TAHOE: STATE OF THE LAKE REPORT 2008

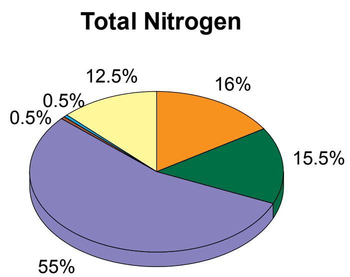
NUTRIENTS AND PARTICLES

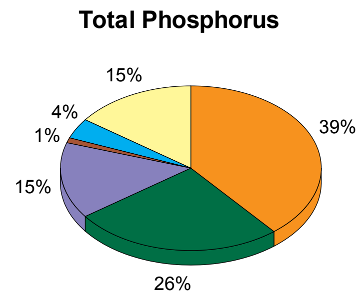
UC DAVIS
TAHOE ENVIRONMENTAL RESEARCH CENTER

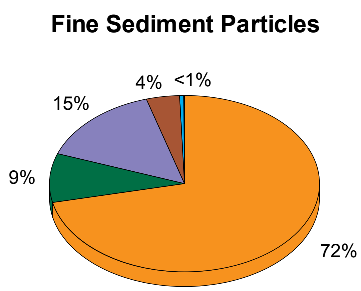
NUTRIENTS AND PARTICLES

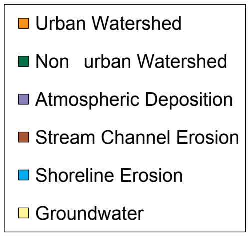
Sources of clarity-reducing pollutants

In the last 10 years, research has quantified the primary sources of nutrients (nitrogen and phosphorus) and particulate material that are causing Lake Tahoe to lose clarity. Fine particulates, the major contributor to clarity decline, primarily originate from the urban watershed (72%), even though such watersheds cover only 10% of the Tahoe Basin. For nitrogen, atmospheric deposition is the major source (55%). Phosphorus is primarily introduced by the urban (39%) and non-urban (26%) watersheds. These categories of pollutant sources are forming the basis of plans to restore Lake Tahoe by agencies including the Lahontan Regional Water Quality Control Board, the Nevada Division of Environmental Protection, the California Tahoe Conservancy, and the Tahoe Regional Planning Agency. (Data were generated for the Lake Tahoe TMDL Program.)









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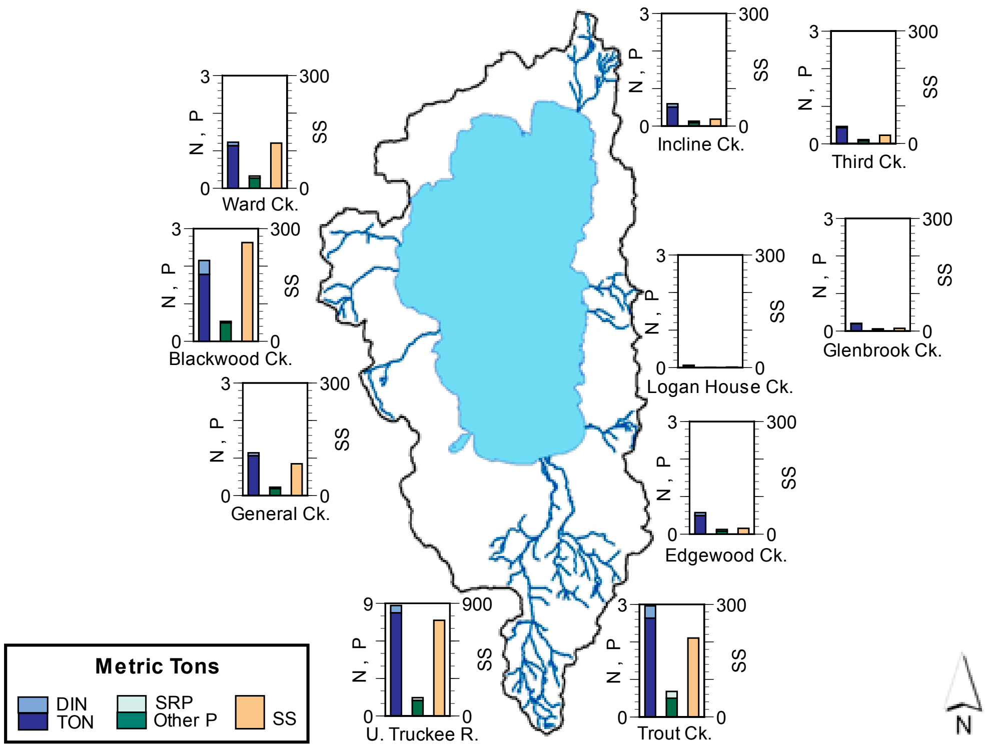
Pollutant loads from 10 watersheds

