TAHOE: STATE OF THE LAKE REPORT 2009

NUTRIENTS AND PARTICLES

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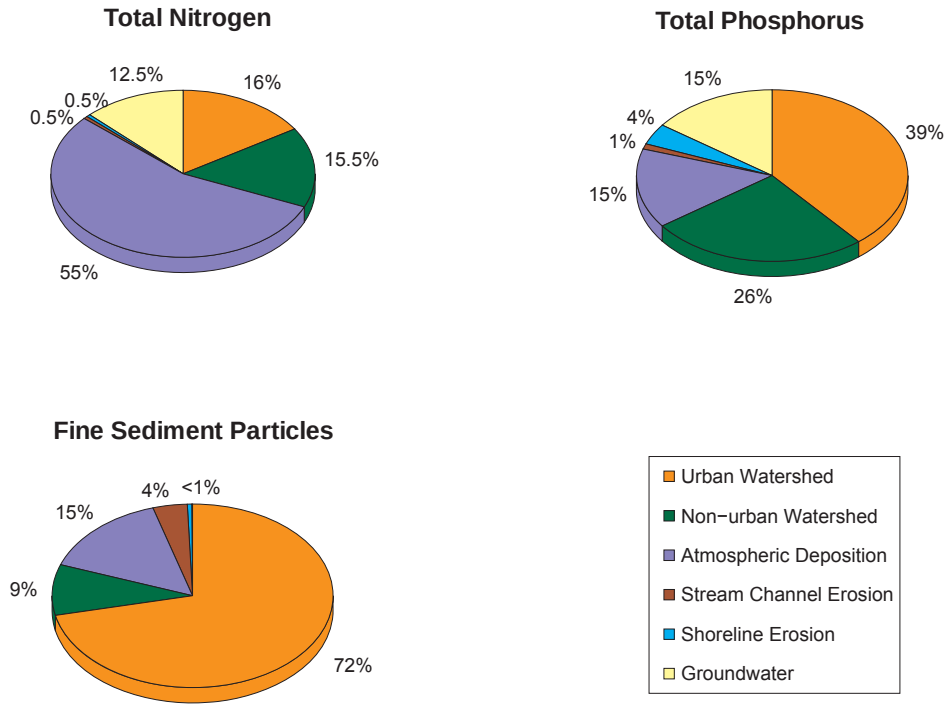
NUTRIENTS AND PARTICLES

