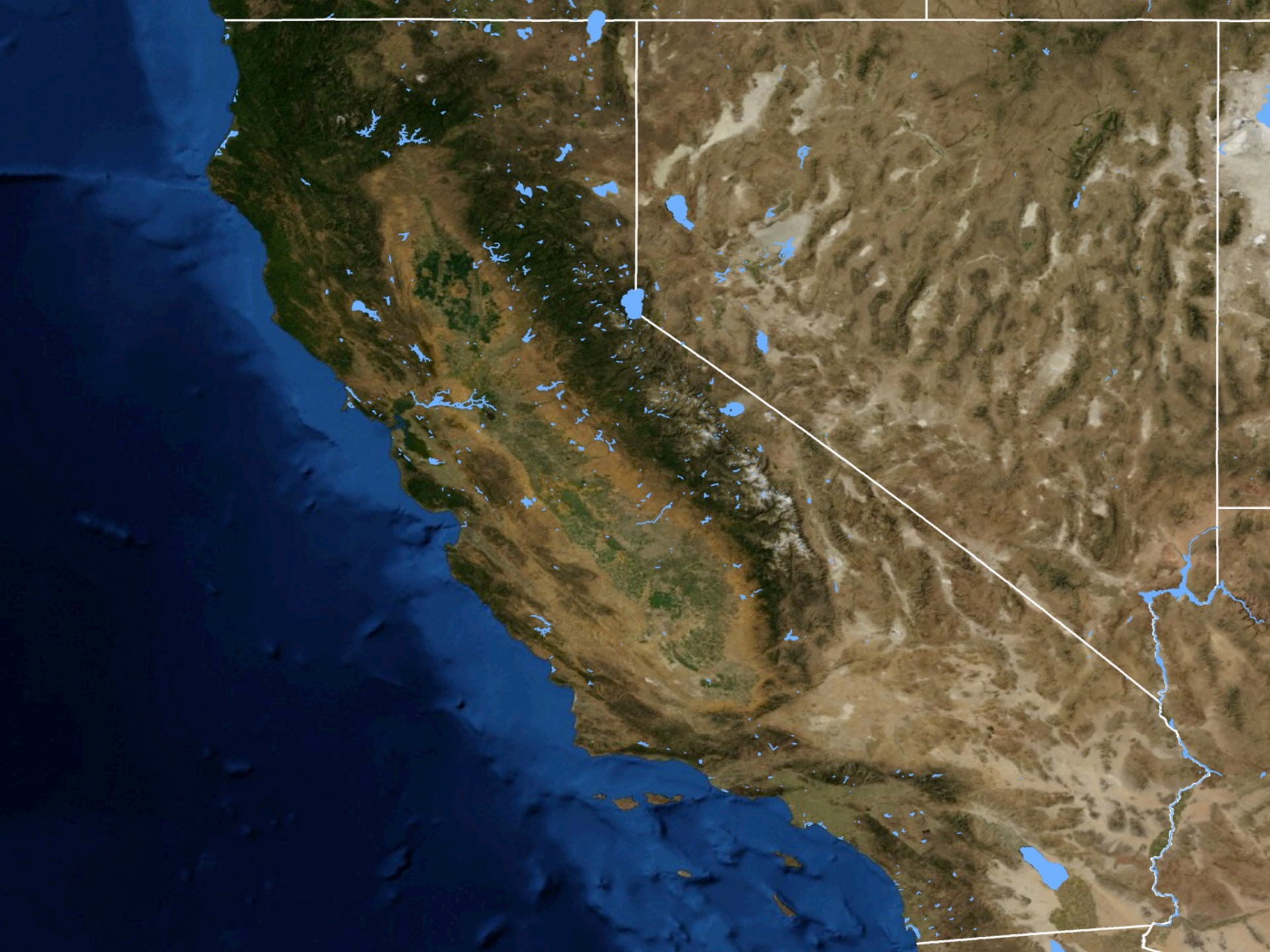
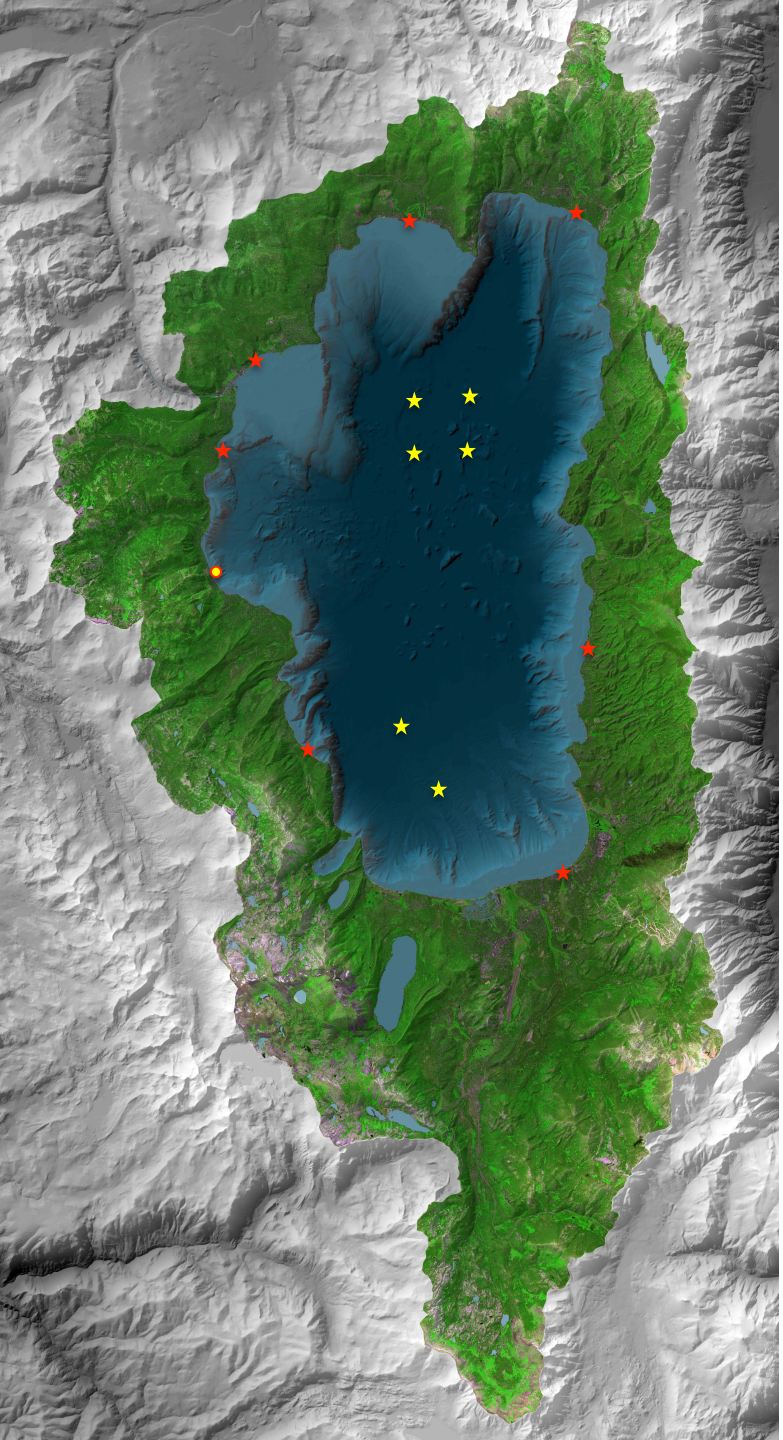
Lake Tahoe, USA

