Water Quality

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The U.S. Geological Survey (USGS) began the National Water-Quality Assessment Program (NAWQA) in 1991 to describe the status of and long-term trends in the quality of the Nation's surface- and ground-water resources. The study of the Santee River Basin and Coastal Drainages began in 1994 and included about 60800 km^2 in North Carolina and South Carolina. A network of data collection sites in the NAWQA study area was designed for ecological, surface-water, and ground-water sampling.

One of the sites in the network was the Coosawhatchie River near Early Branch, SC (USGS Station 02176517) (fig. 1.11). The drainage area of this blackwater river upstream of the site is approximately 1000 km^2. Land use in the basin has consisted almost entirely of agriculture (42 percent), forest (30 percent), and wetlands (24 percent). Water-quality samples were collected monthly at the Coosawhatchie River site from October 1995 through September 1997 as part of the NAWQA program.

Photo by Brian Hughes

Each water sample was split into several bottles using a core splitter to ensure similar subsamples.

Seasonal patterns were observed in nutrients, suspended organic carbon, dissolved oxygen, and silica. Phosphorus concentrations were highest during low streamflows in the late spring and early summer, decreased through the fall, and were lowest during the winter (fig. 1.12). Ammonia-nitrogen concentrations were generally low, with a median of 0.015 mg per liter and a range from below detection (0.002 mg per liter) to 0.12 mg per liter. A comparison of total and dissolved ammonia-plus-organic-nitrogen and ammonia-nitrogen concentrations indicated that the majority of the nitrogen was in the dissolved, organic form. Nitrate-nitrogen concentrations ranged from below detection (0.005 mg per liter) to 0.12 mg per liter. The median suspended organic carbon concentration was 0.5 mg per liter with a range of 0.2 to 2.8 mg per liter. Dissolved oxygen saturation ranged from 25 to 84 percent and was highest in the winter. Silica concentrations ranged from 2.3 to 11 mg per liter and were highest in the winter.

In a 300-m reach of the river, specimens of algae, macroinvertebrates, and fish were collected and aquatic habitat was described. Bed sediment and native bivalve (*Elliptio insula*) tissue samples were collected and analyzed for organic constituents and trace elements. The sediment mercury concentration in this reach of the Coosawhatchie River was 0.26 mg per gram. Trace-element concentrations in the Coosawhatchie River native bivalves were similar to those in other streams in the NAWQA study area (data available at http://wwwsc.er.usgs.gov/nawqa/santhome.html).

Among the organic constituents in the sediment samples, p-cresol was present at the highest concentration, 810 mg per kilogram. The concentration of the next-most-abundant organic compound, di-n-butyl-phthalate, was < 100 mg per kilogram. A metabolite of the pesticide DDT, p, p'-DDE, was detected at a concentration of 8 mg per kilogram. No organic contaminants were detected in the *E. insula* tissue samples.

Fish were collected from the main channel of the Coosawhatchie River by using a boat-mounted electrofishing apparatus. In shallows and sloughs along the reach, a backpack-mounted electrofisher was used. Twenty-three species of fish were collected. The dominant species were the warmouth (*Lepomis gulosus*), comprising 20 percent of the total number of fish captured and 17 percent of the biomass; and the bluegill sunfish (*Lepomis macrochirus*), comprising 15 percent of the total number of fish and 7 percent of the biomass. Compared with 11 other streams in the NAWQA study area, the Coosawhatchie River ranked fifth in the number of fish species collected.

