Mt. Shasta Spring Water Investigations

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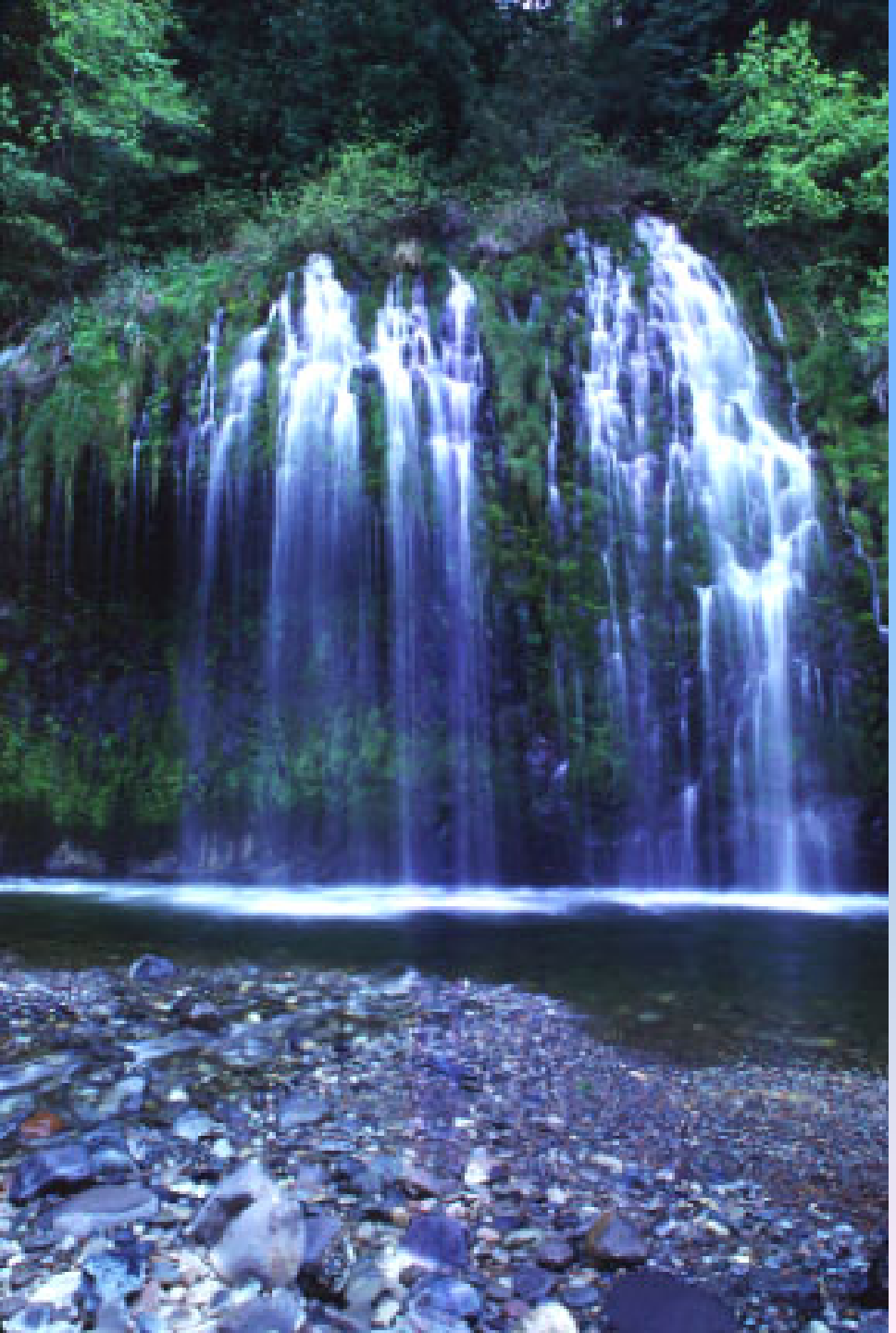
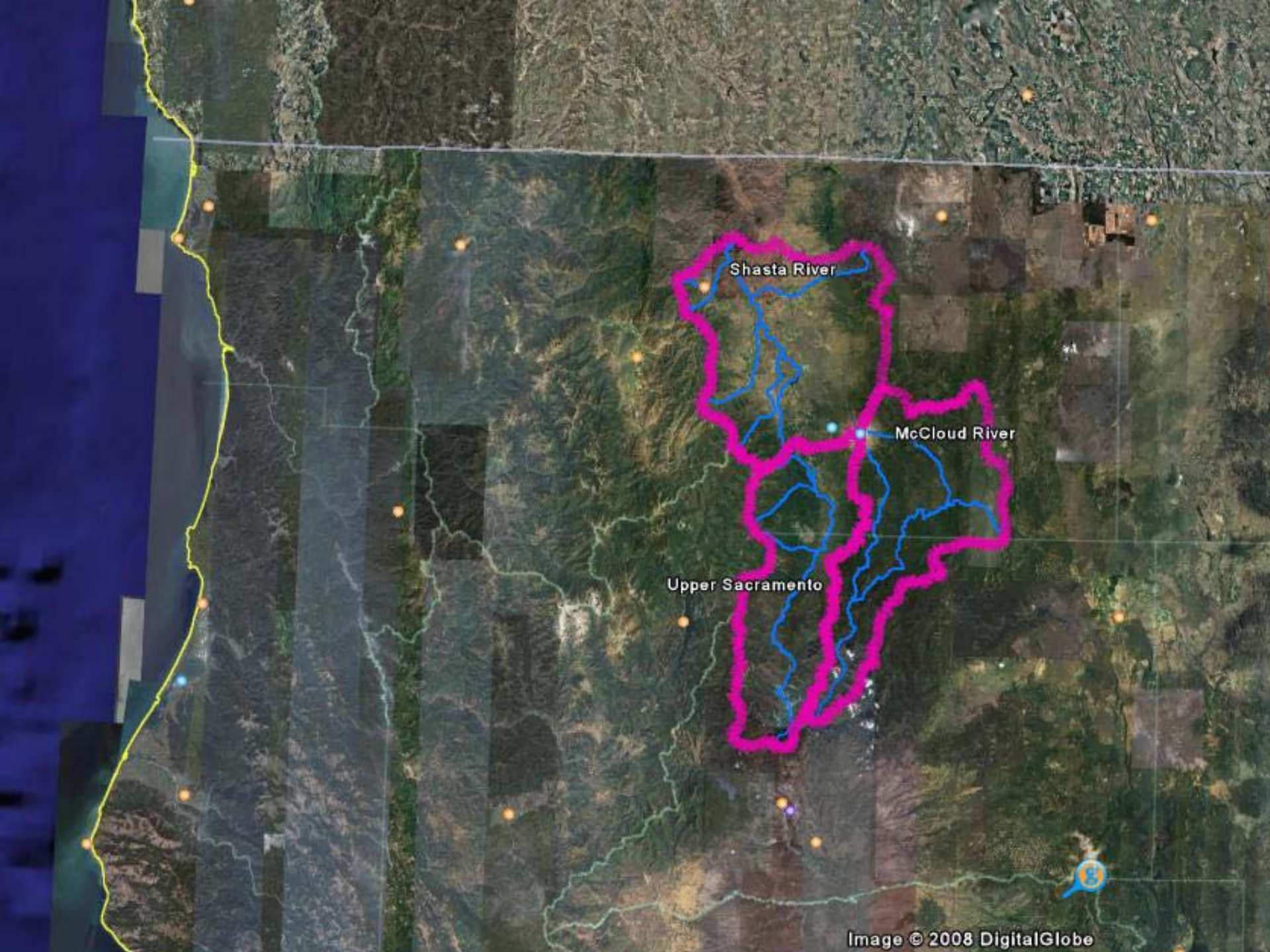