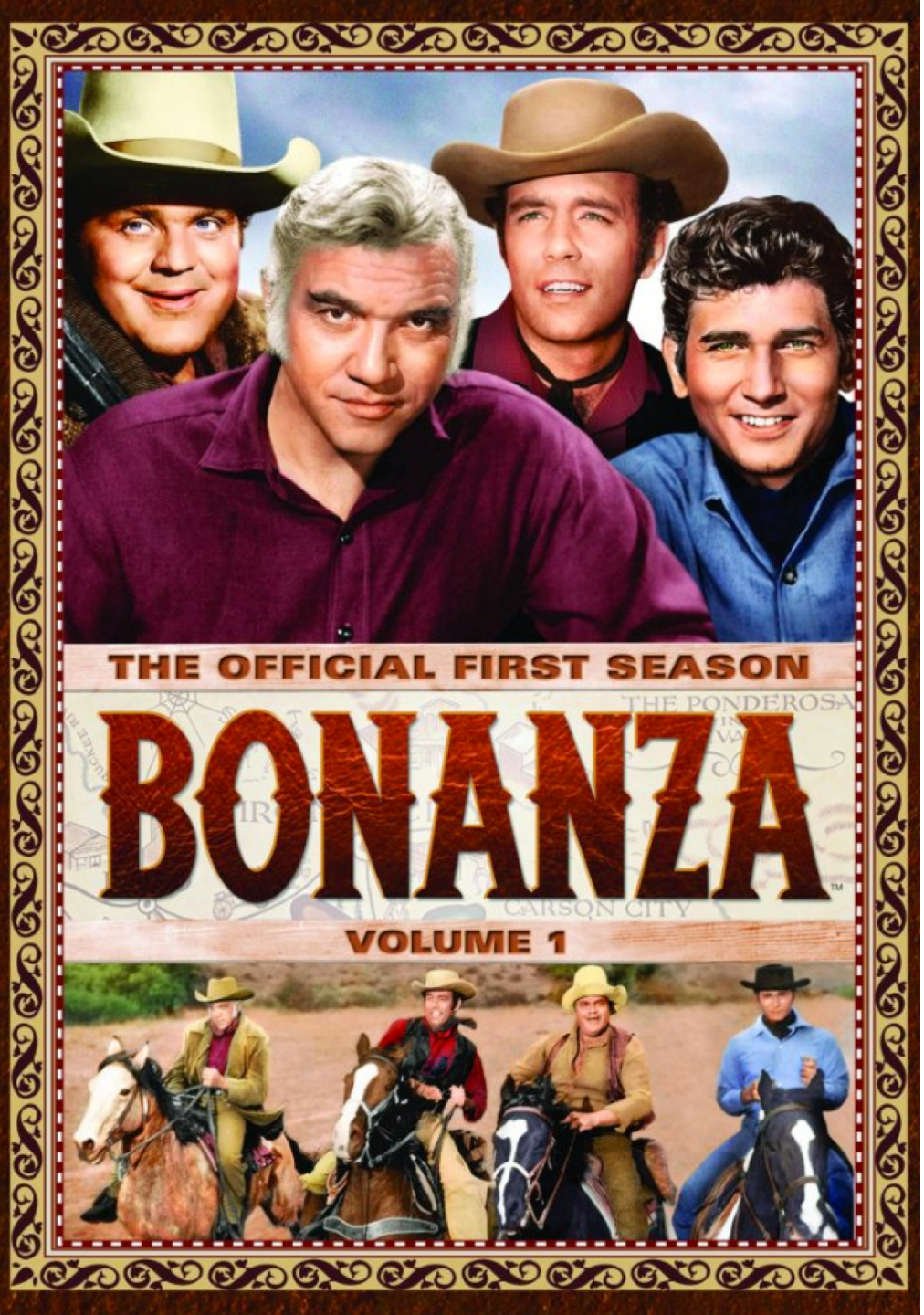
Geoff Schladow
University of California, Davis
Tahoe Environmental
Research Center (TERC)



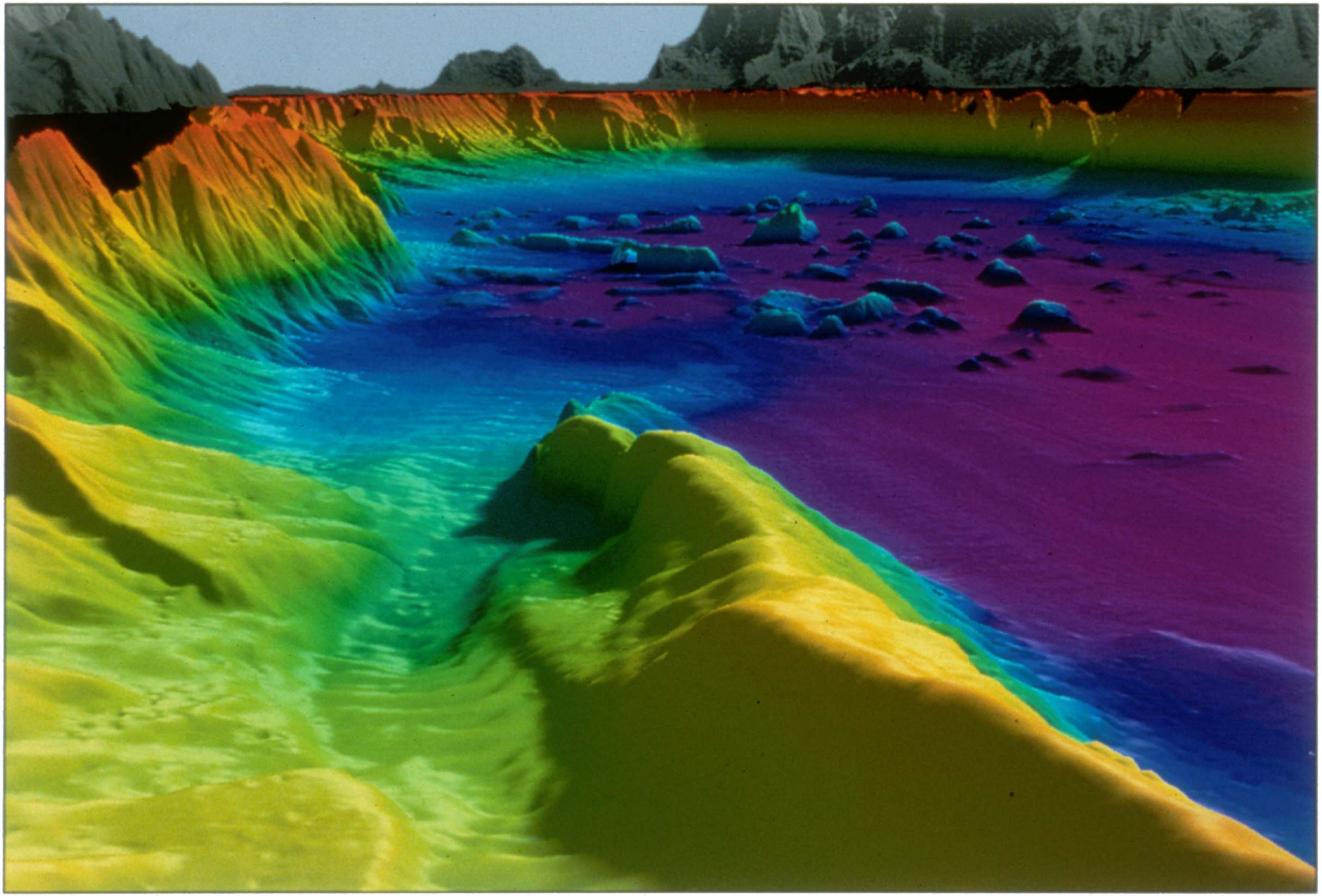


LAKE TAHOE
BASIC FACTS

11th deepest lake in the world
Maximum Depth = 501 m
Mean Depth = 330 m
Lake Surface Area = 500 km^2
Watershed Area = 800 km^2
Shoreline length = 115 km
Ultra-oligotrophic
Monomictic
63 Inflowing streams
1 Outflowing stream
Mean residence time ~ 650 yrs
Altitude = 1895 m
Latitude = 39 °N


THE OFFICIAL FIRST SEASON
BONANZA
VOLUME 1


Reno
Virginia City
The Ponderosa
Washoe Lake
Lake Tahoe
Carson City



USGS
science for a changing world

looking south from Incline area

1300 sq m labs, offices
400 sq m class rooms
350 sq m outreach/ed.

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TAHOE ENVIRONMENTAL
RESEARCH CENTER

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TAHOE SCIENCE CENTER

Shaping Watersheds Interactive Sandbox

EXPLORE LAKE TAHOE IN DEPTH

Thomas J. Long Foundation Education Center

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John Frémont

Kit Carson

An ancient, modern lake – 2 million years old, but first viewed by "Europeans" in 1844

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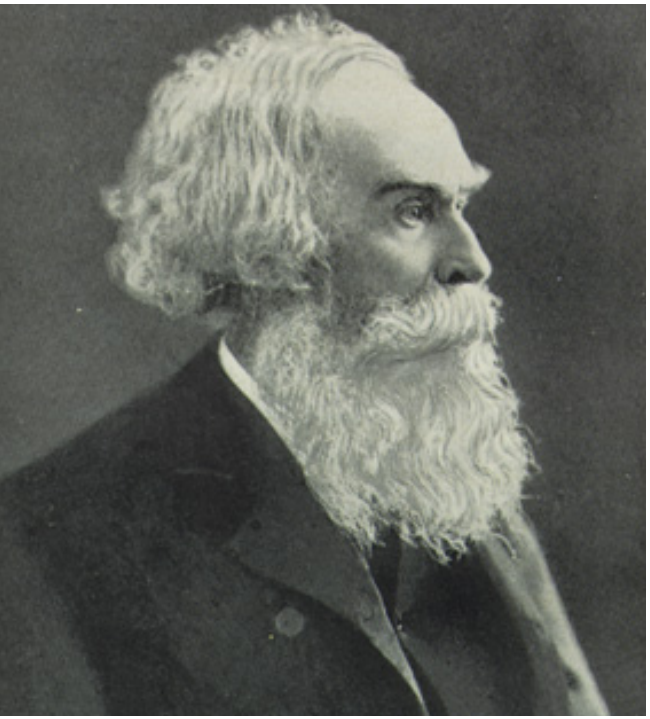
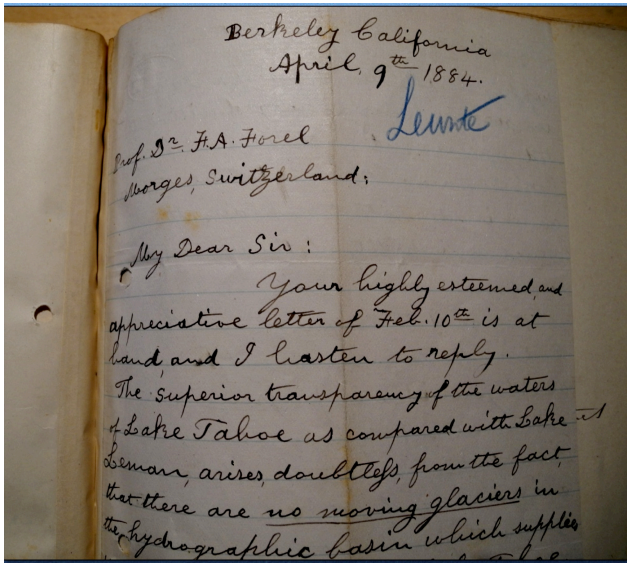
By 1870's research at Lake Tahoe through John LeConte. Measured Secchi depth of 33 m.





