EXECUTIVE SUMMARY

The long-term data set collected on the Lake Tahoe ecosystem by the University of California, Davis, is a valuable tool for understanding ecosystem function and change. It has become essential to public agencies tasked with restoring and managing the Tahoe ecosystem, in part because it allows us to monitor progress toward reaching Tahoe's restoration goals.

This annual *Tahoe: State of the Lake Report* presents 2007 data in the context of the long-term record. It includes new data about impacts of the Angora Fire, and the effects of climate change on snowmelt timing, lake water temperature and density stratification. It also shows how much of the pollutants that reduce lake clarity (fine sediment particles, nitrogen and phosphorus) are contributed by different sources.

The UC Davis Tahoe Environmental Research Center has developed sophisticated computer models that help scientists more accurately predict how Lake Tahoe's ecosystem behaves. Long-term data sets are essential to refine the accuracy of those models. In these times of rapid change, reliable predictive models are indispensable tools for Lake Tahoe Basin resource managers.

This report is available on the UC Davis Tahoe Environmental Research Center website (terc.ucdavis.edu).

Here are some of the highlights presented in the following pages.

ANGORA FIRE

- During the Angora Fire, atmospheric deposition of nitrogen and phosphorus was 2½ to 7 times normal summer rates, but still represented only 1 to 2 percent of the annual loads from all sources. (Fig. 6.1)
- Atmospheric deposition from the Angora Fire had a negligible impact on lake clarity and algal biomass. (Figs. 6.2 and 6.3)

METEOROLOGY

The Lake Tahoe ecosystem is largely driven by meteorology. In the short term, meteorological conditions are expressed as daily variations in weather. In the long term, they are expressed as normal cyclical variations such as wet and dry cycles, and long-term trends related to global climate change.

Historical record:

- The nightly minimum temperatures recorded at Tahoe City have increased by more than 4 degrees F. since 1910. (Fig. 7.1)
- Days when air temperatures averaged below freezing have decreased by 30 days per year since 1910. (Fig. 7.2)
- Since 1910, the percent of precipitation that fell as snow decreased from 52 percent to 34 percent. (Fig. 7.7)
- Peak snow melt averages 2 ½ weeks earlier than in the early 1960s. (Fig. 7.8)

Previous year[1]:

- 2007 was the 14th driest year on record. Precipitation at Tahoe City was 19.7 inches, two-thirds of the annual average of 31.6 inches. (Fig. 7.5)
- Every month in 2007, except February and September, was drier than the 97-year average. (Fig. 7.6)
- Snow represented 37.6 percent of total precipitation at lake level. (Fig. 7.7)

PHYSICAL PROPERTIES

Lake Tahoe's physical properties are largely a response to external factors, especially meteorology. Physical properties, in turn, determine the environment for all the lake's chemical and biological processes (see next sections).

Historical record:

- Water temperature (volume averaged) rose by more than 1 degree F. in the past 37 years. (Fig 8.3)
- Average surface water temperature rose by more than 1.5 degrees F. in the past 37 years, to 51.9 degrees F. (Fig. 8.4)
- Winter surface water temperatures were the coldest measured in the

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[1]*"Previous year" for some parameters means data collated in terms of the water year, which runs from October 1 through September 30; for other parameters, it means data for the calendar year, January 1 through December 31. Therefore, for this 2008 report, water year data are from Oct. 1, 2006 through Sept. 30, 2007. Calendar year data are from Jan. 1, 2007 through Dec. 31, 2007.*

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last 10 years, with the lowest maximum surface water temperature of 41.11 degrees F. (Fig. 8.5)

- Density stratification of Lake Tahoe has increased over the last 37 years as surface water warmed due to climate change. (Fig. 8.8)

Previous year:

- In 2007, lake level fell to a low of 6224.7 feet in December. (Fig. 8.2)
- Lake Tahoe mixed all the way to the bottom in March 2007, the first deep mixing since 2001. (Fig. 8.9)

NUTRIENTS AND PARTICLES

Lake Tahoe's clarity is determined especially by fine sediment particles, and also by nutrients. Tahoe's urban areas contribute 72% of fine particles, despite representing only 10% of the land base.

Nutrients affect lake clarity by promoting algae growth. Offshore, algae make the water greenish and less clear. Along the shoreline, algae are a problem because it coats rocks with green slime.

The two nutrients that most affect algal growth are nitrogen and phosphorus. These nutrients are measured at various depths at TERC's mid-lake and western lake stations.

One form of nitrogen—nitrate—enters the lake through stream and urban runoff, groundwater and atmospheric deposition. Phosphorus occurs naturally in Tahoe Basin soils and enters the lake from soil disturbance and erosion, as well as atmospheric deposition.

Historical record:

- Stream inputs of particles, nitrogen and phosphorus are directly linked to the annual amount of precipitation. (Figs. 9.3 to 9.5)
- Atmospheric deposition of nutrients, both in concentration and total loads, are also linked to precipitation. (Figs 9.6 and 9.7)
- Nitrogen concentrations in the lake have remained generally constant for many years. (Fig. 9.8)
- Phosphorus reached a minimum in 1999 and has increased slightly since. (Fig. 9.9)

Previous year:

- The watersheds that contributed the most particles and nutrients to Lake Tahoe were the Upper Truckee River, Blackwood Creek, Trout Creek, Ward Creek and Incline Creek. (Fig. 9.2)

BIOLOGY

The longest data sets for lake biology are on the base of the food web – the algae (or phytoplankton) and the zooplankton (microscopic aquatic animals that graze on algae). Algae and zooplankton influence the lake's food web, clarity and aesthetics.

Historical record:

- Primary productivity, the rate at which algae produce biomass through photosynthesis, has been increasing since 1959. (Fig. 10.1)
- Since 1984, the annual average depth of the deep chlorophyll maximum has declined. (Fig. 10.4)
- Diatoms remain the dominant algal species and provide high quality food for aquatic species. (Fig 10.6)

Previous year:

- Primary productivity in 2007 was the highest on record, five times the 1959 level. (Fig. 10.1)
- The maximum deep chlorophyll depth increased in 2007 to a mean of 180 feet. (Fig. 10.4)
- Periphyton (attached algae) concentrations were above average in 2007. (Fig. 10.9)
- Zooplankton, an important part of the food web, were at a 10-year low in 2007. (Figs. 10.11 to 10.12)

CLARITY

Clarity remains the indicator of greatest interest about Lake Tahoe because it tracks degradation and the community's efforts to restore clarity to historic levels. Secchi depth (the point below the lake surface at which a 10-inch white disk disappears from view) has been measured continuously since 1968, and is the longest continuous measure of Lake Tahoe's water clarity.

In 2007, the Secchi depth was 70.1 feet, an increase of 2.4 feet over 2006. In the last seven years, Secchi depth measurements have been better than predicted by the long-term linear trend. There is statistical support that Lake Tahoe's clarity decline has slowed significantly, and is now best represented by a curve. (Fig. 11.1)

EDUCATION AND OUTREACH

The public can learn about the science behind Lake Tahoe restoration at TERC's Incline Village education center (the Thomas J. Long Foundation Education Center). In 2007, over 6,900 people participated in our education and outreach activities. (Fig. 12.1)