Sources of clarity-reducing pollutants

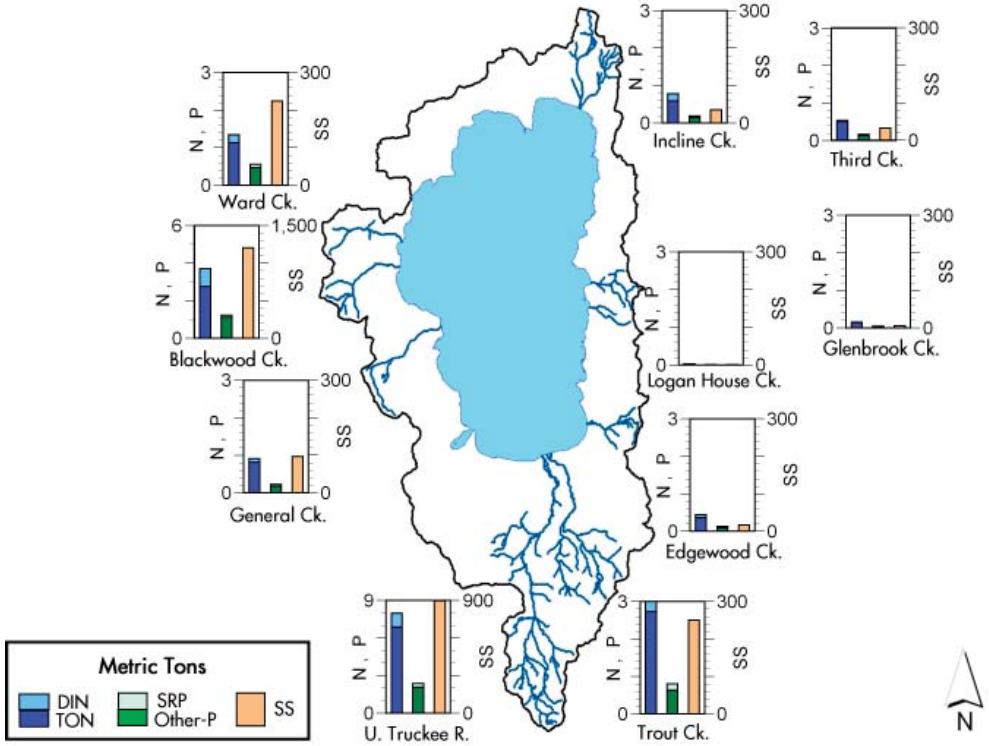
Research has quantified the primary sources of nutrients (nitrogen and phosphorus) and particulate material that are causing Lake Tahoe to lose clarity. Extremely fine particles, the major contributor to clarity decline, primarily originate from the urban watershed (72%), even though these areas cover 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 form the basis of plans to restore Lake Tahoe's open-water clarity by agencies including the Lahontan Regional Water Quality Control Board, the Nevada Division of Environmental Protection, the Tahoe Regional Planning Agency and the California Tahoe Conservancy. (Data were generated for the Lake Tahoe TMDL Program and this figure also appeared in last year's State of the Lake Report 2008.)



NUTRIENTS AND PARTICLES

Pollutant loads from 10 watersheds

The Lake Tahoe Interagency Monitoring Program (LTIMP) measures nutrient and sediment input from 10 of the 63 watershed streams – these account for approximately half of all stream flow into the lake. Most of the suspended sediment contained in the 10 LTIMP streams is from the Upper Truckee River, Blackwood Creek, Trout Creek and Ward Creek, most especially the first two. Over 75 percent of the phosphorus and nitrogen comes from the Upper Truckee River, Trout Creek and Blackwood Creek. The LTIMP stream water quality program is managed by the U.S. Geological Survey in Carson City, Nevada, UC Davis TERC and the Tahoe Regional Planning Agency.

