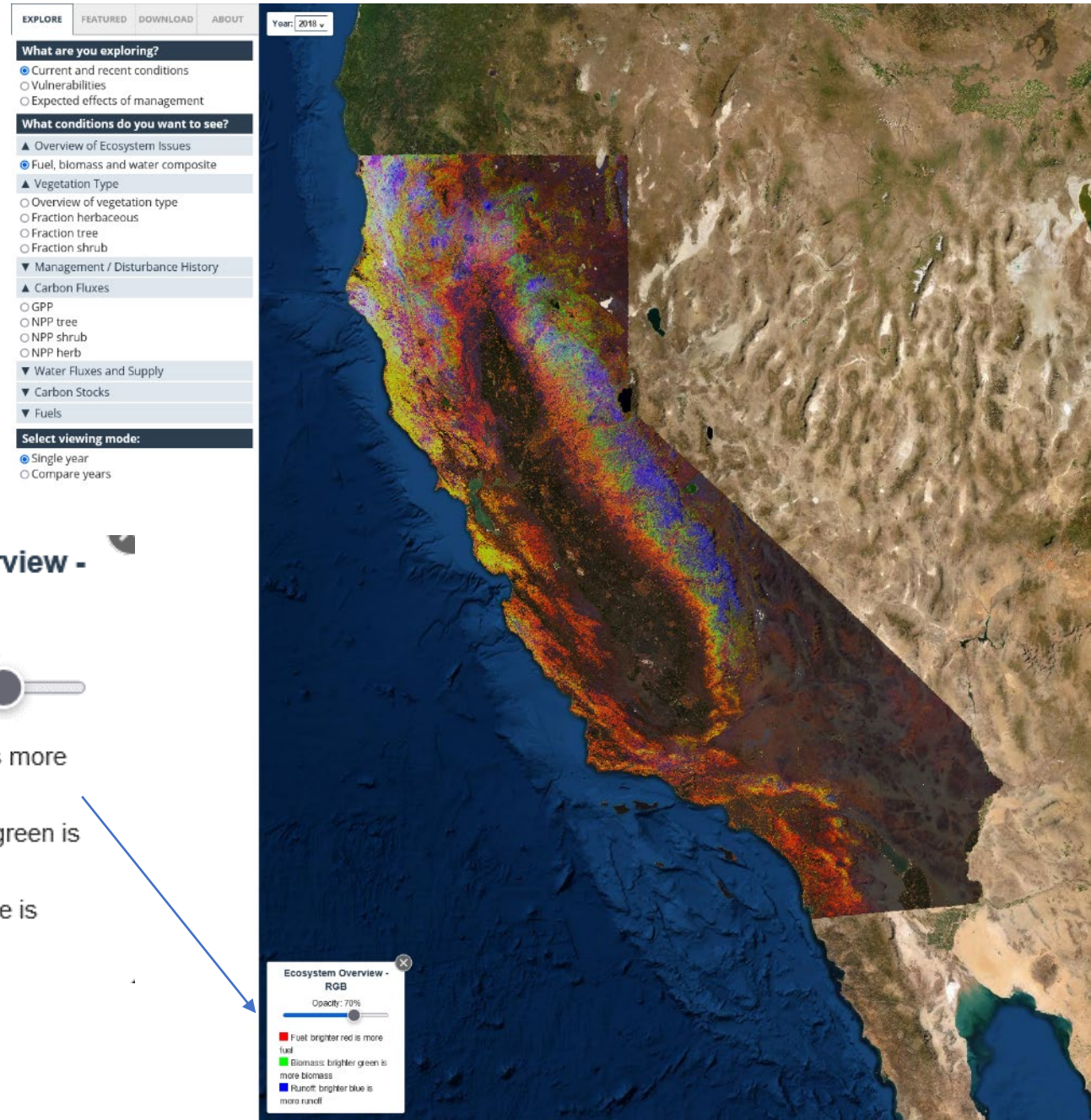
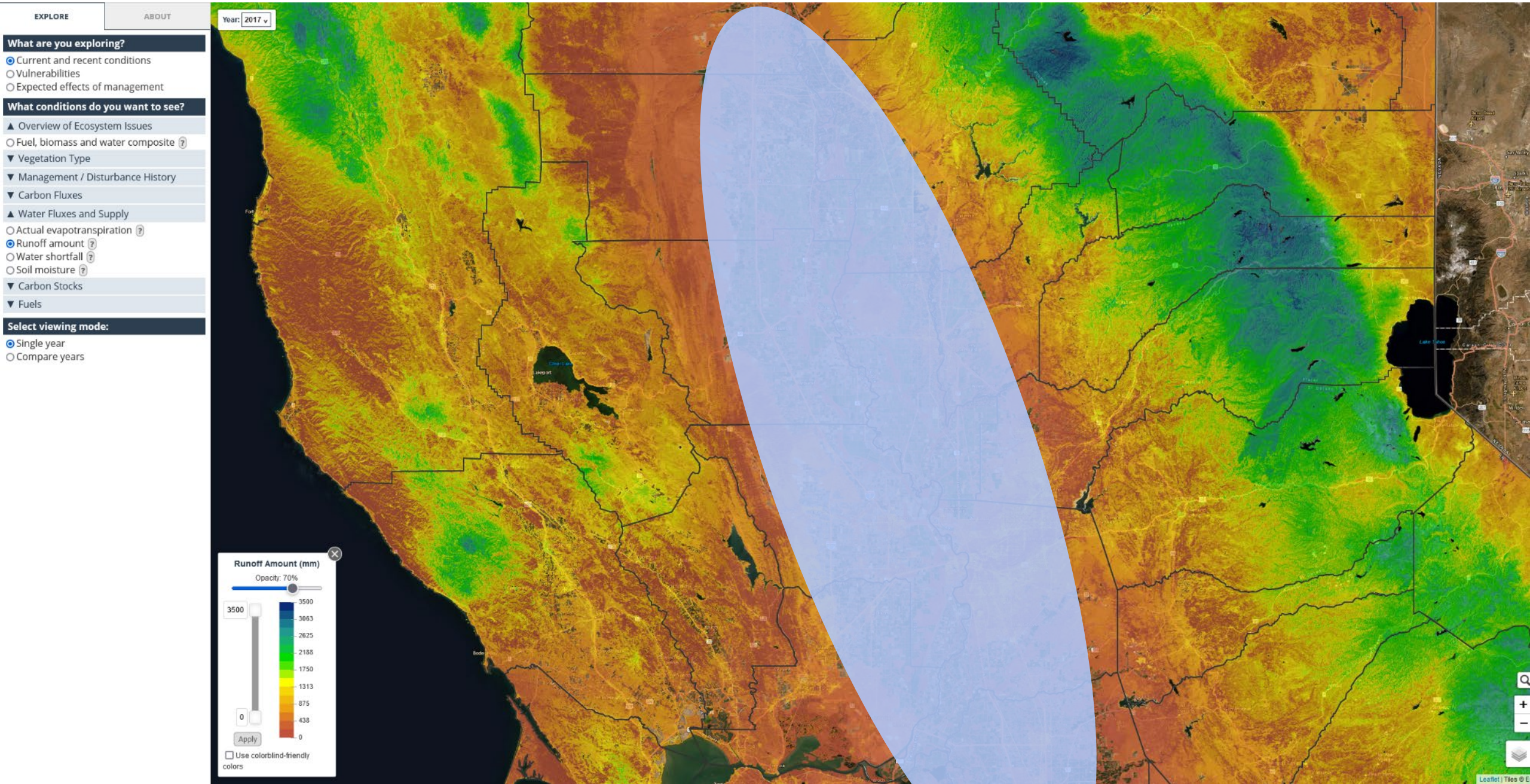
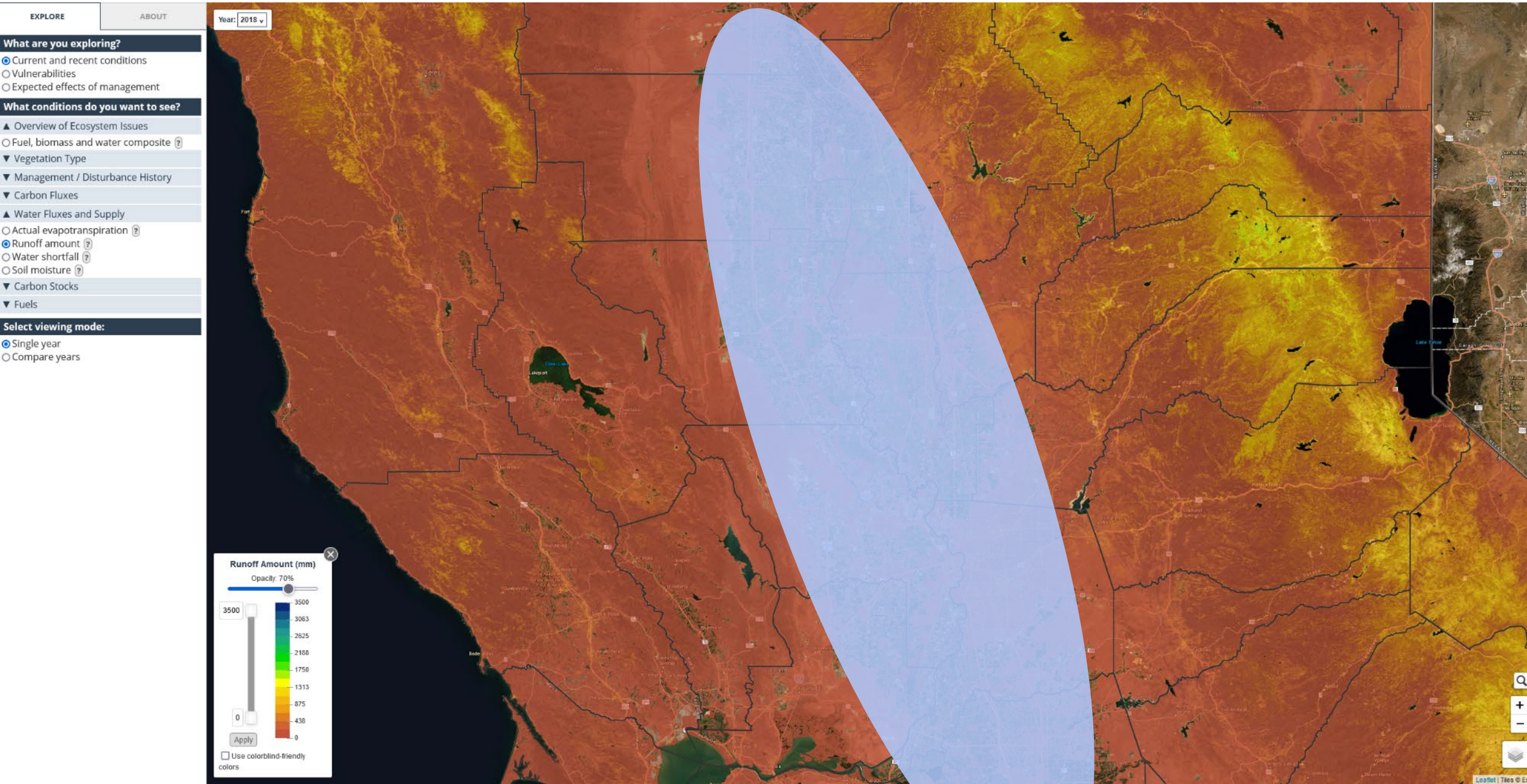