- Protect the ecological and hydrological integrity of Mt. Shasta’s unique headwater areas
- By 2020 achieve water balance and safe yield for Mt Shasta’s hydrologic system

Original Study Objectives

- Assemble existing available information on Mt. Shasta's spring and groundwater resources
- Establish a standardized hydrologic and geochemical monitoring program at prioritized spring locations
- Identify Groundwater Basins
- Develop a vulnerability index


Shasta River
McCloud River
Upper Sacramento
Image © 2008 DigitalGlobe

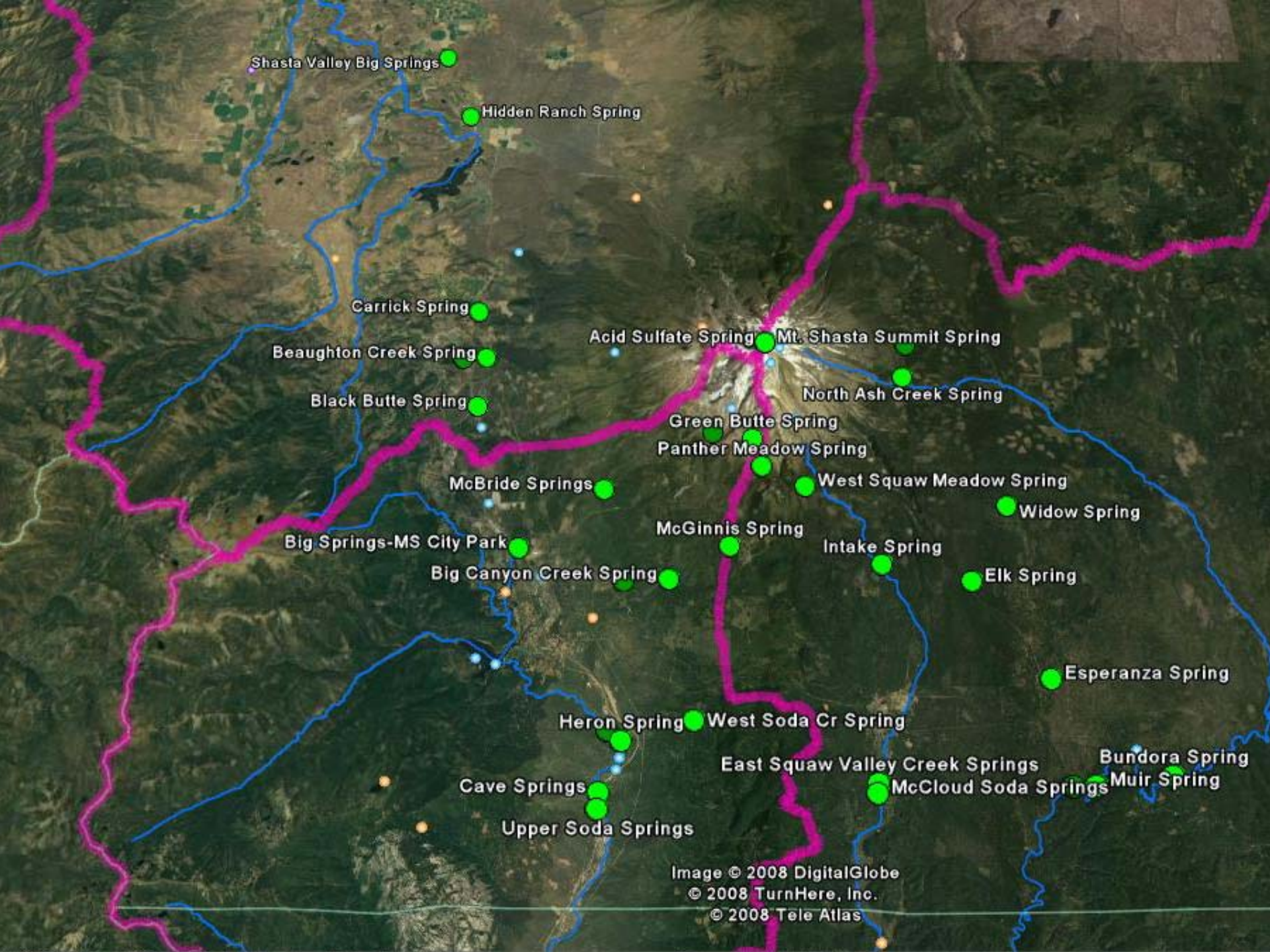
Mt. Shasta Glaciers

- Two predictive models have been performed on the Whitney and Hotlum Glaciers
  - Local data model indicate glacier growth over the next 100 years
  - Regional data model (specifically temperature forecasting) indicate loss of most of the glacier volume within the next 50 years