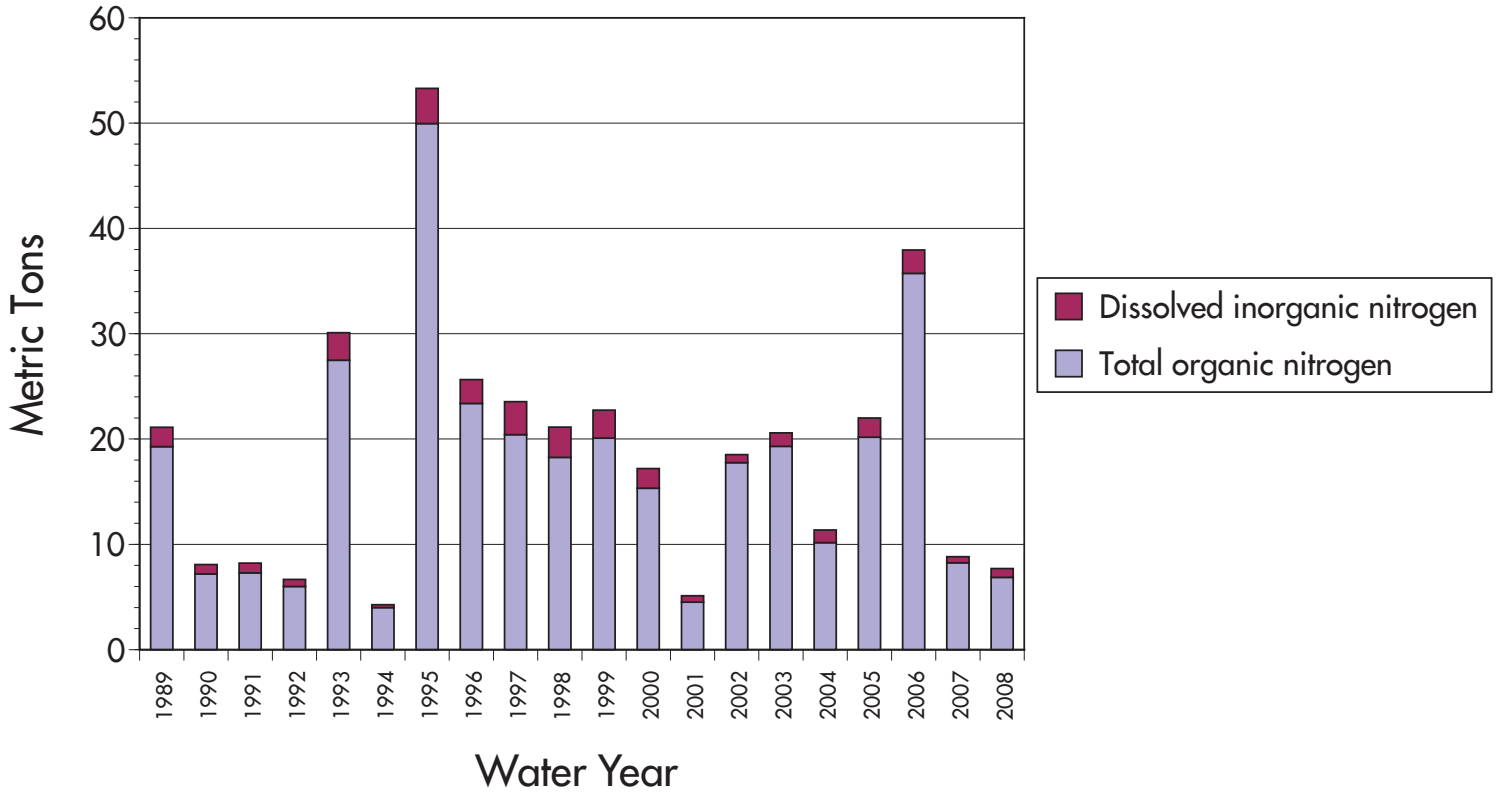


NUTRIENTS AND PARTICLES

Nitrogen contribution by Upper Truckee River

Since 1989

Nitrogen (N) is important because it, along with phosphorus (P), stimulates algal growth. (Fig. 9.1 shows the major sources of N and P to Lake Tahoe) 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 loads 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 2008 resulted in a low nitrogen load. The watershed burned in the Angora Fire (June 2007) drains directly to the Upper Truckee River. 2008 was the first year after the fire and nitrogen load was not elevated as a result of that event. (One metric ton = 2,205 pounds.)



