

PROTECTING LAKE TAHOE WITH SCIENCE

Tahoe Science Advisory Council

SCIENCE & TAHOE: SIX DECADES TOGETHER

The name Tahoe conjures images of snow-capped peaks, cloudless blue skies, and pristine, clear waters. Protecting that vision depends on a strong partnership between scientists and those that manage the Jewel of the Sierra.

Science has the unique ability to link the ways people enjoy Tahoe to the Lake's environmental health. For more than 60 years, scientists have been on the front lines of the most consequential issues facing Tahoe, from sewage treatment to urban development.

However, Tahoe's dazzling clarity has inspired admiration for much longer. In the 1860s, Mark Twain memorialized Lake Tahoe as "the fairest picture the whole Earth affords." Now, scientists are working hard to ensure that people can enjoy the same beauty for the next 160 years.

BLUE WATER = CLEAR WATER

Like Twain, many experience and enjoy Lake Tahoe through its clear waters. But the Lake is only as blue as it is clear. Tahoe's clean air and water are the key to the Lake's dazzling clarity and blue color. Lake Tahoe is blue in part because it's reflecting the sky, and in part because Tahoe's clear water absorbs red light, leaving the rich blue color that we all see. If we lose Tahoe's clarity, we also lose its blueness.

Clarity has served as a barometer of the Lake's overall health; a visible indicator of how multiple related

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factors are affecting this national treasure. From the earliest application of science to preserve the Lake, water clarity has taken center stage. Much of the regulatory system that protects the Tahoe Basin today is built on the foundation of preserving and restoring water clarity.

TAHOE IS CHANGING

In the six decades since scientists and preservationists first teamed up to export sewage out of the Tahoe Basin, much has changed about the character of the Lake, the environment, and our understanding of this ecosystem. Lake Tahoe's health is far more complex than how deep you can see below its surface.

Recently, Tahoe has changed in very visible ways: the risk of wildfire is increasing, populations of aquatic invasive species are expanding, Lake temperatures are changing, and regional weather patterns continue to shift. In addition, Tahoe lacks national park protections, although it sees more annual visitation than the top two national parks combined.

To protect Tahoe for the future, our understanding and approach must evolve to preserve the Lake.

For more than 60 years, science has helped protect and preserve Lake Tahoe.

In the 1960s, science was instrumental in stopping sewage from entering the Lake. In the 1980s, scientists working with management agencies and non-profits helped rein in out-of-control development to protect Tahoe's famed water clarity. In the 2000s, science informed ecosystem restoration projects to preserve Tahoe's delicate ecology.

Today, the Tahoe Science Advisory Council continues the tradition – using science to preserve Lake Tahoe.



A low water level and wildfire smoke show the impacts of climate change at Lake Tahoe.

The Council

The Tahoe Science Advisory Council is a group of scientists from Nevada, California, and federal institutions who partner with resource management agencies to coordinate research and monitoring. Together, the group's members represent leadership, management, research, and preservation efforts for a place they share a desire to protect – Lake Tahoe.

Lake Tahoe's unique quality, beauty, and location is the unifying force that brought together these leading scientific minds under the banner of the bi-state Tahoe Science Advisory Council, or "the Council" for short.

THE COUNCIL'S ROLE

More than ever, land and natural resource managers need the best available science to guide their decisions and policies to protect Tahoe's unique value, which draws millions of people to the Lake year after year. The Tahoe Science Advisory Council offers expert, independent perspectives on pressing science issues and provides a venue for efficient communication between research partners and land management agencies.

As the Lake changes and faces threats, both old and new, what each of us treasures about it comes under increasing risk. To protect Lake Tahoe today and for future generations, our understanding of the Lake and its surroundings must change, evolve, and adapt. The Council is up to the task.

The Council is applying its multidisciplinary expertise to Keep Tahoe Blue.

By interpreting science on how the Lake works and how our interactions with it cause ripple effects, the Council helps ensure that the Tahoe we know and love today remains a source of wonder for future generations of outdoor enthusiasts.