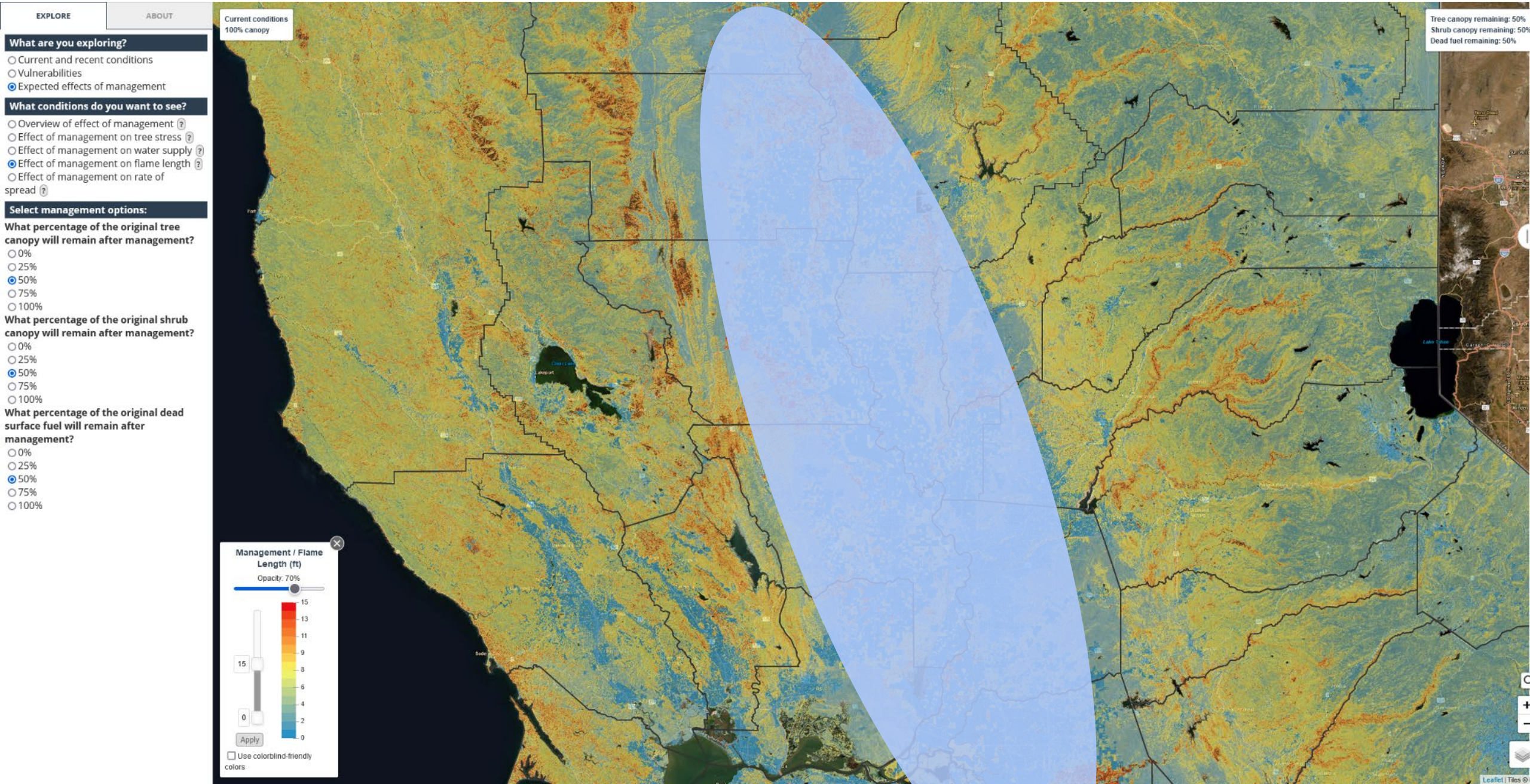
Runoff: 2017 (very wet year)



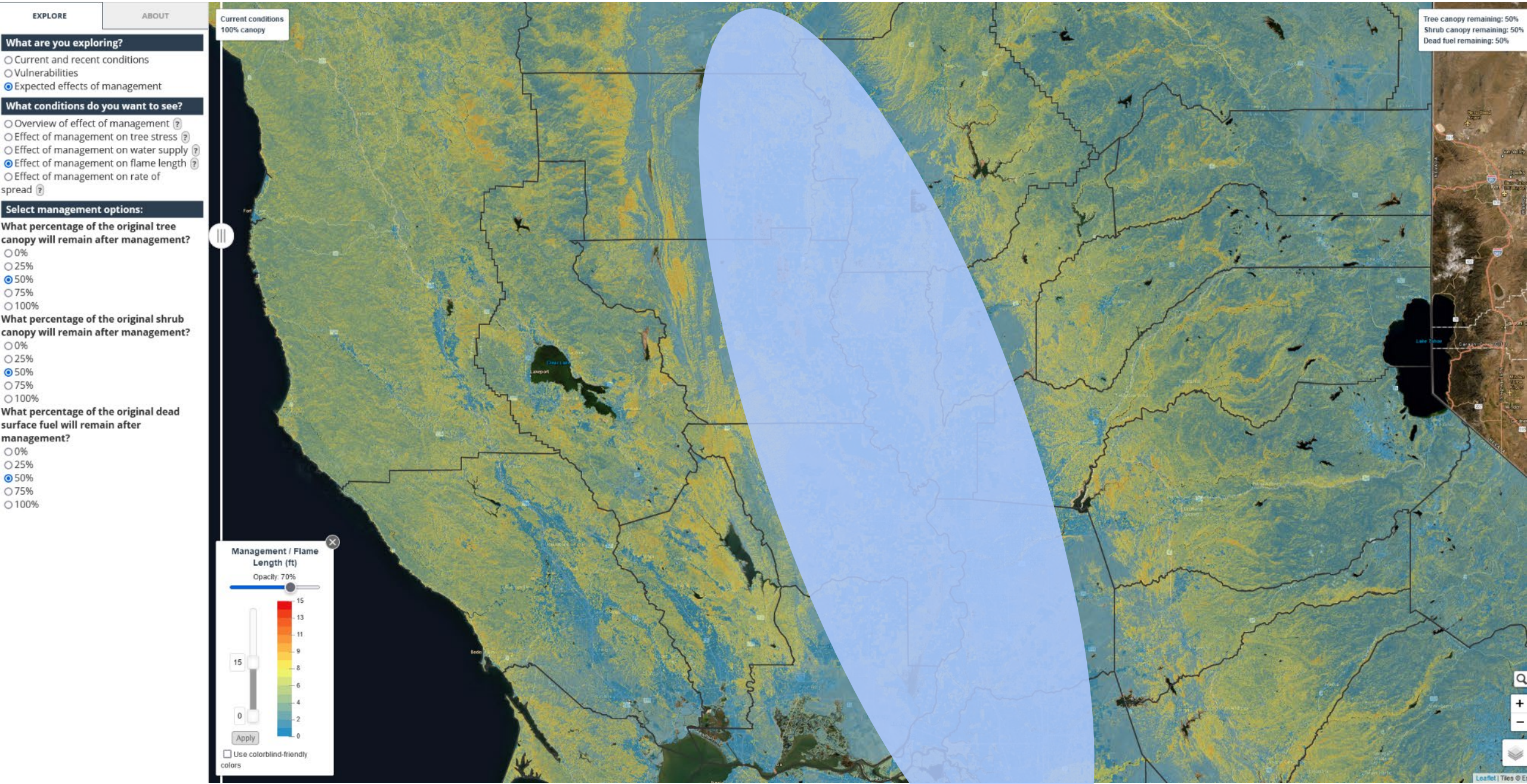
Runoff: 2018 (dry year)



Projected flame length: 2018 conditions



Management effects on flame length: 50% reduction in shrub canopy & dead surface fuel, 25% reduction in tree canopy



North Yuba partnership

Partnerships facilitate planning, permitting, financing, implementation, monitoring, research, communication, public support

J. Alvarez photo

Lookout above New Bullards Bar, July 2021