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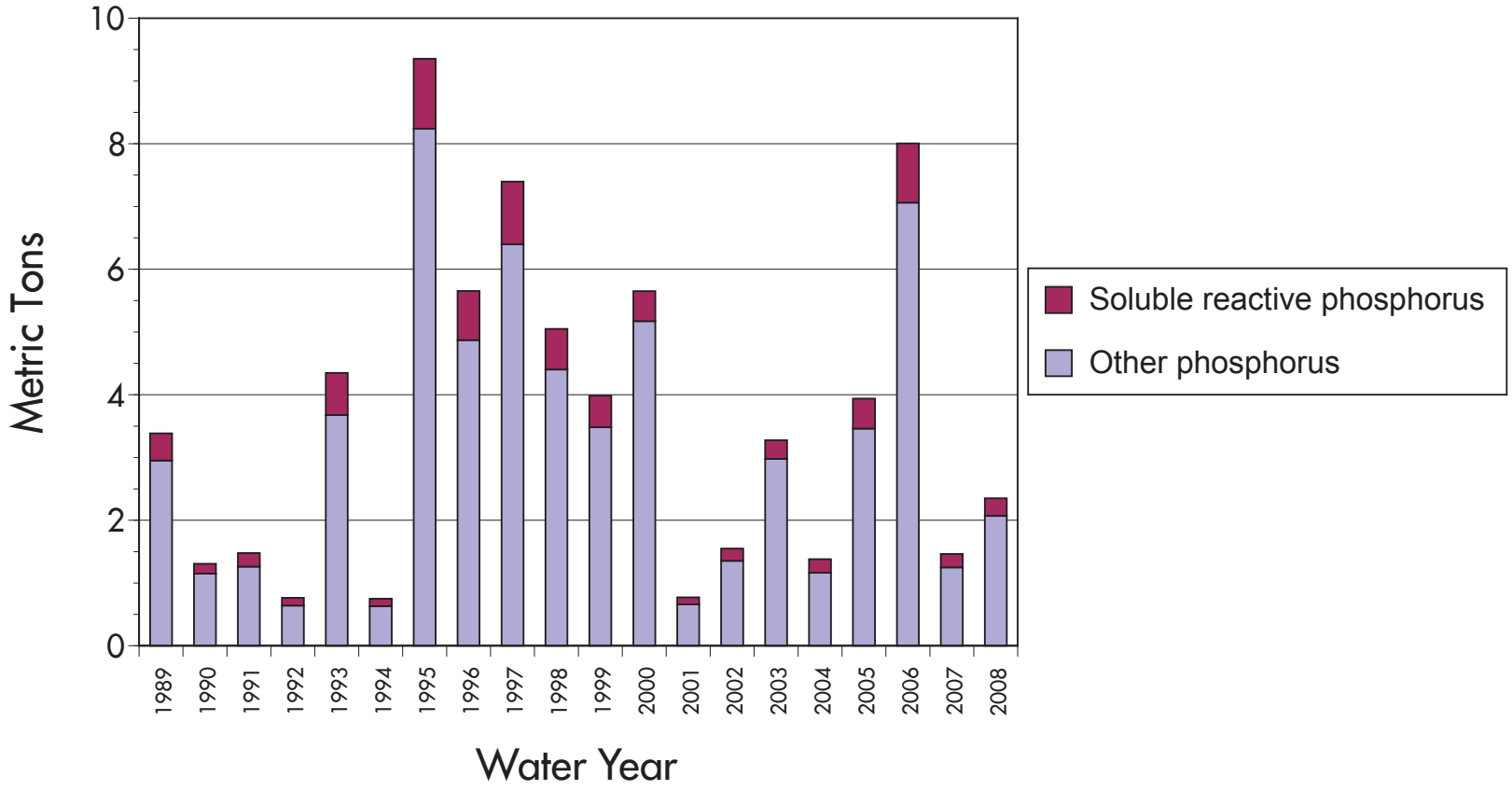
Phosphorus contribution by Upper Truckee River

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 2008 resulted in a relatively low phosphorus load. Unlike nitrogen and suspended sediment, phosphorus was somewhat higher in 2008 versus 2007. The possible influence of the Angora Fire is being investigated.

Total phosphorus is the sum of SRP and other phosphorus, which includes organic phosphorus and phosphorus associated with particles. (One metric ton = 2,205 pounds.)