What The Council Is Working On

The Council's projects share common goals: advancing a holistic understanding of Lake Tahoe's natural system and human interactions with it; determining how to measure changes to the system; and informing governments and public agencies about emerging threats and potential actions to protect Lake Tahoe.

FINDING CLARITY IN TAHOE'S CLARITY

Scientists have been tracking Lake Tahoe's water clarity for more than 50 years. To take individual clarity measurements, researchers lower a 10-inch white disk, known as a Secchi disk, into the water and record the depth at which it is no longer visible from the surface. Annual clarity figures are averages of measurements taken throughout the year.

A record Lake Tahoe clarity depth of 108 feet was measured in the late 1960s, followed by decades of steady clarity loss. Clarity conditions stabilized in the 2010s. Then, following a winter punctuated by record precipitation, clarity reached an all-time low of 60 feet in 2017. The most recent annual figures are marked by year-to-year variation. To understand what it all means for the health and beauty of Lake Tahoe, let's take a closer look at clarity and how the Lake's system works.

SUMMER CLARITY vs WINTER CLARITY

Following 2017's record low clarity, the Council was charged with reassessing the drivers of Lake Tahoe's overall health, and to interpret 40 years of data and research on seasonal clarity trends. That was no small task.

Seasonal clarity trends highlight Lake Tahoe's complexity and offer suggestions for how climate change may be having an influence.

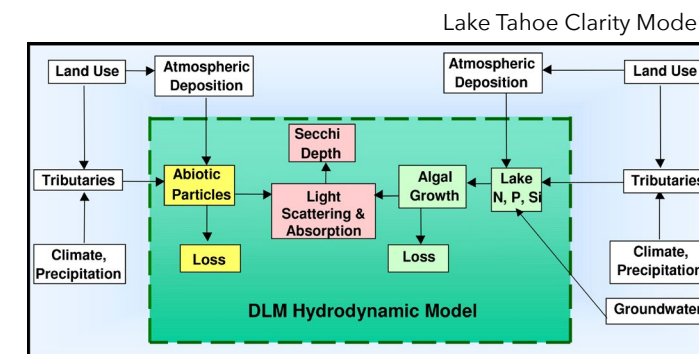
Here are some of the Council's key findings.

- Over the past 20 years, winter clarity has stabilized while summer clarity continues to decline.
- For decades, there has been a concerted effort to reduce pollution entering the Lake from land and air. The focus on preventing pollution, or "load reduction," has likely helped stabilize winter clarity. While more data is needed to confirm the cause-effect relationship, this marks a significant victory and signals that load reduction is important.
- Lake Tahoe's temperature varies with depth, stacking like a layer cake in summer with warmer water on top and colder water beneath. Warming water and air temperatures are affecting how the layers of water in Lake Tahoe mix. These changes in lake "stratification" are pushing a trend of declining water clarity during the summer, when the differences in water layers are most dramatic.
- Fine particles in suspension (tiny grains of soil or microorganisms that sink very slowly) remain the single biggest factor influencing the clarity of Lake Tahoe. However, we need to measure how many of the particles are organic (animals) versus inorganic (soil derived from rocks), so we can take informed action to prevent them from affecting clarity.
- Research shows that the Lake's biology (what lives in the Lake) and food web interactions (what eats what) influence seasonal and annual changes in the Lake's health and clarity. These ecological factors are just as influential as what humans are adding to the Lake through the land and air.

CRACKING THE CODE TO TAHOE'S HEALTH

If imitation is the ultimate form of flattery, Lake Tahoe should be blushing.

Nearly 20 years ago, scientists created a Lake Clarity Model to mimic the processes that impact water clarity in Lake Tahoe. Using that model to predict what would happen, policies were created to reduce pollutant inputs to the Lake. Those policies appear to be working, as water clarity during the winter has ceased declining.



In the last two decades, our understanding of the Lake, along with technology, has evolved. For the same reason you don't still use your cell phone from 2000, it's now time to upgrade the Lake Clarity Model so it works better for the Tahoe of today.

The Council was charged with reviewing the Lake Clarity Model and providing recommendations to improve it. By using advances in science and technology, and our improved understanding of the relationship between clarity and the Lake's overall health, we can make the model more useful.