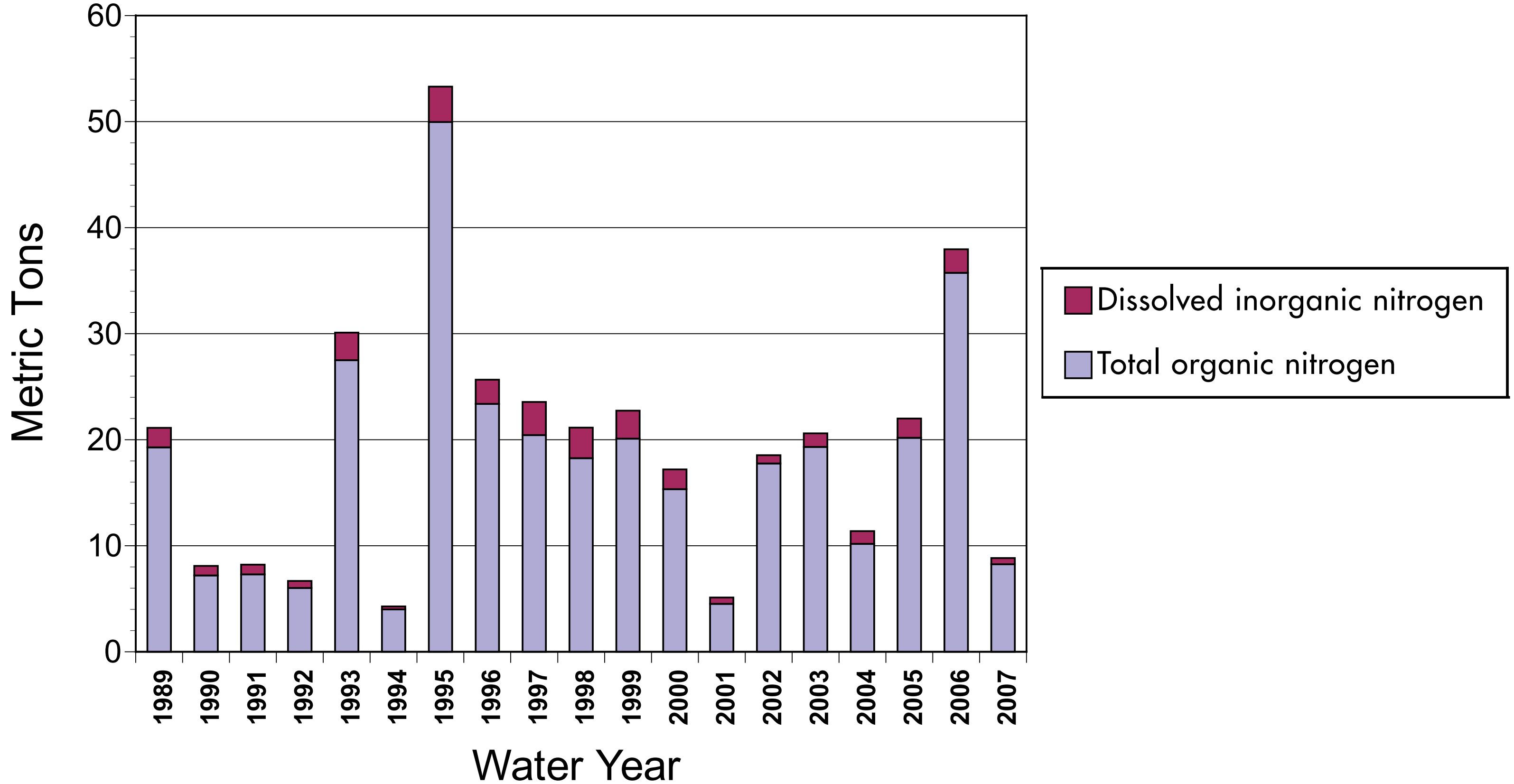
The Lake Tahoe Interagency Monitoring Program (LTIMP) has measured nutrient and sediment input from 10 of the 63 watershed streams, which account for half of all stream flow into the lake. Most of the suspended sediment is from the Upper Truckee River, Trout Creek, Ward Creek and Blackwood Creek. About 30 percent of the phosphorus comes from the Upper Truckee River, Trout Creek, Ward Creek and Blackwood Creek. The LTIMP stream water quality program is managed by the U.S. Geological Survey in Carson City, Nev.; UC Davis TERC, and the Tahoe Regional Planning Agency.