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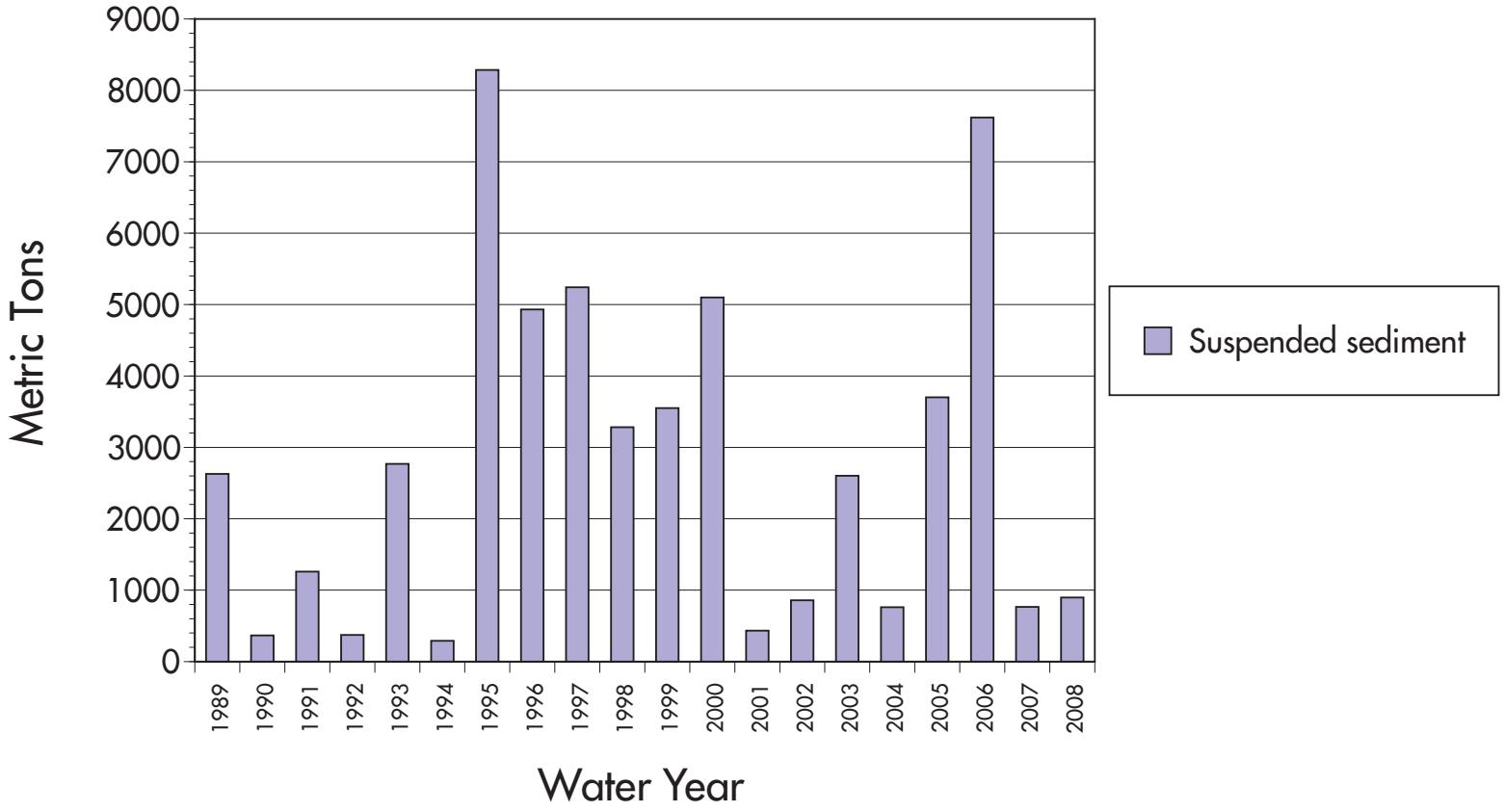
Suspended sediment contribution by Upper Truckee River

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 2008 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). As with nitrogen and phosphorus, no large-scale effect of the Angora Fire on suspended sediment transport to the Upper Truckee River was seen in the first year after the fire. This was most likely the result of the low amount of precipitation that year. (One metric ton = 2,205 pounds.)