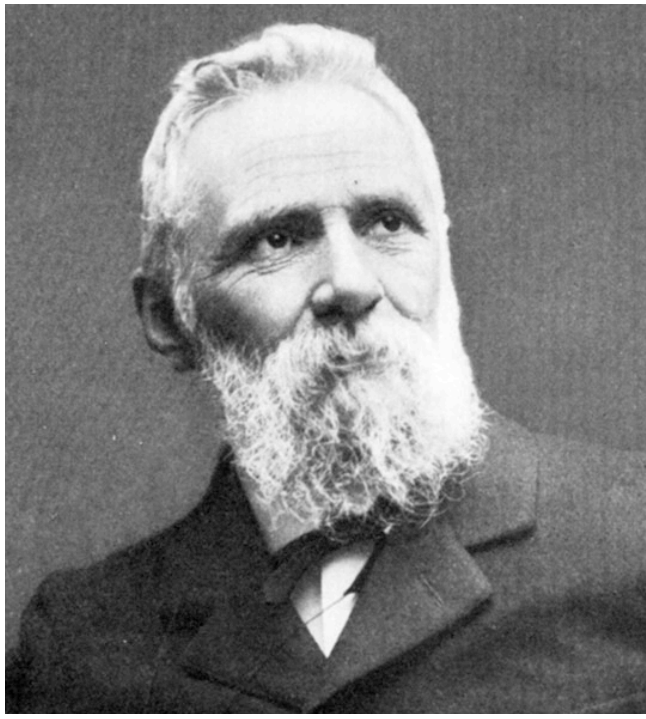
Berkeley California
April 9th 1884.

Leute

Prof. Dr. F.A. Forel
Morges, Switzerland.

My Dear Sir:

Your highly esteemed and appreciative letter of Feb. 10th is at hand, and I hasten to reply. The superior transparency of the waters of Lake Tahoe as compared with Lake Leman, arises, doubtless, from the fact that there are no moving glaciers in the hydrographic basin which supplies



John LeConte
1818 - 1891

François A. Forel
1841 - 1912

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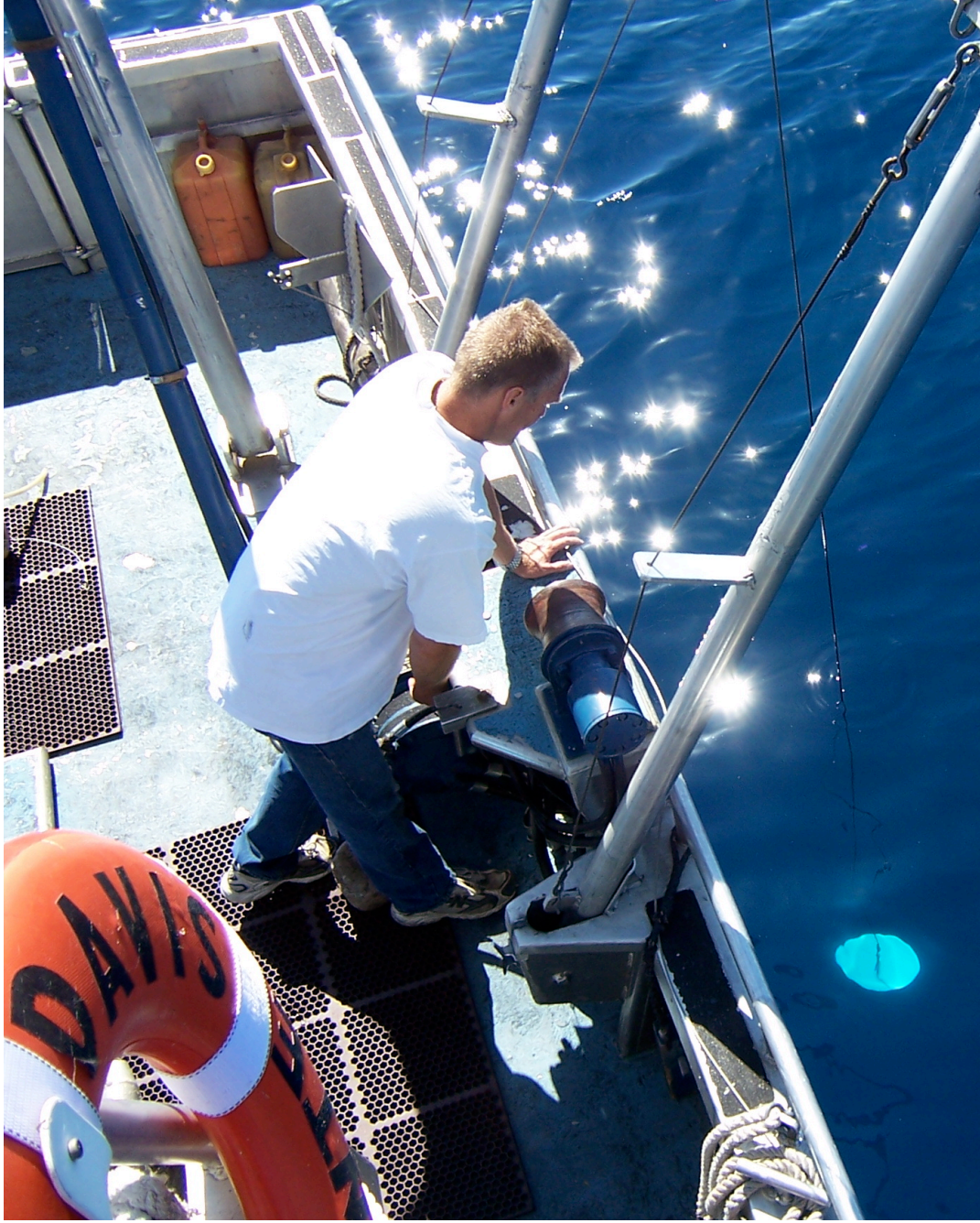
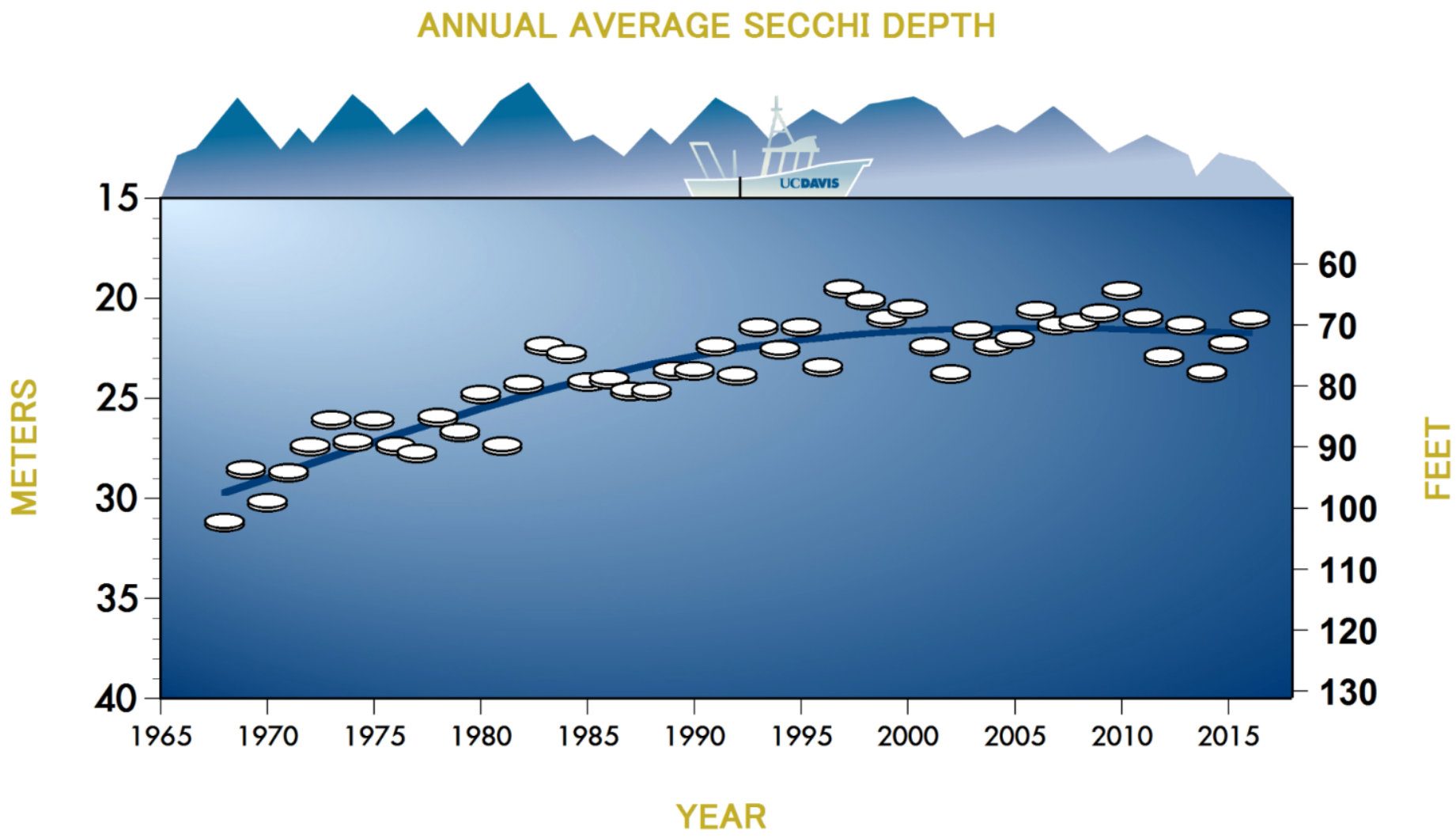
photo courtesy of *The Sacramento Bee*

