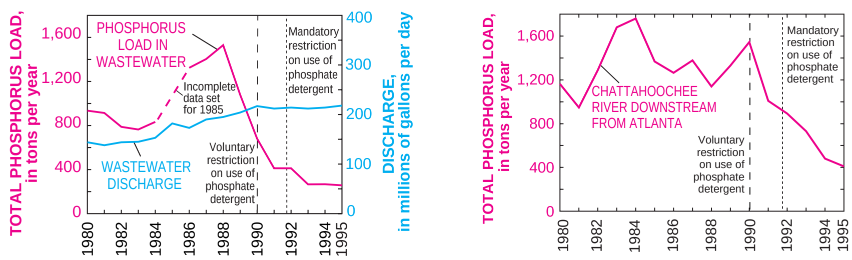
Nutrient conditions have changed over time in streams

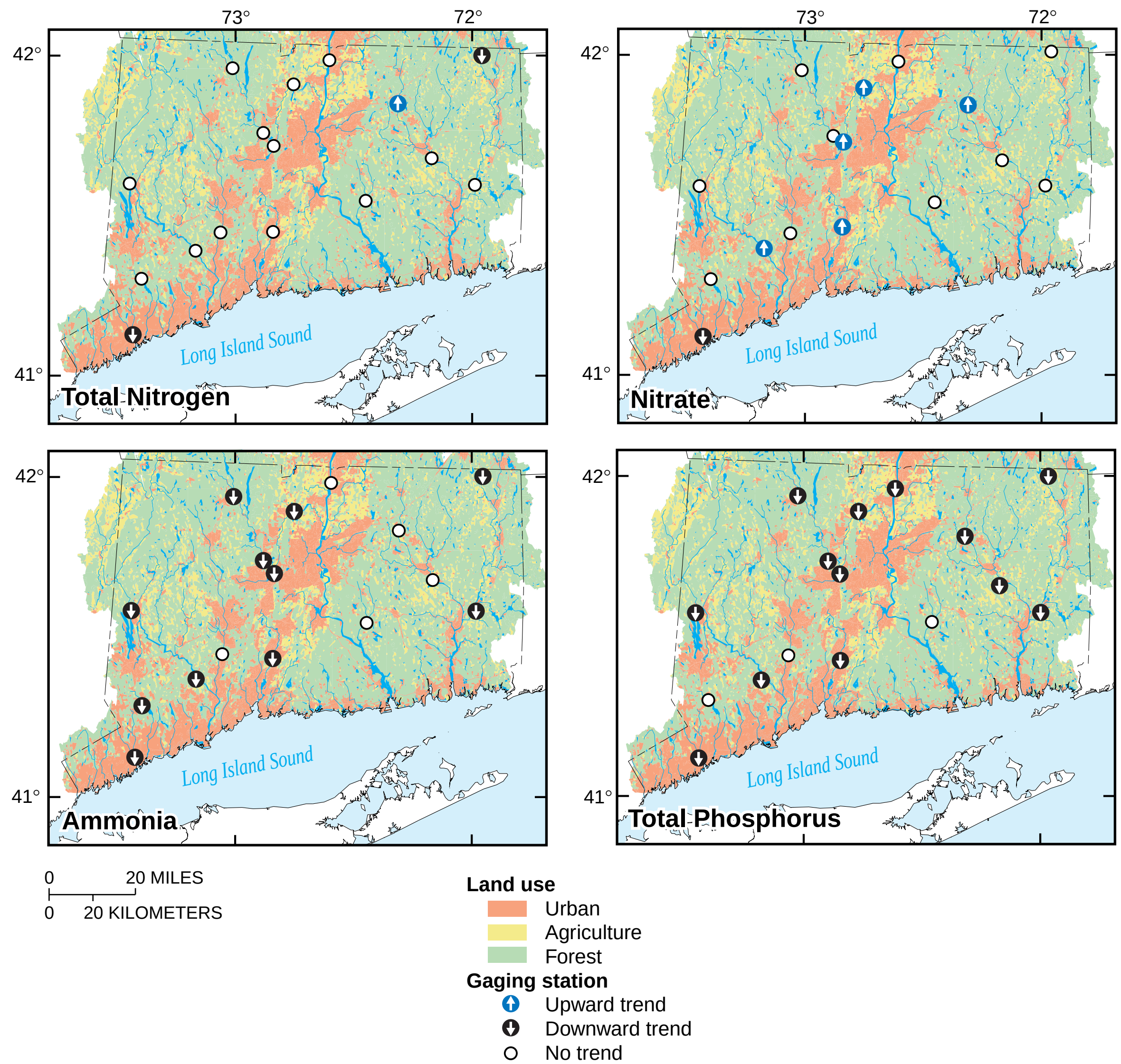
Decades of monitoring may be necessary to adequately assess the effects of land- and water-management decisions on water quality. For example, decreases in phosphorus concentrations resulting from improved wastewater treatment technology and phosphate detergent bans have been documented in the Apalachicola-Chattahoochee-Flint River Basin; Albemarle-Pamlico Drainage; Connecticut, Housatonic, and Thames River Basins; Lower Susquehanna River Basin; Potomac River Basin, and Western Lake Michigan Drainages.