Howat et al. 2006

Mt. Shasta Springs Study

- 23 springs sampled for general and physical chemistry and for stable hydrogen and oxygen isotopes
- Subset of these springs have been monitored monthly for flow
- Preliminary data to determine: recharge elevations and relationships
- Age date a small subset- one spring in each basin


Shasta Valley Big Springs
Hidden Ranch Spring
Carrick Spring
Beaughton Creek Spring
Black Butte Spring
Acid Sulfate Spring
Mt. Shasta Summit Spring
North Ash Creek Spring
Green Butte Spring
Panther Meadow Spring
McBride Springs
West Squaw Meadow Spring
Widow Spring
McGinnis Spring
Intake Spring
Big Springs-MS City Park
Big Canyon Creek Spring
Elk Spring
Esperanza Spring
Heron Spring
West Soda Cr Spring
East Squaw Valley Creek Springs
Bundora Spring
Muir Spring
McCloud Soda Springs
Cave Springs
Upper Soda Springs
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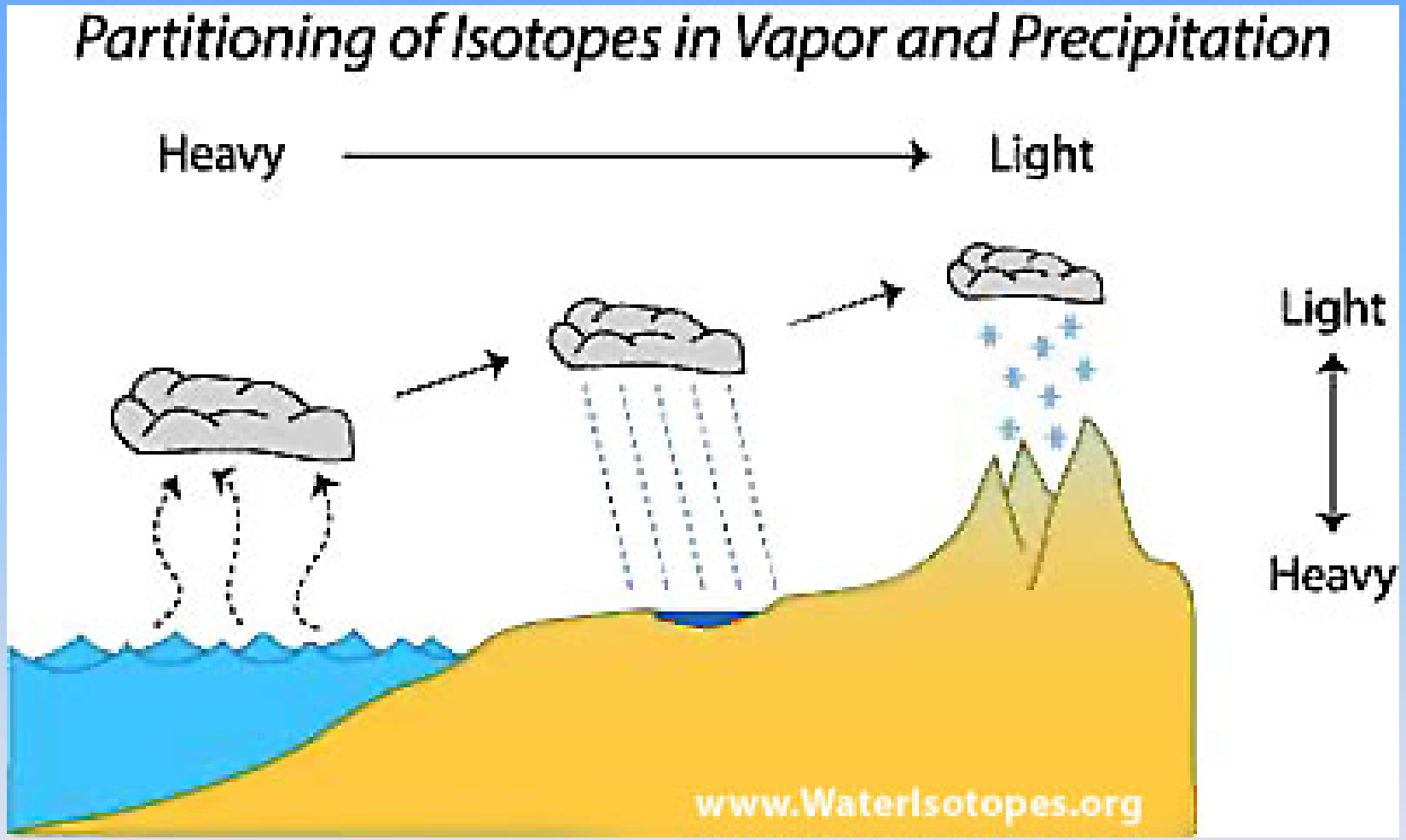
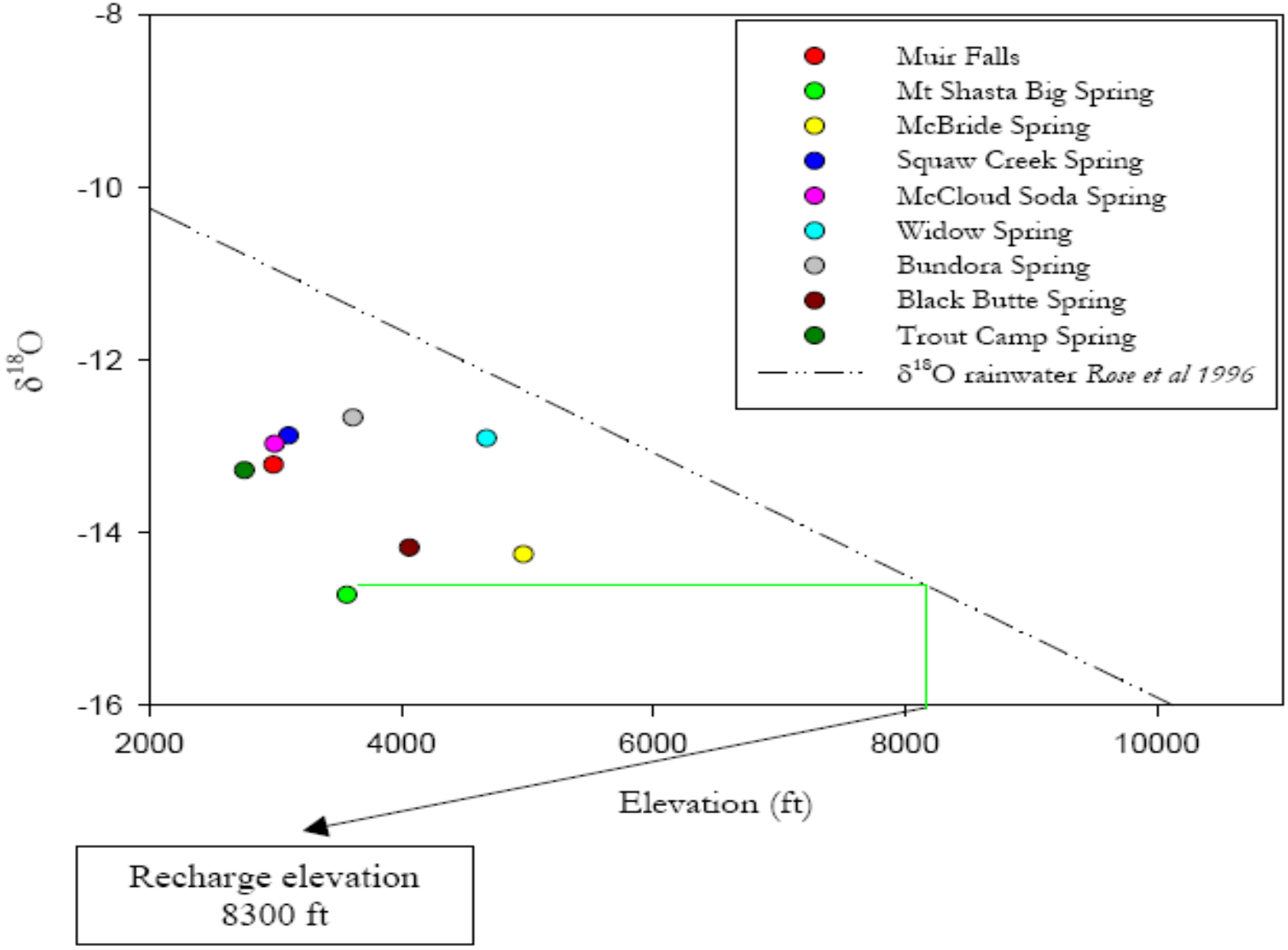

