

Sierra lakes hold answers to climate change

By Carole Jablon-Bernardi

INCLINE VILLAGE – The Sierra Nevada snow drifts are at a drought busting 173 percent of average, with the most snow recorded since 1995, so said California water managers as of Feb. 2. That was before another 2 feet of snow fell overnight Thursday on the North Shore.

On a snowy Feb. 9 evening it was appropriate the topic at Tahoe Environmental Research Center on the campus of Sierra Nevada College was climate change.



Steve Sadro talks climate change on Feb. 9. Photo/Carole Jablon-Bernardi

Steve Sadro, who is with Department of Environmental Science and Policy at UC Davis, titled his lecture “Climate Change and Lake Temperature in the Sierra Nevada.”

Water temperature regulates a broad range of fundamental

ecosystem processes in lakes. While climate can be an important factor controlling lake temperatures, in many lakes, water temperatures are responding differently than air temperatures. Through multiple decades of climate and water temperature data from a high-elevation catchment in the Southern Sierra Nevada scientists now hope to be able to illustrate the magnitude of warming taking place and demonstrate the role of winter snowpack in regulating those lake temperatures.

Sadro's study is Emerald Lake, a glacial cirque lake located in the Tokopah Valley of Sequoia National Park. The Tokopah Valley forms the headwaters of the Marble Fork of the Kaweah River in the Southern Sierra Nevada. The lake, situated at 8,200 feet, runs 30 feet deep and 400 yards across. It is one of approximately 14,000 lakes in the Sierra.

This area has been the focus of sustained limnological and watershed research since 1983. Ultimately, the knowledge gained through Sadro's research could help with understanding how these thousands of lakes and watersheds are responding to global change.

Lakes have long been studied by environmental scientists and the insights from their investigations have led to advances in the natural sciences. Mountain lakes, in particular, are recognized as excellent indicators of regional environment conditions and are increasingly being used by regulatory agencies.

What Sadro pointed out is the importance of mountain snowpack to freshwater supplies mandates that attention be paid to the bio-geo-chemistry, hydrology and ecology of these systems.

"In the next 50 years, we have an opportunity to alter the course of climate change on a global scale. Despite the political turmoil and/or setbacks, I feel we can all take heart," Sadro said. "Irregular funding might create gaps, but

the impact to humanity remains.”

Mark Twain was once said, “Climate is what we expect, weather is what we get.” One could say that Sadro’s exact words in comparison reflect the same observation: “Climate reflects long-term trends and weather is the noise.”

Climate trends include factors such as air temperature, sea levels, snow cover, solar input, CO₂ and glacial mass. To be even more specific, Sadro broke it down to an acute focus on Sierra lakes:

- Greenhouse gas emissions
- Carbon and nutrient cycling
- Lake productivity
- Community ecology
- Bioenergetics
- Water equality
- Physical dynamics.

He went a step further to break it down to three primary areas of cause and effect:

- Warming air temperatures: high elevation in certain Sierra sites are warming at well above regional rates.
- Drought: the frequency and severity of droughts have increased in recent decades (and in lake research drought is about “supply and demand”; evaporative drought).
- Lake temperature governed by snow, water, equivalent: a large snowpack buffers lakes from warming.

Snow-water-equivalent is what’s commonly known as snowpack measurement. It is the amount of water contained within the

snowpack. It can be thought of as the depth of water that would result if the entire snowpack melted instantaneously. For example, a swimming pool that is filled with 36 inches of powdery snow at 10 percent water density. Melt all the snow and there would be 3.6 inches of water in the pool.

Although Sadro's research and analysis was strictly based on Emerald Lake, the majority of locals who attended the lecture were obviously also interested in the body of water just down the road – Lake Tahoe.

In the **2015 "State of the Lake"** document TERC Director Geoff Schladow warned about Tahoe's ever increasing average temperature. It is getting warmer at a faster rate than the historical average.

Even more disturbing to scientists is how all this warming has affected lakes' abilities to mix its own waters, a natural process that Sadro described as a predictor of "anoxia", which is the absence of oxygen supplied to an organ or tissue. This can deprive fish and other life forms from thriving in their normal habitat.