Clinton and Gore on UC Davis research vessel John LeConte, 1997

CLARITY





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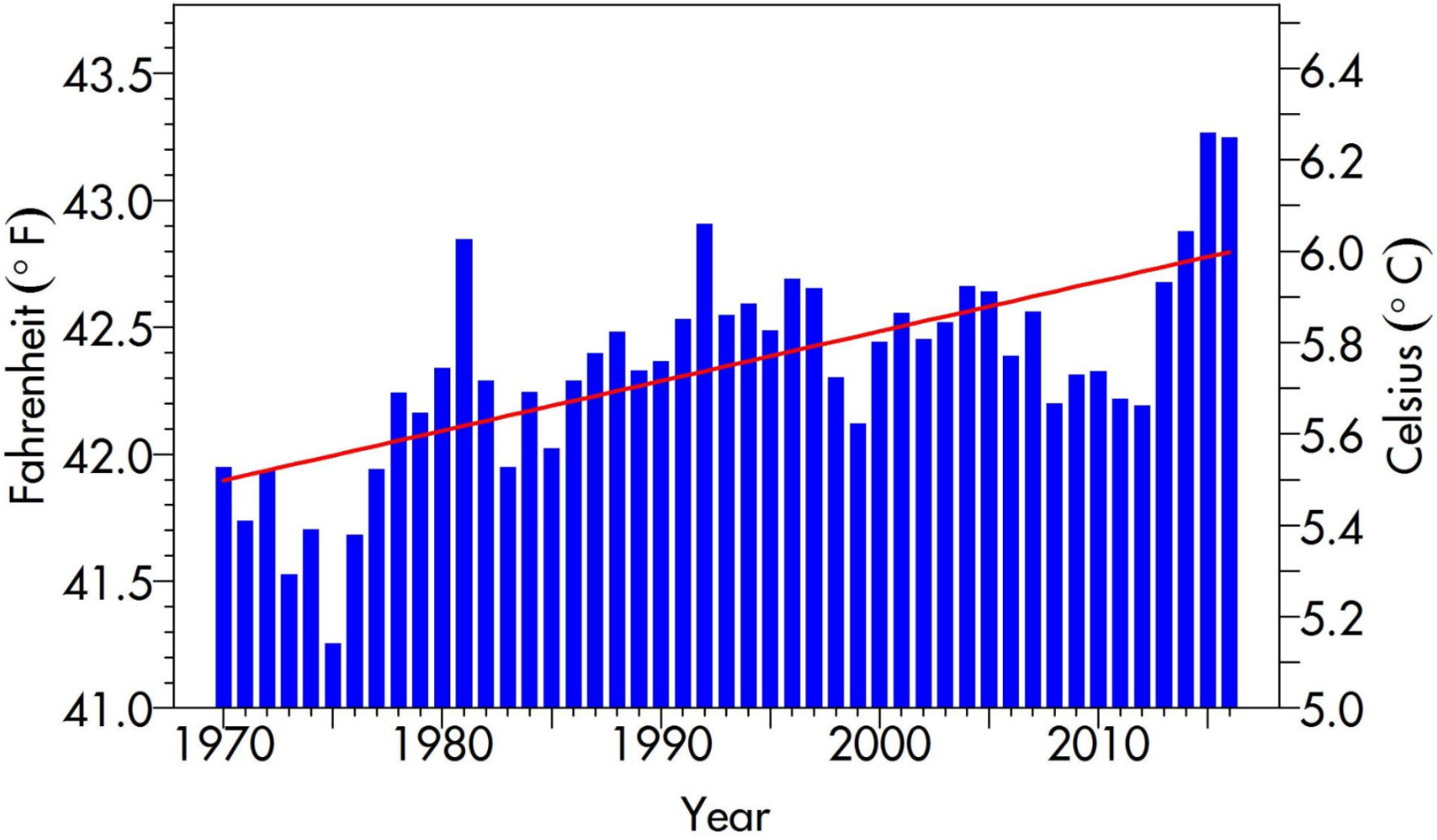
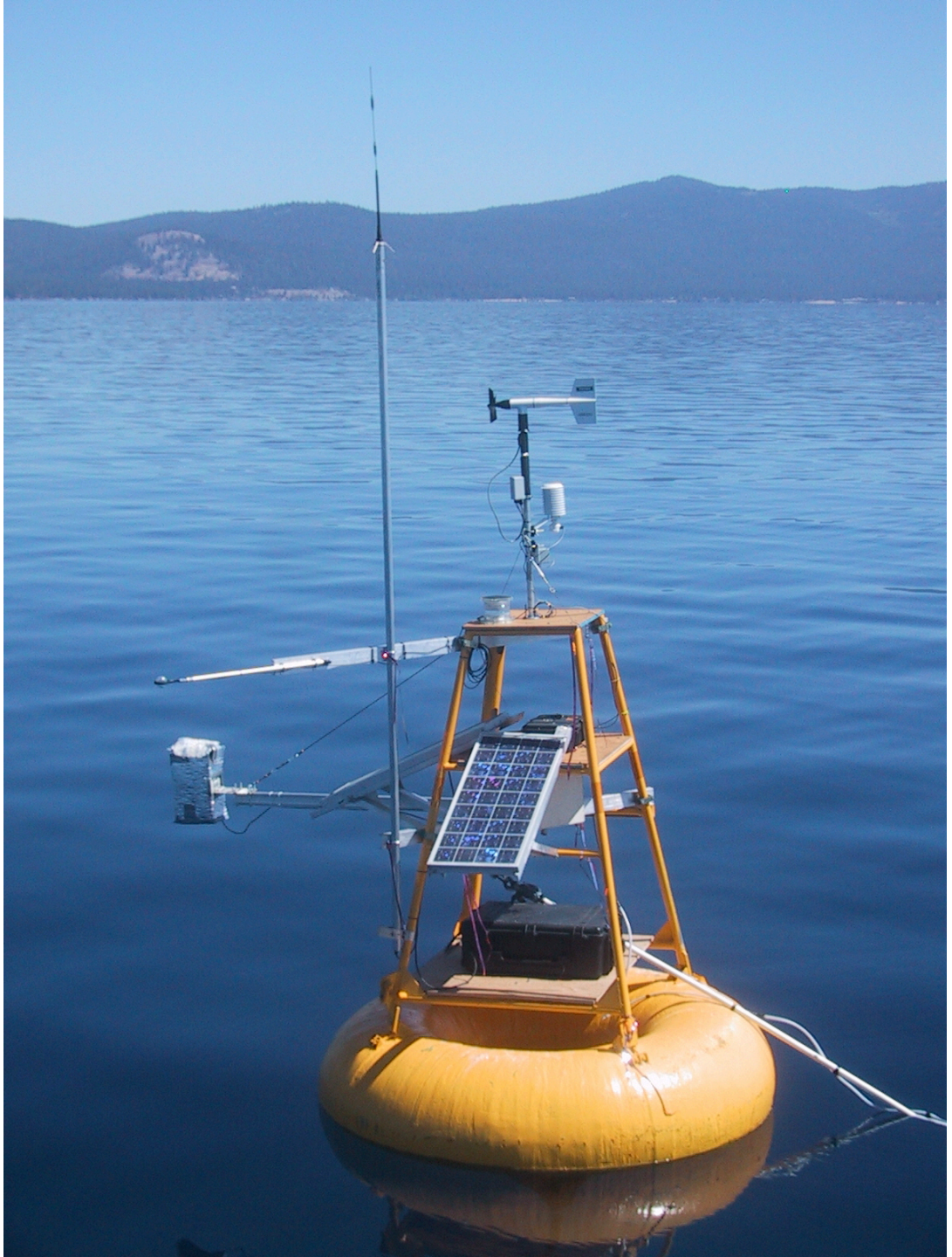
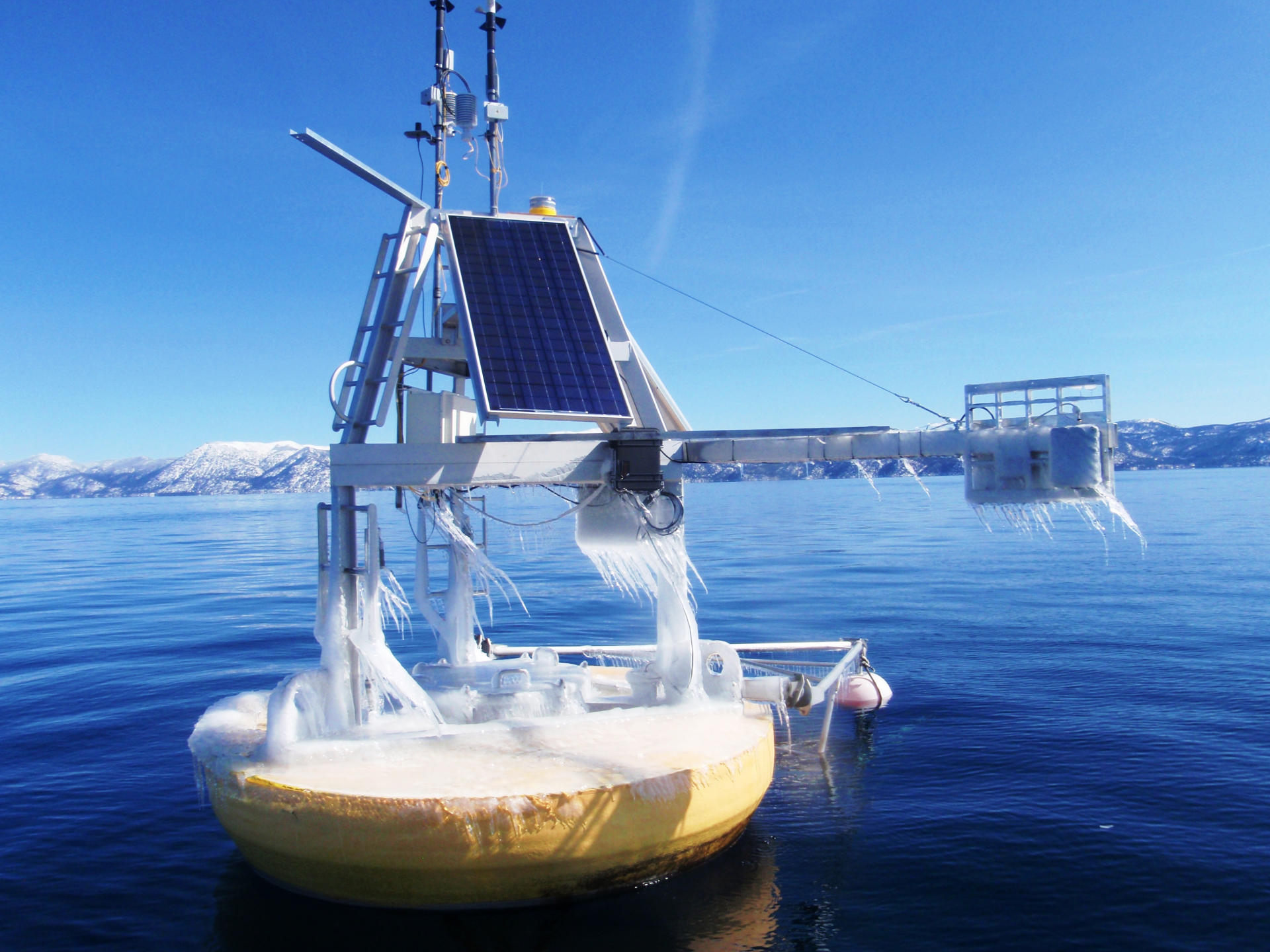
Annual Average Lake Temperature