Improvements in wastewater treatment and bans on phosphate detergents have resulted in decreased phosphorus concentrations in the Chattahoochee River downstream from Metropolitan Atlanta. Wastewater discharge to the Chattahoochee River from the six largest Metropolitan Atlanta wastewater treatment facilities increased by about 50 percent from 1980 to 1995; however, the total phosphorus load from these facilities decreased by about 83 percent relative to the highest load recorded in 1988. Improvements in wastewater treatment account for about two-thirds of the decrease in phosphorus load, and restrictions on phosphate detergents account for about one-third of the decrease. By 1995, decreased phosphorus loads from point sources had resulted in total phosphorus loads in the Chattahoochee River downstream from Metropolitan Atlanta that were 77 percent less than the highest load measured in the Chattahoochee River in 1984.

Ammonia has decreased, but nitrate has increased, in the Trinity River downstream from Dallas, Texas. As a result of upgrades to wastewater treatment plants in the Dallas area, concentrations of ammonia plus organic nitrogen decreased about 95 percent from 1974 to 1991 at five sites on the Trinity River. Nitrate concentrations increased by a similar magnitude during the same period because the ammonia was converted to nitrate. The decrease in ammonia has led to an increase in dissolved oxygen, which reduces the threat of fish kills.

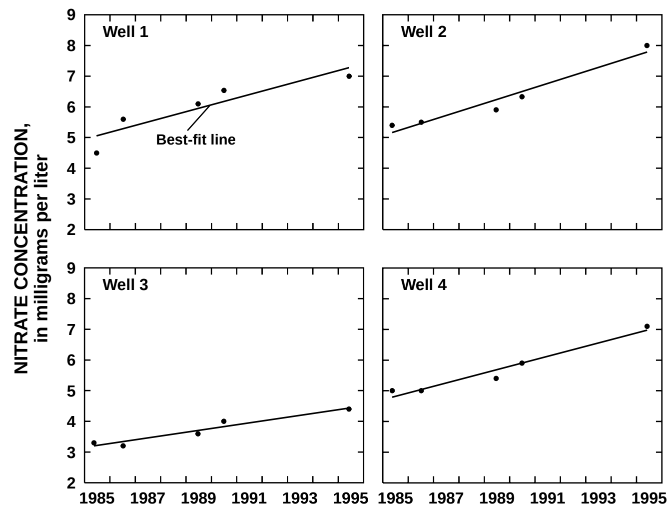
Despite decreases in ammonia and phosphorus in the Connecticut, Housatonic, and Thames River Basins, nutrients are still considered an environmental concern in Long Island Sound. Significant downward trends in total phosphorus concentrations were documented in 13 of 16 streams and rivers from 1980 to 1992 in the Connecticut, Housatonic, and Thames River Basins. The decreased phosphorus concentrations are likely due to improvements in wastewater treatment and to the elimination or reduction of phosphates in detergents. Ammonia decreased and nitrate increased during the same period, primarily as a result of the improved wastewater treatment processes, which convert ammonia to nitrate. Although improved treatment technology has enhanced surface-water quality in many parts of the Study Unit, the total amount of nutrients (particularly nitrogen) discharged to Long Island Sound is still considered an environmental concern. Excess nutrients continue to cause algal blooms, which decay and result in low dissolved-oxygen concentrations and poor habitat for fish and other marine animals in the Sound.



Removal of ammonia from point sources has enhanced stream quality in several Study Units, including the Connecticut, Housatonic, and Thames River Basins; Lower Susquehanna River Basin; Potomac River Basin; San Joaquin-Tulare Basins; and Trinity River Basin. Ammonia removal generally involves conversion to nitrate, and decreased ammonia concentrations typically have been accompanied by increased nitrate concentrations. Consequently, total nitrogen concentrations in these streams have remained about the same. Although toxicity to aquatic life has decreased as a result of ammonia removal, potential for eutrophication of surface waters probably has not changed.