Nitrogen contribution by Upper Truckee River

Since 1989

Nitrogen concentration is important because it, along with phosphorus, promotes algal growth. (Fig. 9.1 shows the sources of Lake Tahoe's pollutants.) The Upper Truckee River is the largest of the 63 streams that flow into Lake Tahoe, contributing about 25 percent of the inflowing water. The river's contribution of dissolved inorganic nitrogen (nitrate and ammonium) and total organic nitrogen are shown here. The year-to-year variations primarily reflect changes in precipitation. For example, 1994 had 16.6 inches of precipitation and a low nitrogen load, while 1995 had 60.8 inches of precipitation and a very high nitrogen load. Low rainfall in 2007 resulted in a low nitrogen load. (One metric ton = 2,205 pounds.)



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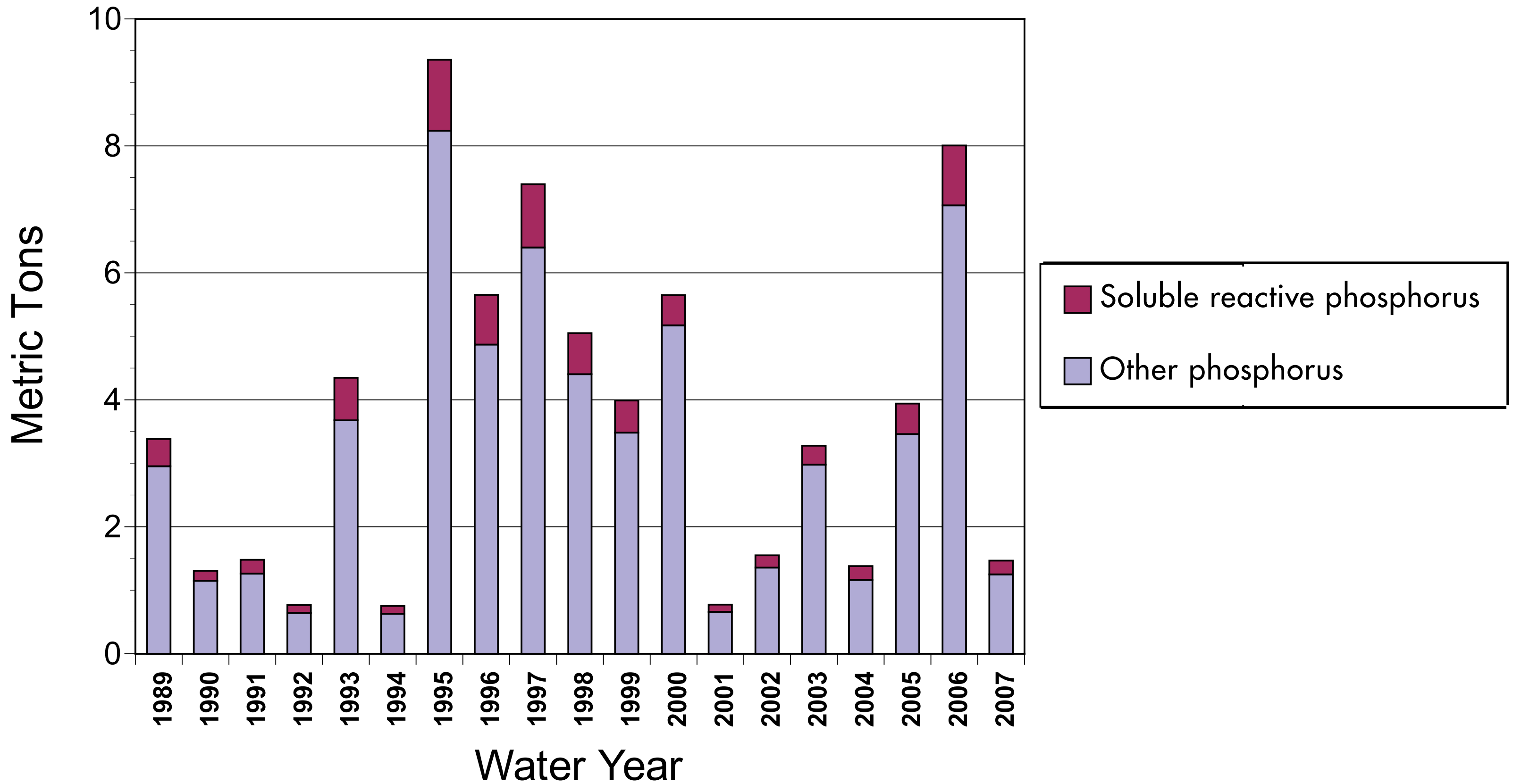
Phosphorus contribution by Upper Truckee River