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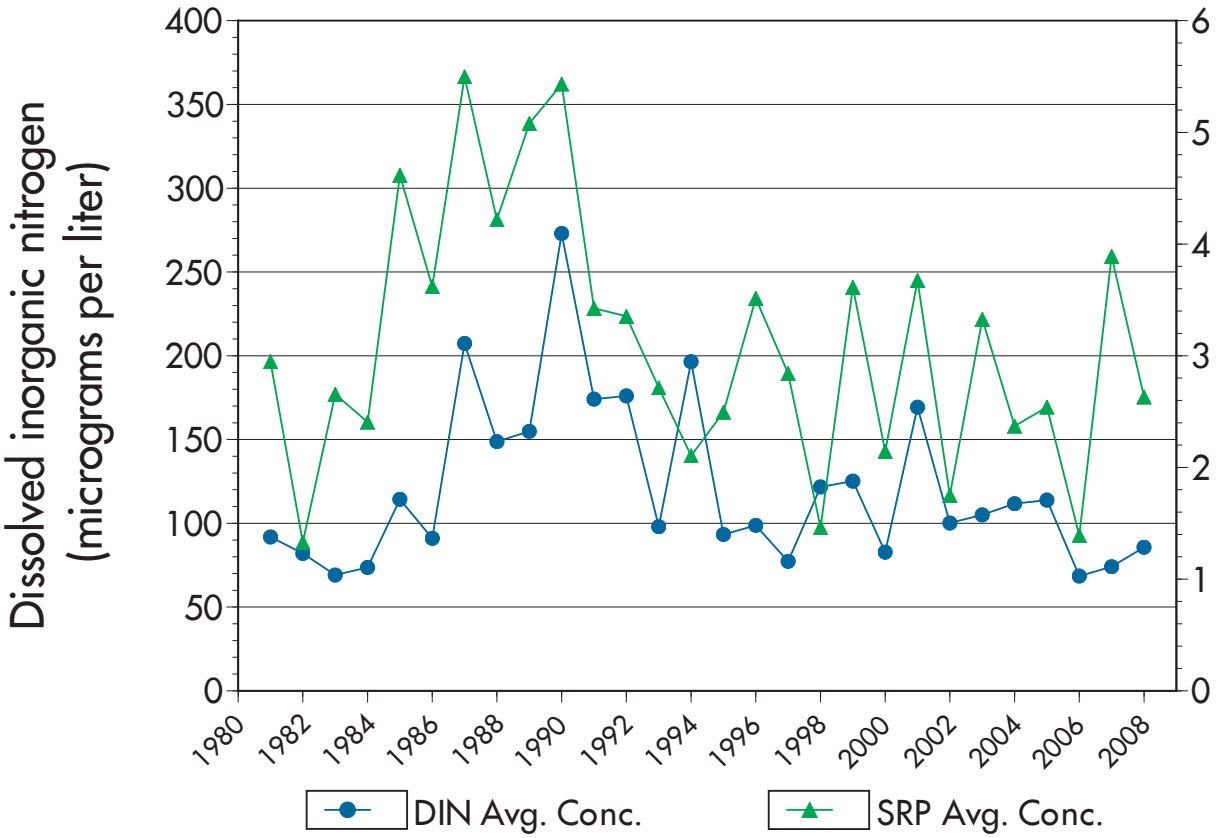
Nutrient concentrations in rain and snow

Yearly since 1981

Nutrients in rainwater and snow (called wet deposition) contribute large amounts of nitrogen, but also significant phosphorus, to Lake Tahoe. Nutrients in precipitation have been measured near Ward Creek since 1981, and show no consistent upward or downward trend. Annual concentrations in precipitation of dissolved inorganic nitrogen (DIN) and soluble reactive phosphorus (SRP) vary from year to year. In 2008, concentrations of DIN in precipitation remained relatively low, but were close to the average for SRP since the early 1990s.