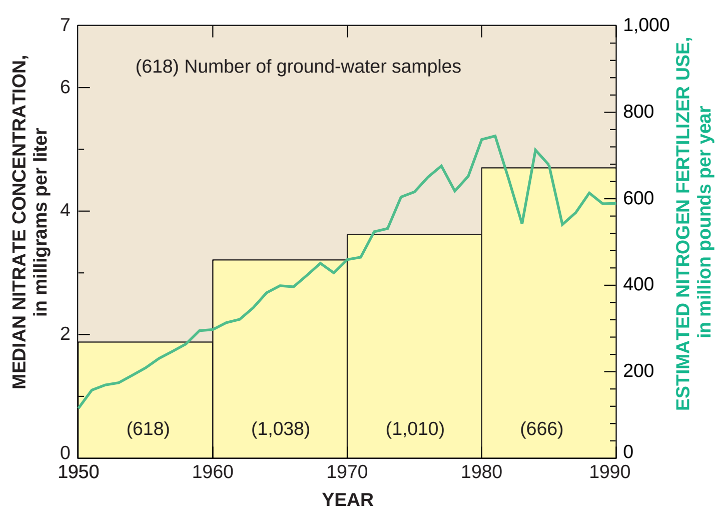
Nutrient conditions have changed over time in ground water

Little information exists about trends of nitrate in ground water, particularly at a national scale, because few monitoring programs have been designed to look at the quality of ground water over time. Some information on nitrate trends is available, however, for the Upper Snake River Basin and San Joaquin-Tulare Basins. Studies in the San Joaquin Valley indicate that from 1950 to 1980, the largest source of nitrate (nitrogen fertilizer) increased from 114 to 745 million pounds per year. Concentrations of nitrate in ground water also increased, from less than 2 mg/L in the 1950s to about 5 mg/L in the 1980s.



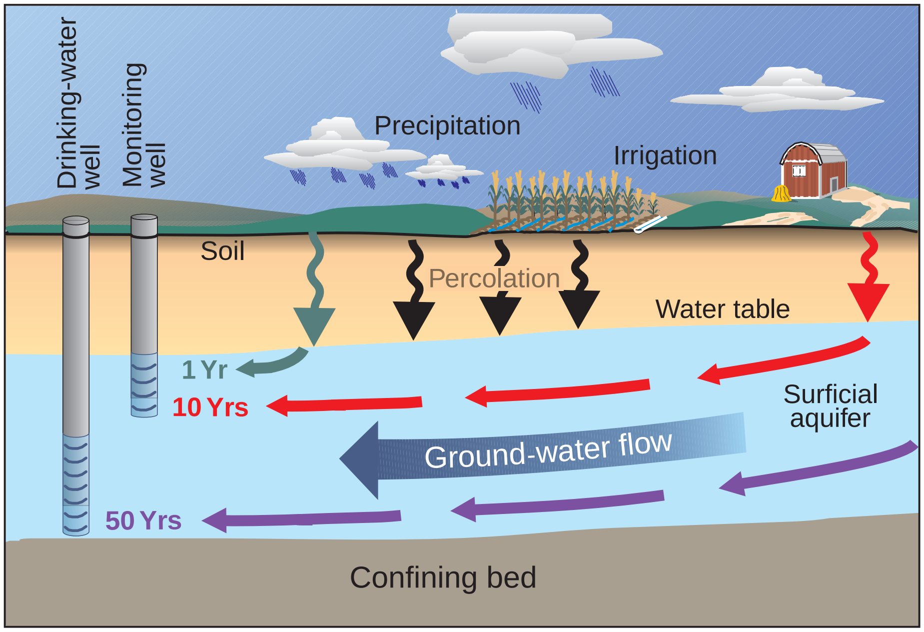
Concentrations of nitrate in shallow ground water have increased in agricultural areas of the Upper Snake River Basin. Water from four wells (average depth, 40 feet) in the alluvial aquifer in the Minidoka Irrigation District north of Burley, Idaho, showed an increase in nitrate between 1985 and 1995.

Neil M. Dubrovsky



Fertilizer use and nitrate concentrations in ground water in the eastern San Joaquin Valley (left) generally have increased over the last four decades. Although confined animal feeding operations and manure production also have increased during this period, nitrogen fertilizer is still considered to be the largest single source of nitrate to ground water.

The effects of past and present land-use practices may take decades to become apparent in ground water. When weighing management decisions for protection of ground-water quality, it is important to consider the time lag between application of nitrogen to the land and arrival of nitrate at a well. This time lag generally decreases with increasing aquifer permeability and with decreasing depth to water. In response to reductions in nitrogen applications to the land, the quality of shallow ground water will improve before the quality of deep ground water, which could take decades.



Jon Farrar, Nebraskaland Magazine, Nebraska Game and Parks Commission

Robert B. Swanson

Nitrate concentrations have decreased in shallow ground water in parts of the Central Nebraska Basins. In the mid-1980s, the Central Platte Natural Resources District (CPNRD) established fertilizer management areas in part of the central Platte Valley, where nitrate concentrations were as high as 40 mg/L. Stringent guidelines were imposed on the timing and application rates of fertilizer in an area where the median nitrate concentration had increased from about 8 mg/L in 1974 to about 18 mg/L in 1986. In 1994, after implementation of the fertilizer management strategy, the median nitrate concentration decreased to less than 2 mg/L. It is important to note, however, that local variations in soil characteristics, amounts of recharge, and other factors affect responses to management strategies: nitrate concentrations in nearly 25 percent of the wells sampled by the CPNRD in the area with the most stringent guidelines continued to exceed 20 mg/L in 1994.