Yearly since 1989

Soluble reactive phosphorus (SRP) is that fraction of phosphorus immediately available for algal growth. As with nitrogen (Fig. 9.3), the year-to-year variation in load largely reflects the changes in precipitation. Low rainfall in 2007 resulted in a low phosphorus load. (Total phosphorus is the sum of SRP and other phosphorus, which includes organic phosphorus and phosphorus attached to particles.) (One metric ton = 2,205 pounds.)



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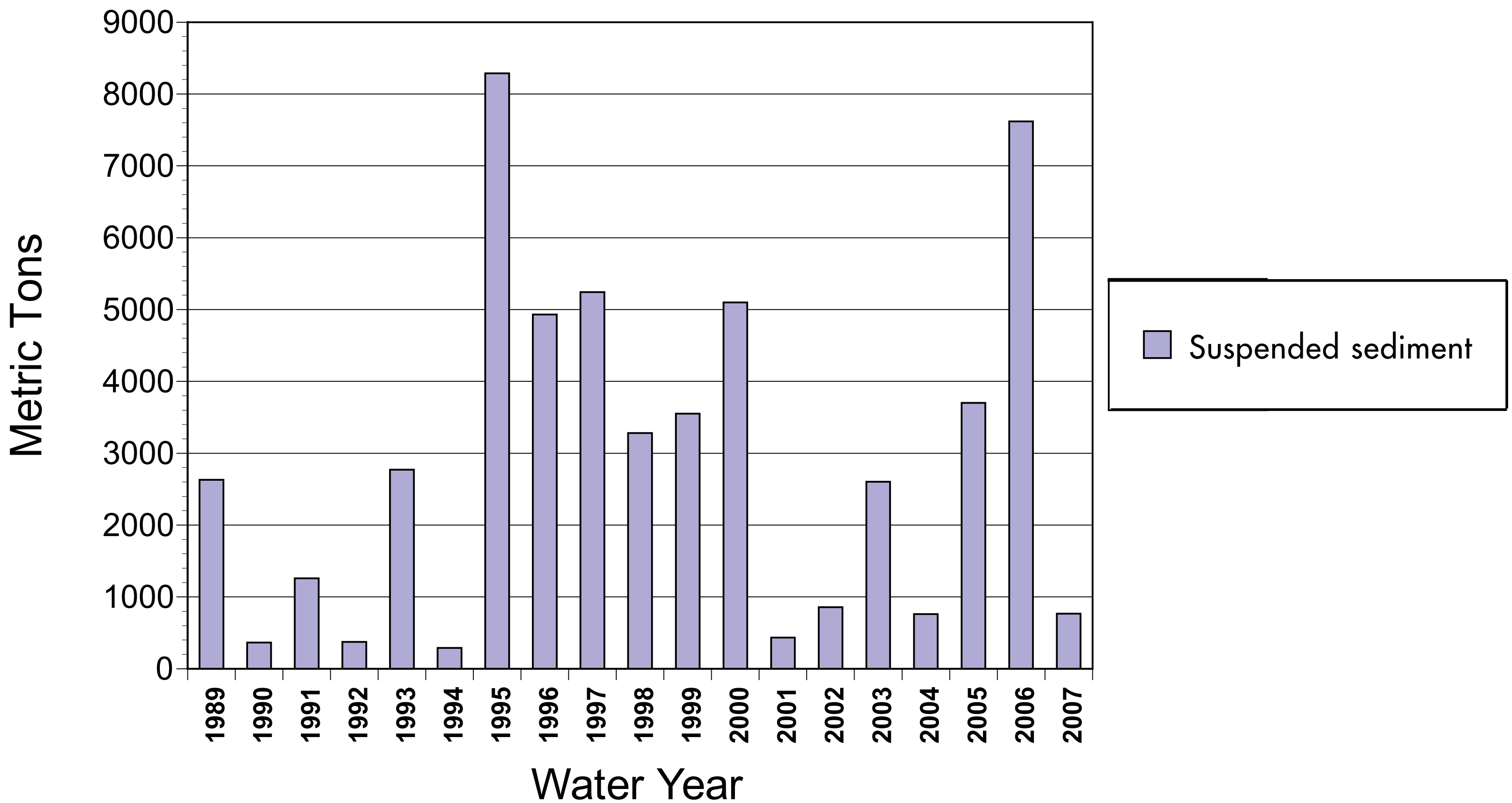
Suspended sediment contribution by Upper Truckee River