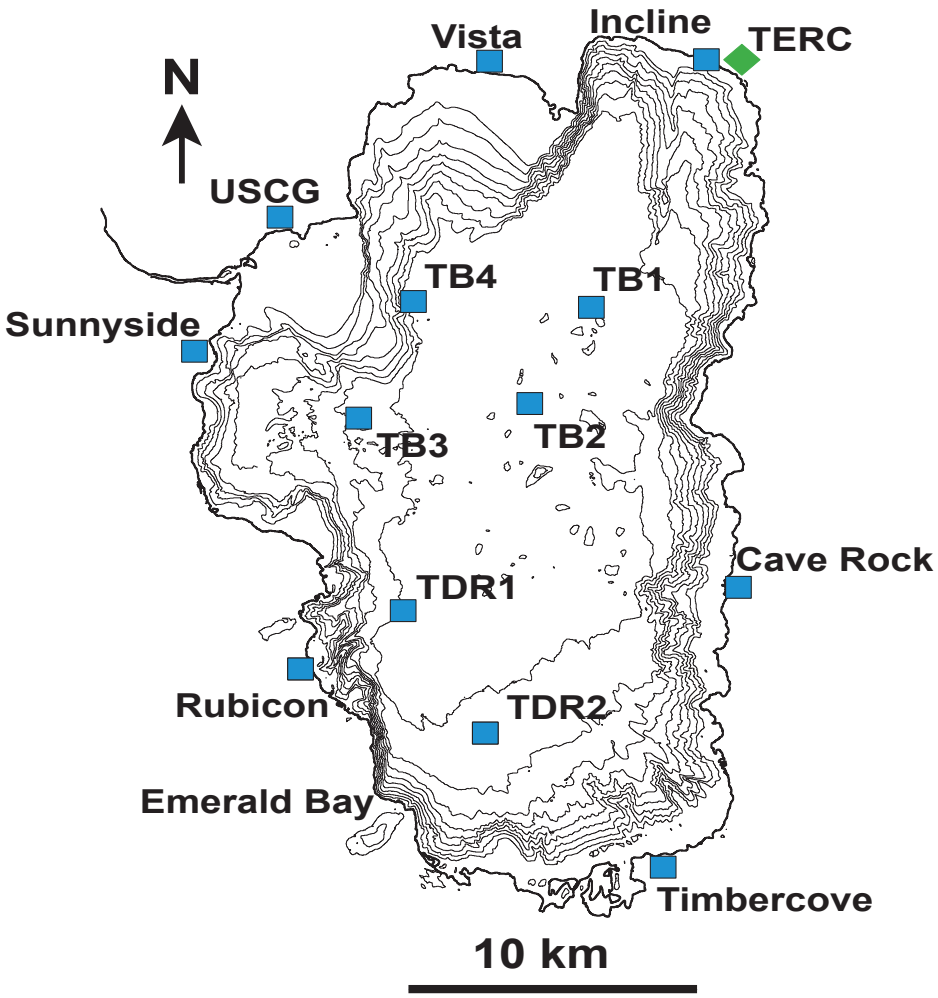


PAST NASA-JPL INVESTMENTS AT TAHOE



Oct 29, 2002





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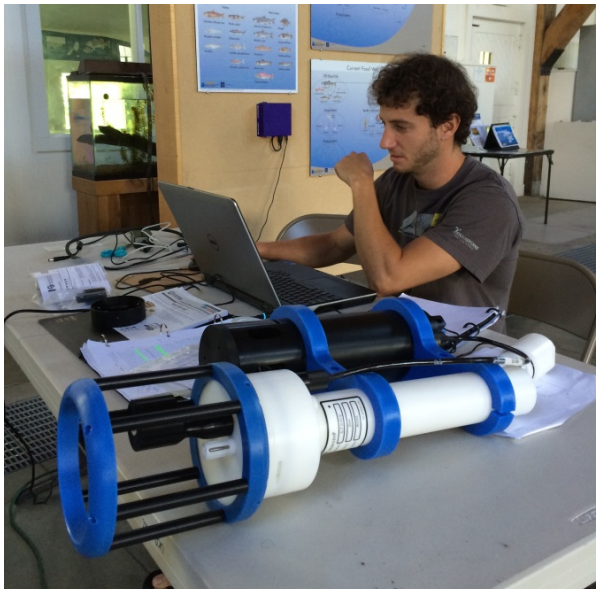
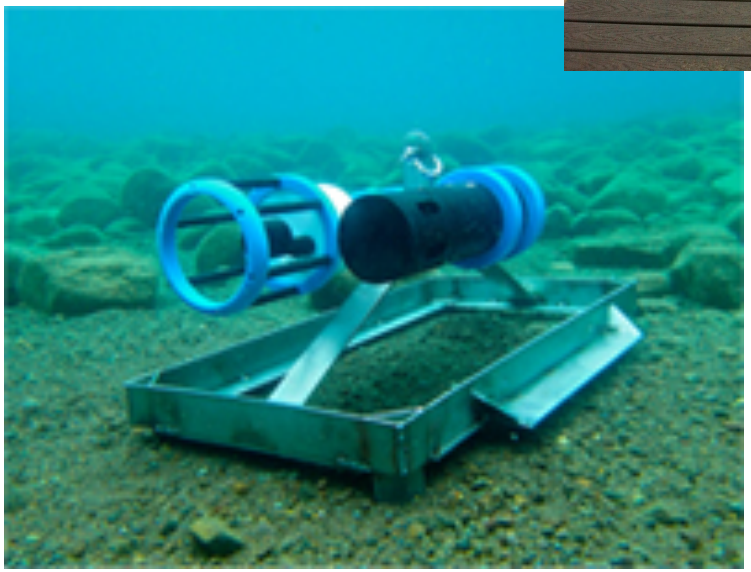
Measuring Nearshore Water Quality

- Sensors tethered to docks around the lake measure the clarity, algal concentration, lake metabolism, dissolved oxygen, temperature, wave height etc. every 30 seconds, 24 hours of every day.