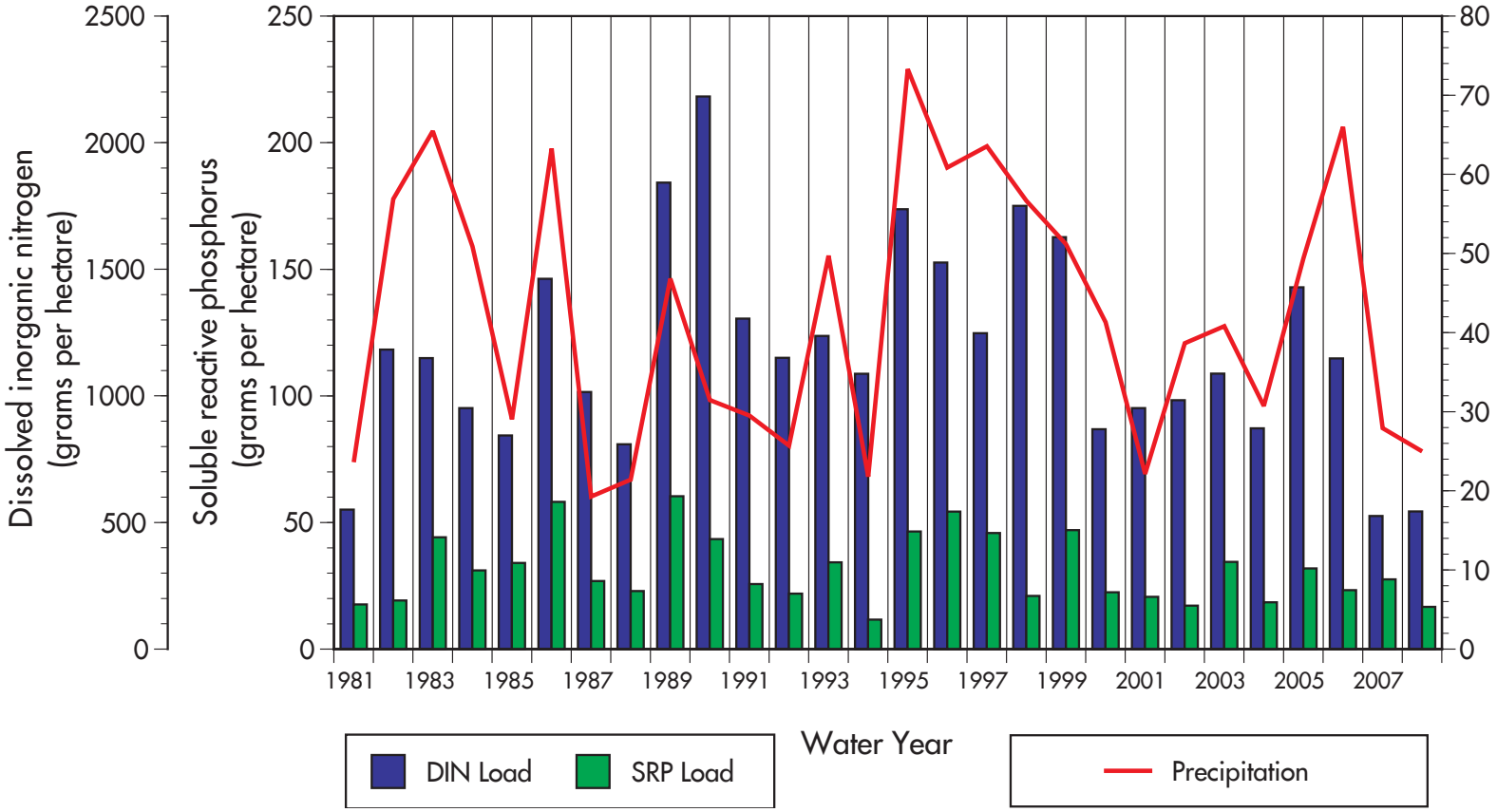


NUTRIENTS AND PARTICLES

Nutrient loads in rain and snow

Since 1981

The annual load for wet deposition is calculated by multiplying the concentration of dissolved inorganic nitrogen (nitrate and ammonium) 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 2008, the phosphorus load was near or slightly lower than the historical average while the nitrogen load was similar to that measured in 2007, the lowest on record.