Yearly since 1989

The load of suspended sediment delivered to the lake by the Upper Truckee is tied directly to precipitation and stream flow. Low rainfall in 2007 resulted in a low suspended sediment load. This and the previous two figures illustrate how greatly changes in hydrological conditions affect pollutant loads. Plans to restore lake clarity emphasize reducing loads of very fine suspended sediment (less than 20 microns in diameter). (One metric ton = 2,205 pounds.)



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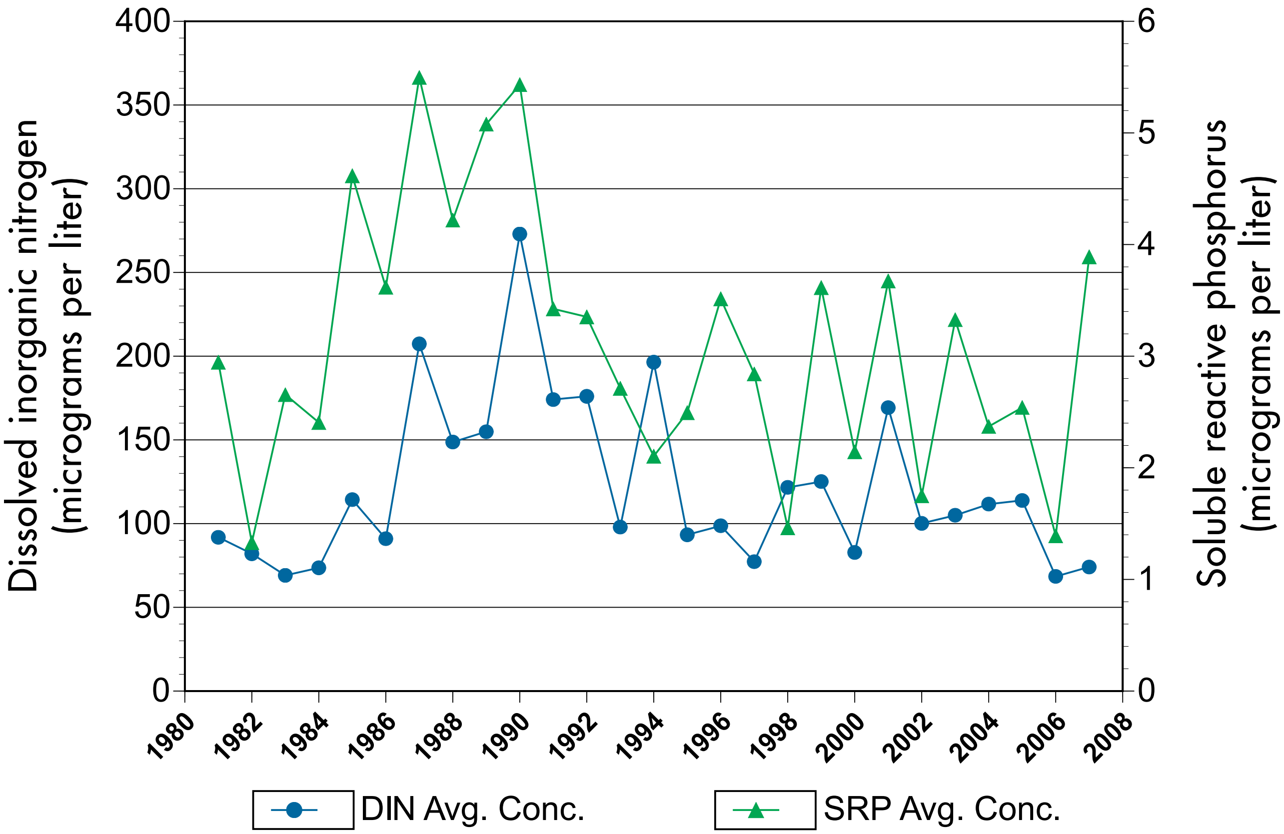
Nutrient concentrations in rain and snow

Yearly since 1981

Nutrients in rainwater and snow (called wet deposition) contribute significant amounts of especially nitrogen, but also phosphorus, to Lake Tahoe. Nutrients in precipitation have been measured near Ward Creek since 1981, but show no consistent trend.