- To date 11stations





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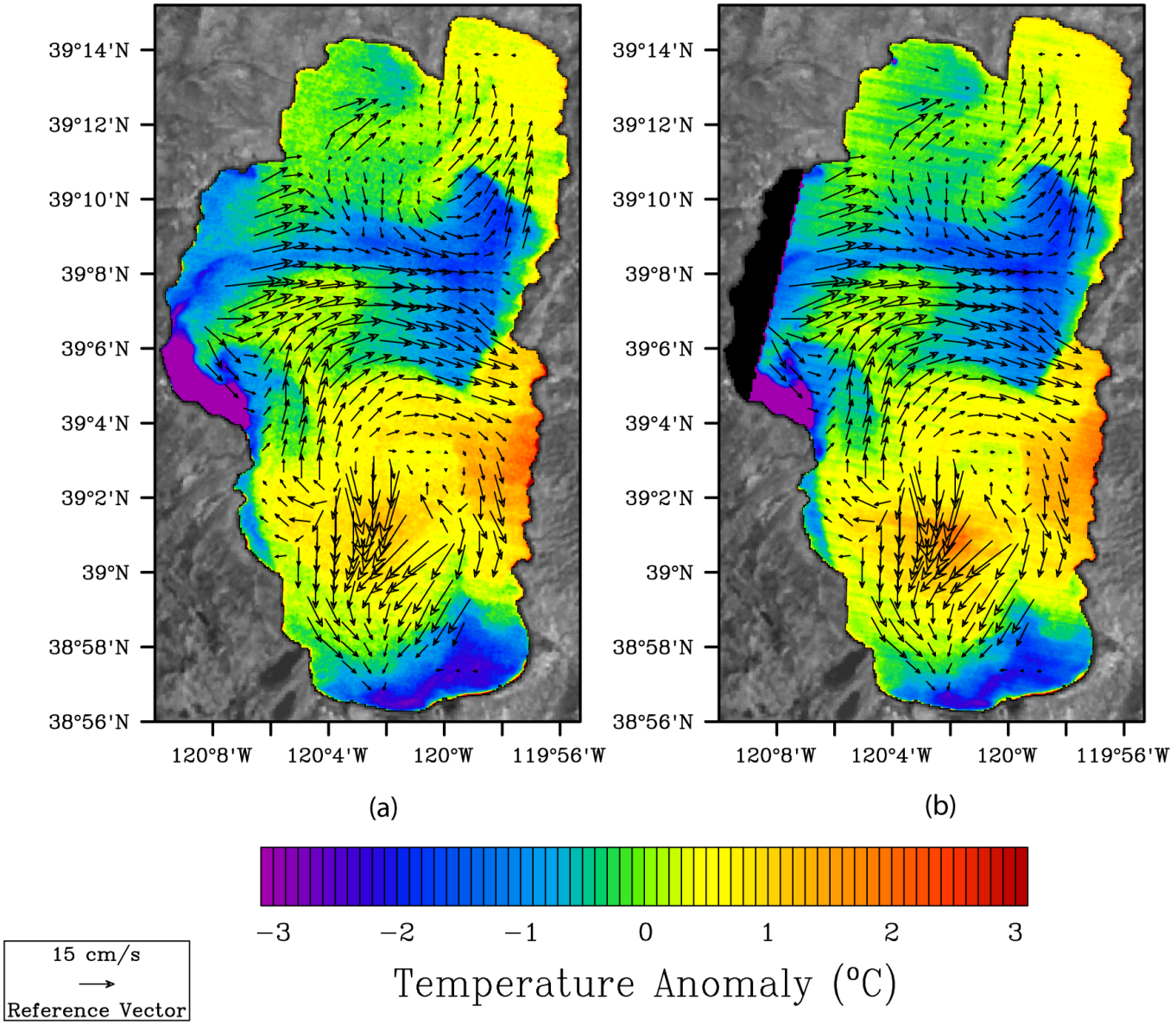
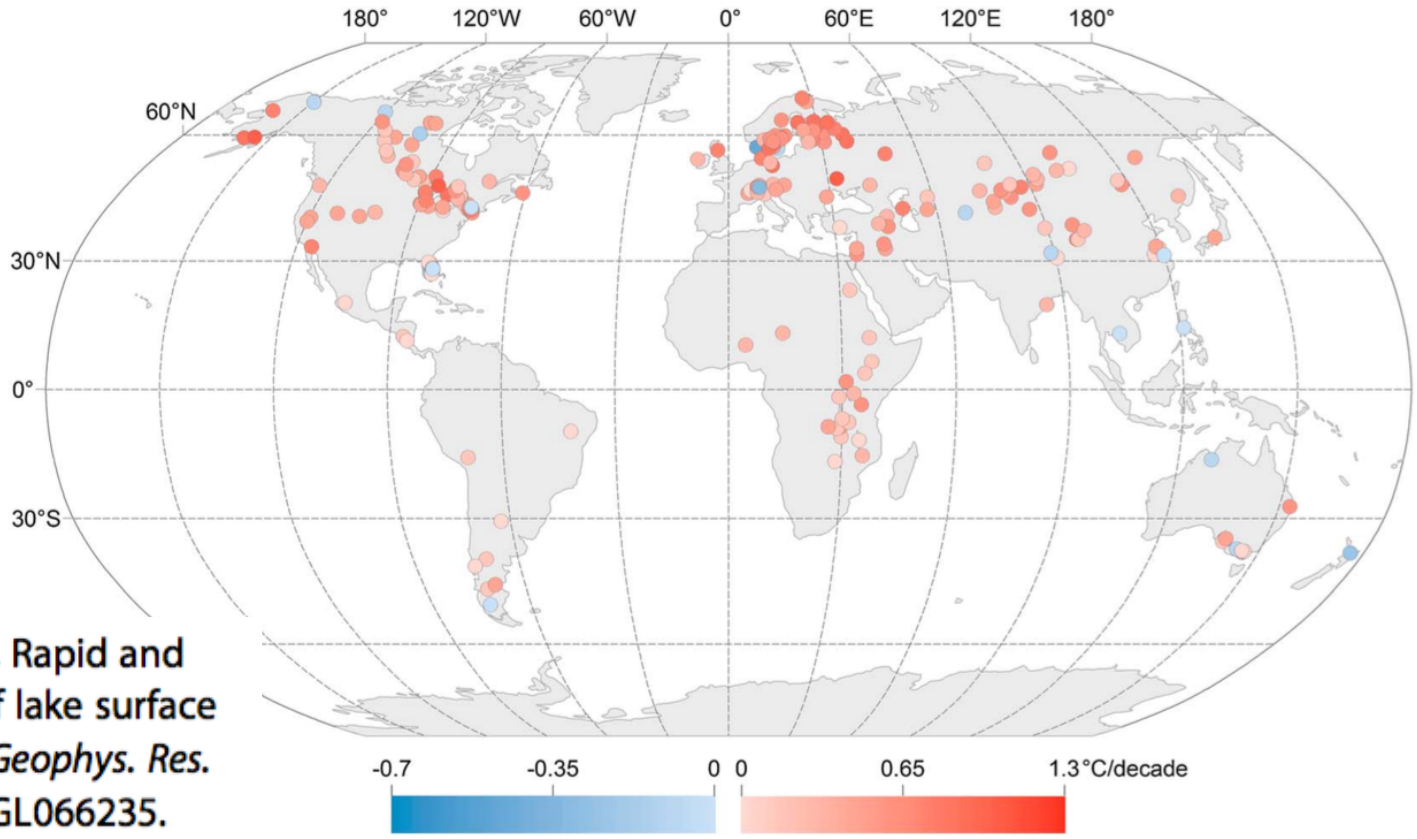
Satellite Image-Derived Surface Currents