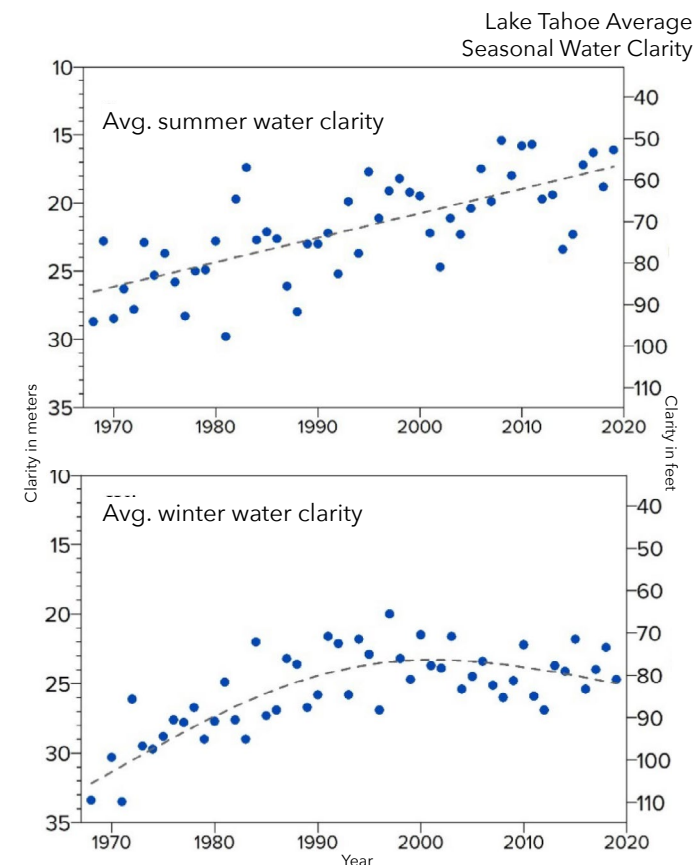
THE ROLE OF CLIMATE CHANGE

The impacts of climate change are already being felt at Lake Tahoe: surface waters are warming, periods of drought are increasing, and more precipitation is falling as rain than snow compared to the past.

To build the Lake's resilience to a changing climate, we must quickly apply what we've learned, assess the outcomes, and refine our approach. By supporting this science-based, adaptive management approach with an updated Lake Clarity Model, we will have a tool that can evolve along with the latest research and data.

The Council recommended that the new model should accurately represent the physical, chemical, and biological processes occurring in four dimensions (space and time) at Lake Tahoe, including food web interactions and a changing climate.

With a more sophisticated model, land managers and policy makers will be able to better predict how the Lake will respond to change – including those we can't control.



FROM SCIENCE TO ACTION

From both an ecological and political perspective, Lake Tahoe is big, dynamic, and complex. With such an important resource at stake – the Jewel of the Sierra – coordination is crucial to protecting the Lake.

The Council's next task is to take what it has learned, enhance it, and share it through collaboration with Lake Tahoe Basin land managers.

In 2021, the Council is working to improve its coordination with land managers around the Lake to share data, define a process to crunch that data into meaningful conclusions, and help explain the current health of the Lake.

Working together, scientists and land managers – such as the U.S. Forest Service, Nevada State Parks, California State Parks, and the Tahoe Regional Planning Agency – will make knowledge sharing easier, grow our understanding of what drives Lake clarity loss, and open the door for coordinated action to stop that loss.

You can play a role too. When you're enjoying this special place, consider how your actions are impacting it, and always make the Lake-friendly choice. When you leave the Lake better than you found it, you are supporting science, effective management, and a clean, blue Lake for future generations to enjoy.

Please share this document with others, read the Council's reports at tahoesciencecouncil.org, and check out "Between 2 States," a video interview series where we get to know the scientists working to Keep Tahoe Blue.

MEET THE SCIENTISTS WORKING
TO PROTECT LAKE TAHOE.
Visit bit.ly/b2s-video

Tahoe Science Advisory Council

Great scientific minds striving to protect the world's greatest lake



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