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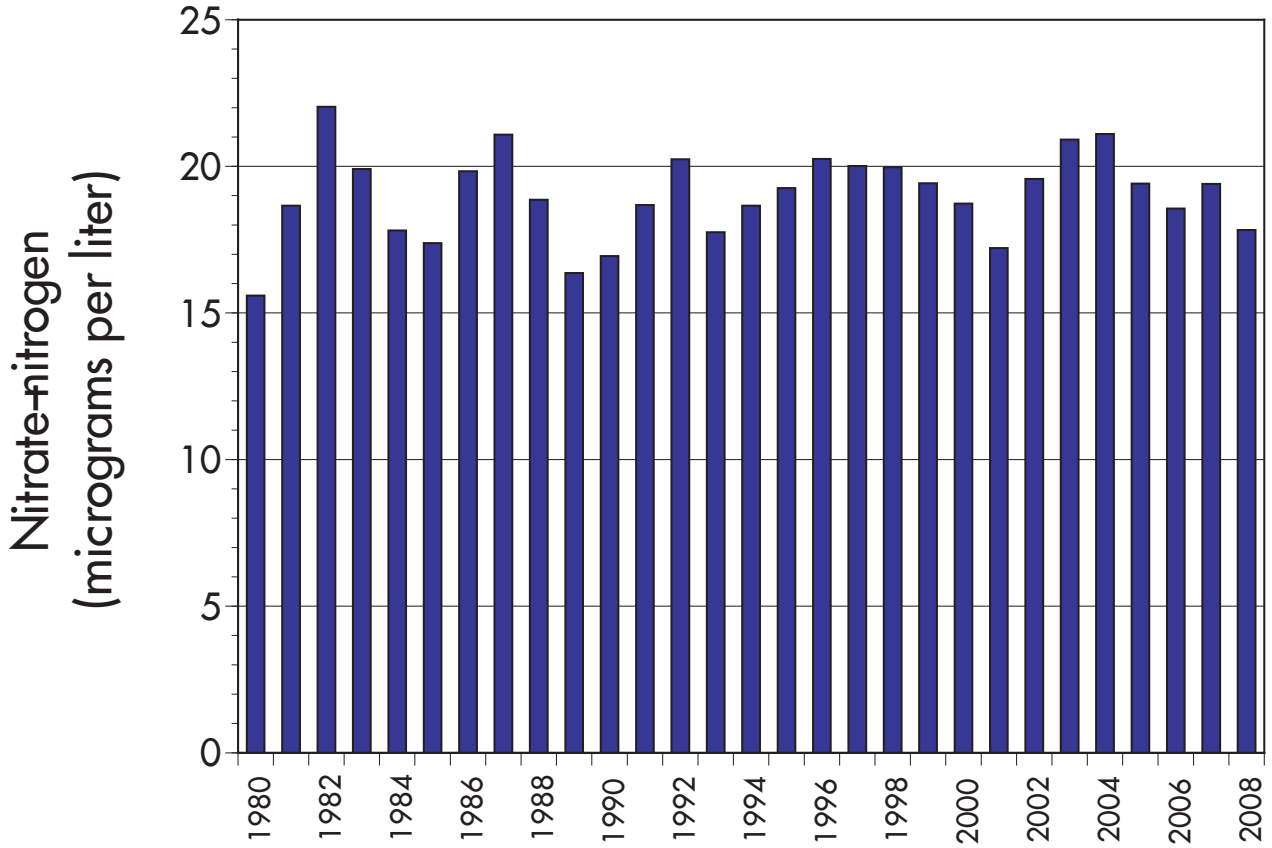
Lake nitrate concentration

Yearly since 1980

Since 1980, the lake nitrate concentration has remained relatively constant, ranging between 16 and 22 micrograms per liter. In 2008, the volume-weighted annual average concentration of nitrate was approximately 17.5 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 2008, the volume-weighted annual average concentration of THP was just under 2.0 micrograms per liter and the lowest annual average since monitoring of this parameter began in 1980.