Annual concentrations in precipitation of dissolved inorganic nitrogen (DIN) and soluble reactive phosphorus (SRP) vary from year to year. In 2007, concentrations of DIN in precipitation were relatively low, but were above average for SRP.



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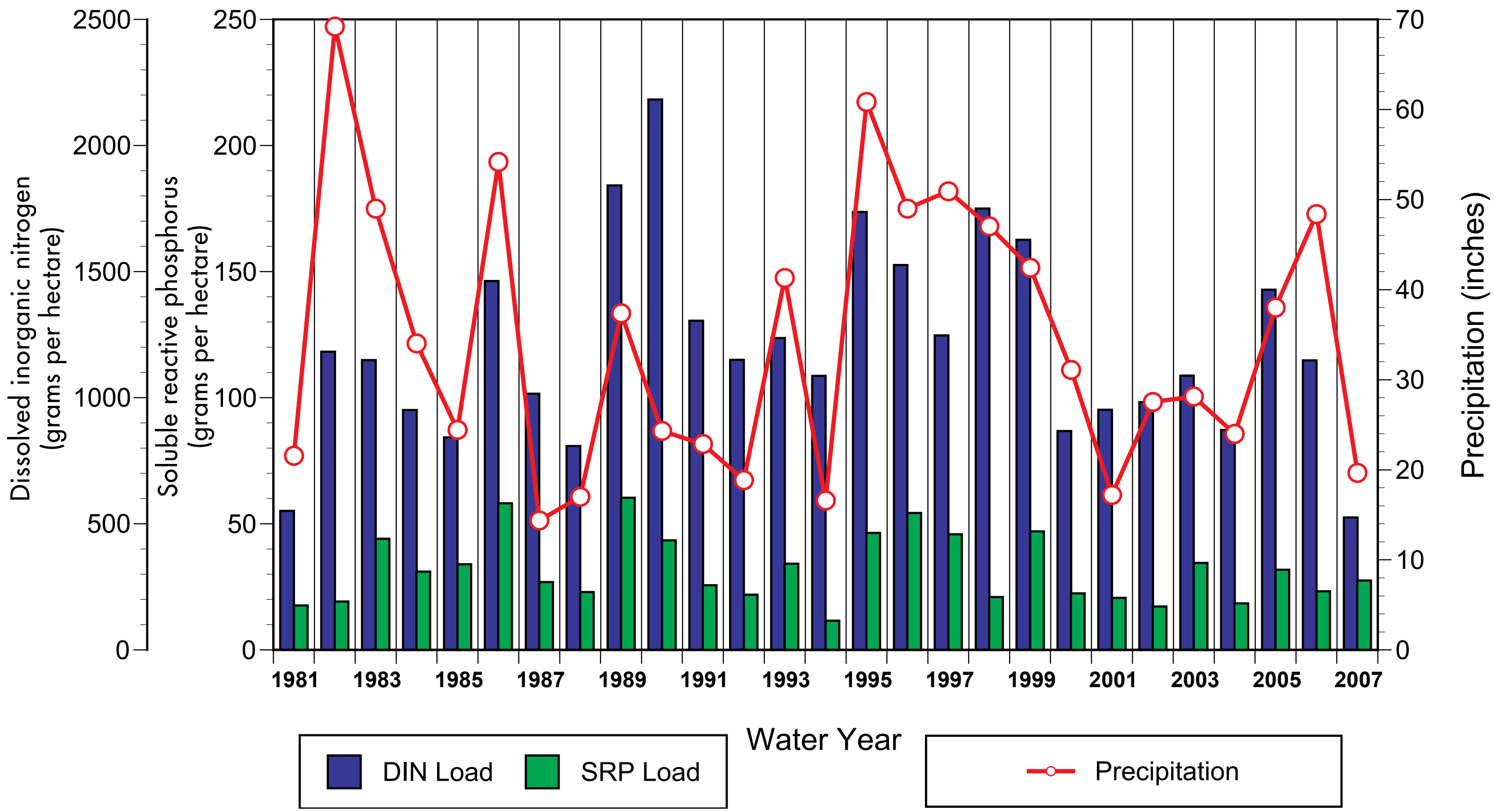
Nutrient loads in rain and snow