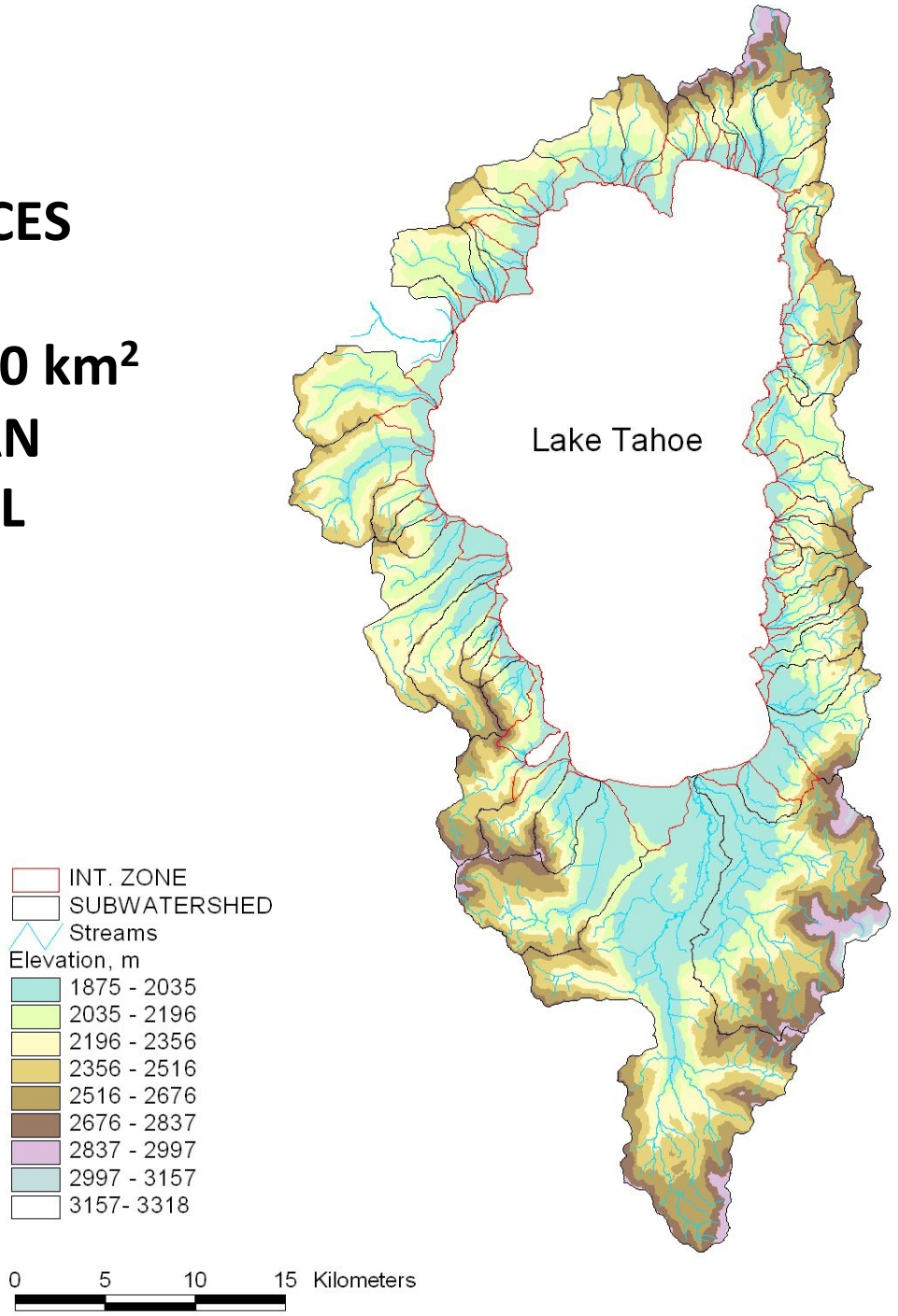


Geophysical Research Letters 10.1002/2015GL066235



O'Reilly, C. M., et al. (2015), Rapid and highly variable warming of lake surface waters around the globe, *Geophys. Res. Lett.*, *42*, doi:10.1002/2015GL066235.

THE LARGE RANGE IN ALTITUDE, SOIL TYPES, OROGRAPHIC DIFFERENCES AND DIVERSITY OF VEGETATION ACROSS 800 km^2 TAHOE BASIN MAKE IT AN "EFFICIENT" TERRESTRIAL CAL/VAL SITE



Upper Truckee River Restoration Projects

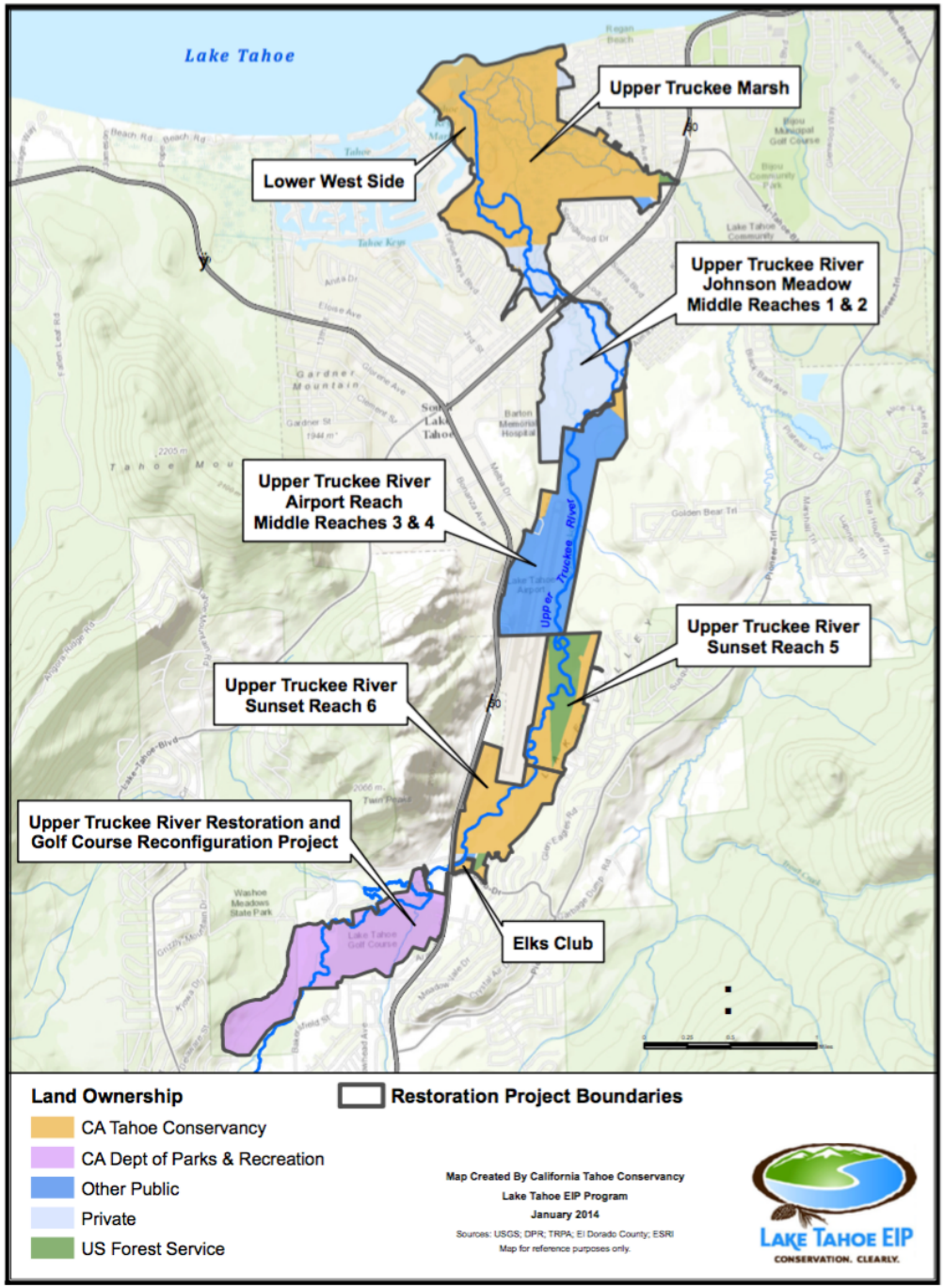
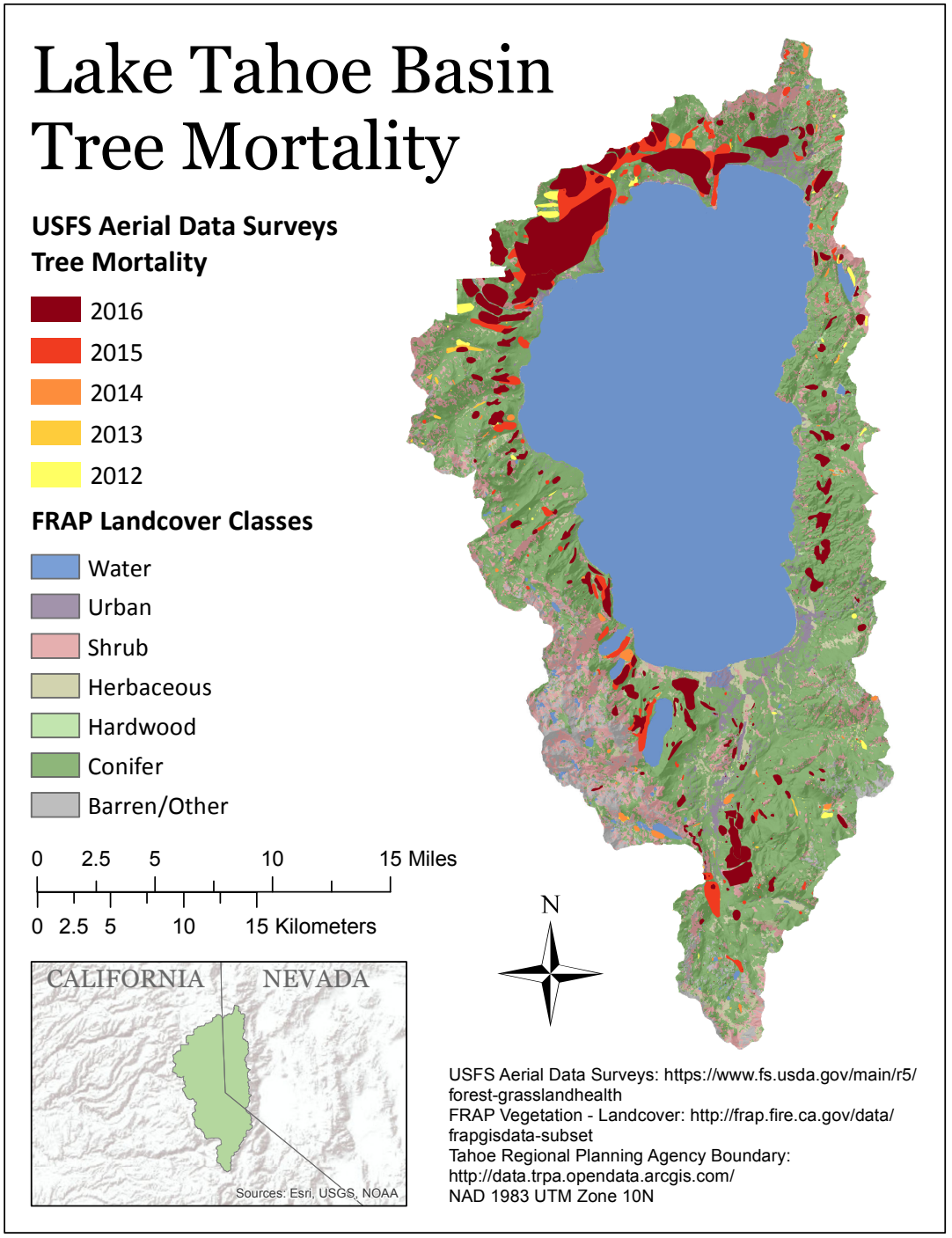
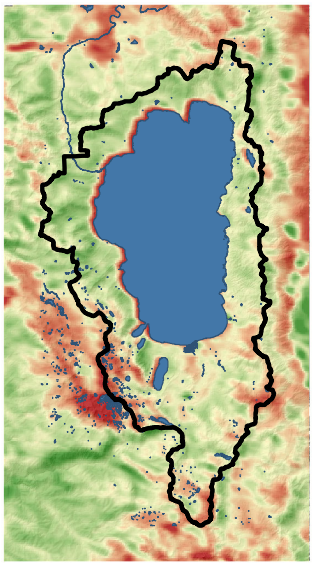