Partitioning of Isotopes in Vapor and Precipitation
Heavy
Light
Light
Heavy
www.WaterIsotopes.org

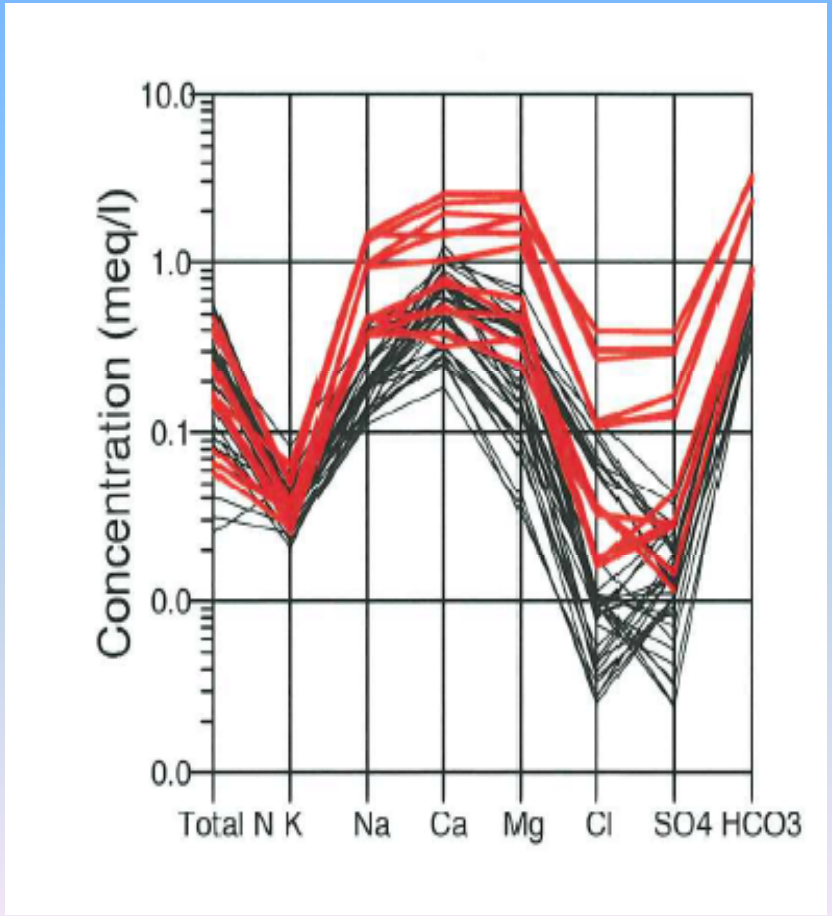
Mt Shasta Spring Water

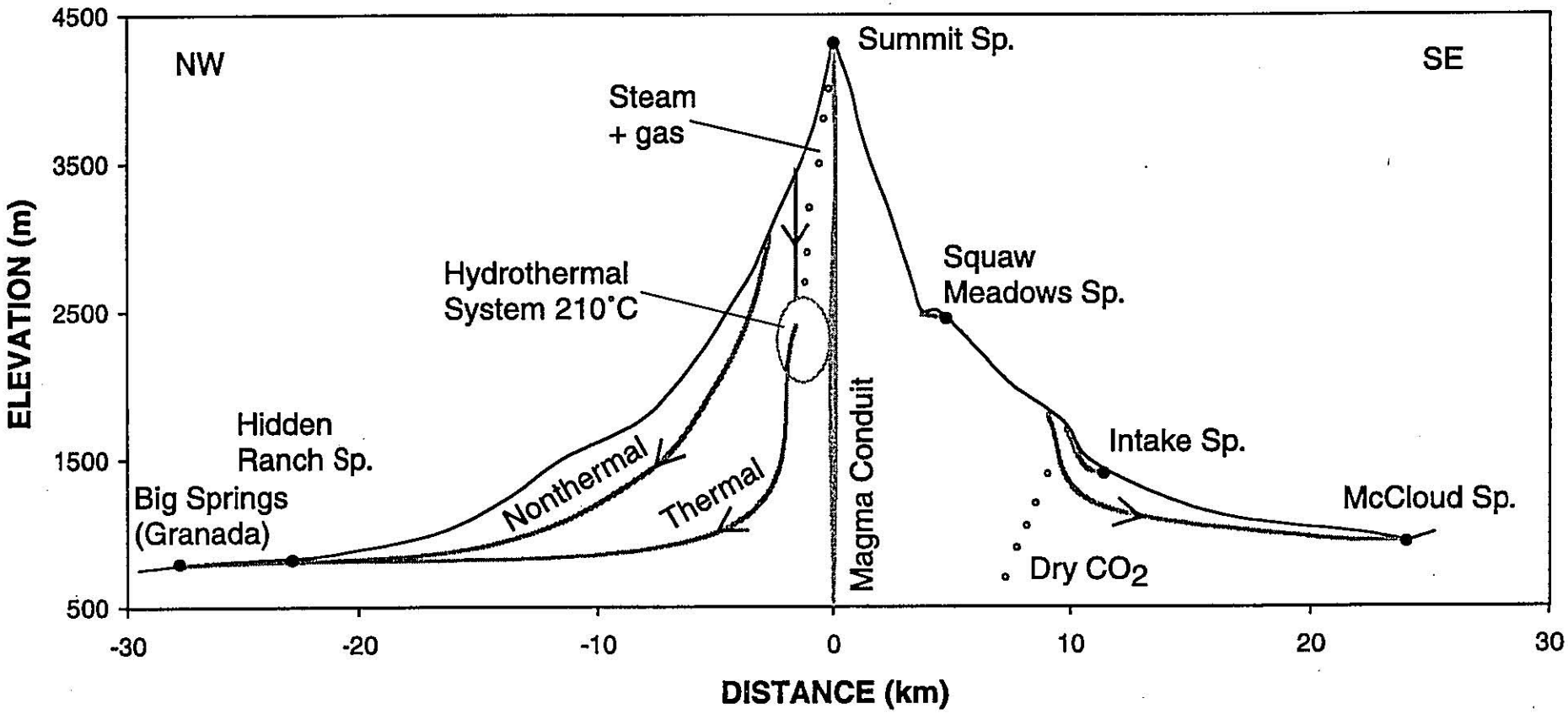


Tritium Isotope Analysis

Sample ID	Age using EA (yr)
Carrick Spring	>50
Mt Shasta Big Springs	>50
Muir Springs	13.9
Shasta E. Spring	44.4
Shasta N. Spring	26.6

Travel Distance and Mineral Content





Nathenson, et al. 2006

1. Non-thermal springs, immediate recharge area, higher vulnerability

2. Non-thermal springs, high recharge elevation, lower vulnerability

3. Slightly thermal springs, high recharge elevation, hydrothermal influence

4. Slightly thermal *mineral* springs with high amounts of dissolved constituents

Future Objectives

- Create a isotopic composition line specific to Mount Shasta
- Chart historical snow pack on the mountain within the wilderness area
- Work with local communities to age date potable water sources and springs that have biological significance
- Forecast potential drought years
- Finalize the Vulnerability Index