Since 1981

The annual load for wet deposition is calculated by multiplying the concentration of dissolved inorganic nitrogen and soluble reactive phosphorus (in the previous graph) by total annual precipitation. While nitrogen and phosphorus loads from precipitation have varied from year to year at the Ward Creek monitoring site, no obvious long-term trend has emerged. In 2007, the phosphorus load was near the historical average while the nitrogen load was the lowest on record.



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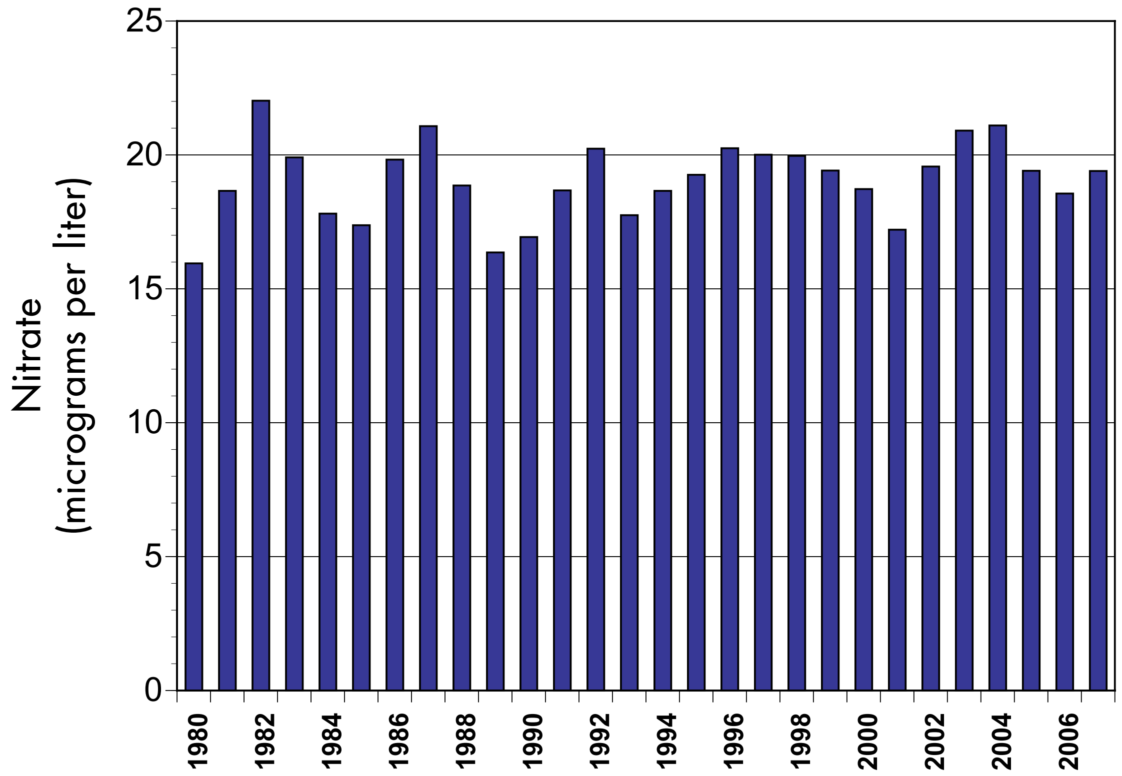
Lake nitrate concentration

Yearly since 1980

Since 1980, the lake nitrate concentration has remained relatively constant, ranging between 16 and 22 micrograms per liter. In 2007, the volume-weighted annual average concentration of nitrate was 19.2 micrograms per liter (or parts per billion).



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Lake phosphorus concentration

Yearly since 1980

Phosphorus naturally occurs in Tahoe Basin soils and enters the lake from soil disturbance and erosion. Total hydrolyzable phosphorus, or THP, is a measure of the fraction of phosphorus algae can use to grow. Since 1980, THP has tended to decline. In 2007, the volume-weighted annual average concentration of THP was 2.35 micrograms per liter (or parts per billion).