Figure credit:Yufang Jin





Tahoe Basin EVI Differences 2012-2016

Enhanced Vegetation Index (EVI)
Late August Average 2001-2011

High : 0.53

Low : 0.05

Tahoe Basin

Lakes and Rivers

DIfference from Baseline EVI

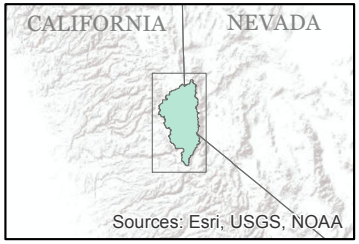
-0.2 - -0.05	0 - 0.01
-0.05 - -0.02	0.01 - 0.02
-0.02 - -0.01	0.02 - 0.2
-0.01 - 0	

MODIS MCD43A, NASA EOSDIS Land Processes DAAC, USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota (https://lpdaac.usgs.gov)
Tahoe Regional Planning Agency Boundary: http://data.trpa.opendata.arcgis.com/
Water Bodies: USGS National Hydrography Dataset (NHD)
NAD 1983 UTM Zone 10N

0 5 10 20 Miles

0 5 10 20 Kilometers

N



The difference maps below display where the late August EVI in each year diverge from the baseline EVI. Positive (green) values indicate an increase in EVI, negative (red and yellow) values indicate a decrease in EVI.

2012 2013 2014 2015 2016

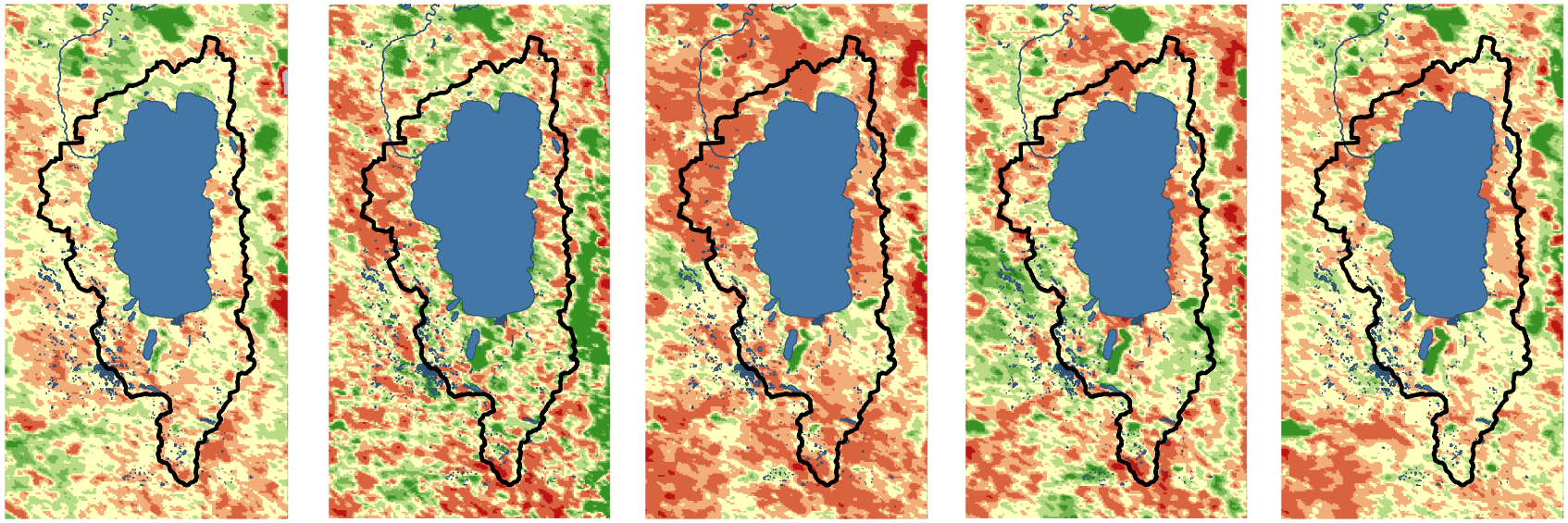
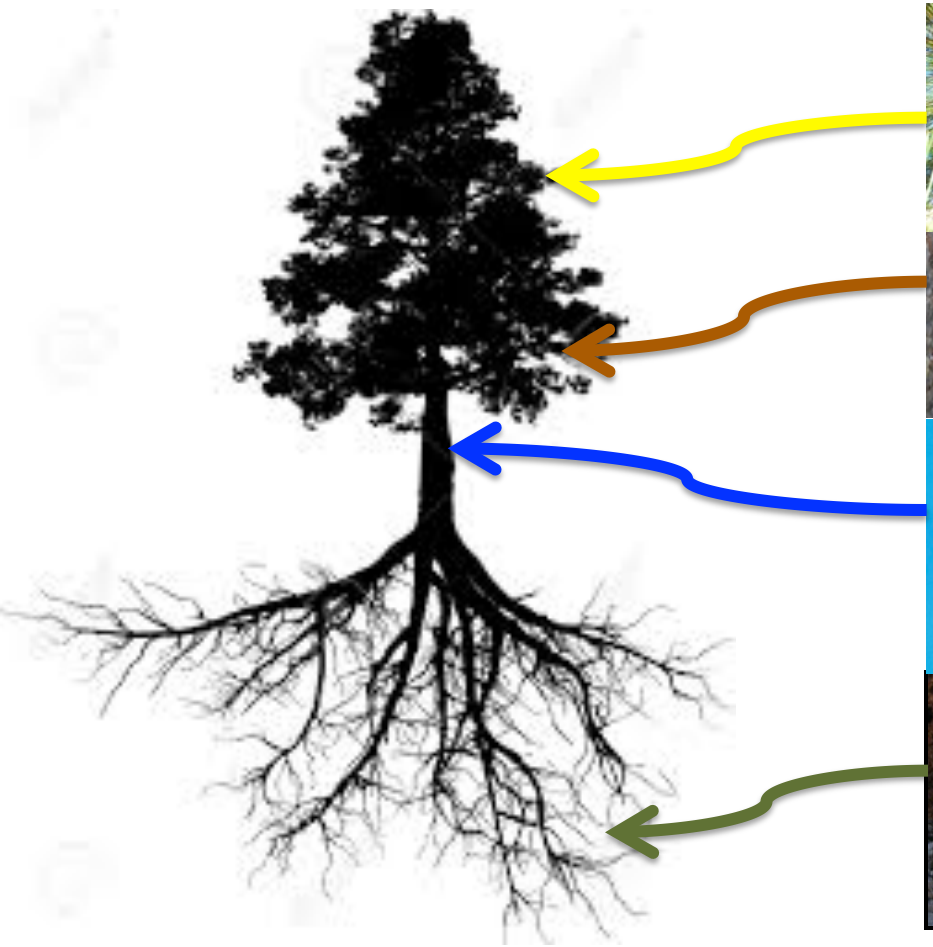
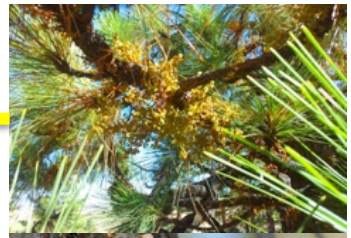


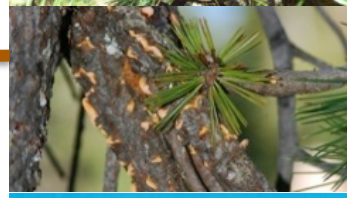
Figure credit: Yufang Jin & Susan Ustin

Forest Health,Tree Ecophysiology, & Drought





Dwarf mistletoe: Water-demanding parasitic plant.



White pine blister rust: Canker pathogen-girdles tree & restricts water uptake.

Bark Beetles: Preferentially attack drought-stressed trees, microbial associates (blue stain fungi) are wilt pathogens.

Root Diseases: Damage root system and limit/impede water uptake.

Tricia Maloney

- Water-land-atmosphere exchange processes in complex environments:
  - Fully 3-D flow structure
  - Multi-Scale & non-local
  - Spatially variable

- Katabatic flow is just one regime:
  - Anabatic flow & transition periods

- Many open & interesting questions → improve surface coupling models, forecasting and management strategies.

Future field studies:

- Move from 1D towers to in-situ observatories

- Strategies to meet the spatial and temporal scales of the flow and its drivers.

Sensor development

Long-term trends: predictions with climate drivers & influence of persistent drought or fire damage.

Holly Oldroyd