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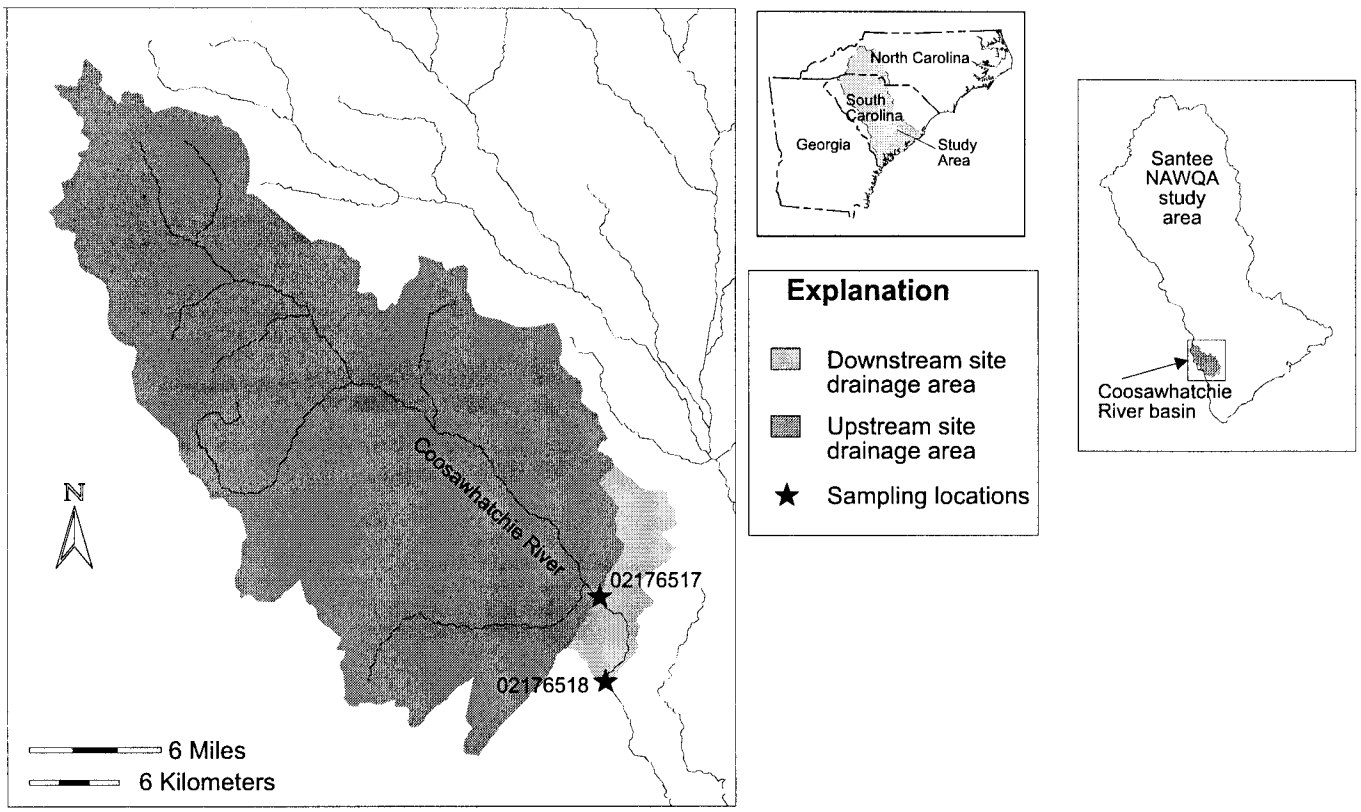

Figure 1.11—The extent of the Coosawhatchie River watershed and the Coosawhatchie Bottomland Ecosystem Study gauge locations at Early Branch, SC, (USGS Station 02176517) and Grays, SC (USGS Station 02176518).

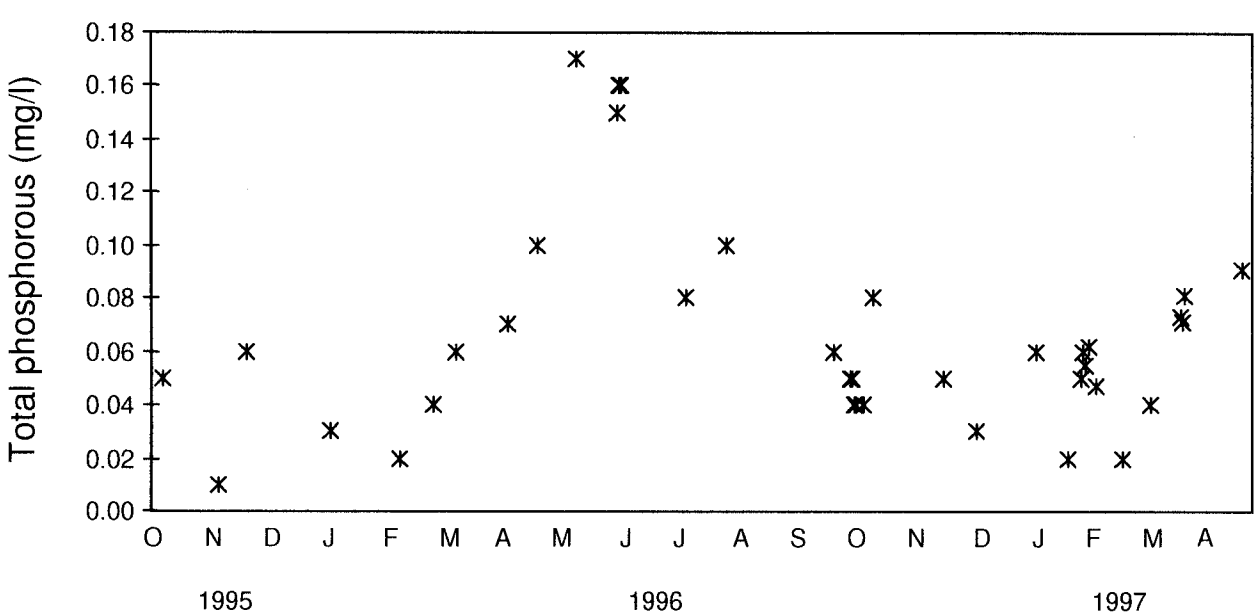

Figure 1.12—Seasonal patterns in total phosphorus concentrations in the Coosawhatchie River above the study site near Early Branch, SC, 1995–97.

Water-quality samples were analyzed and results compared between the Coosawhatchie River near Early Branch, SC (USGS Station 02176517), and a downstream site near Grays, SC (USGS Station 02176518) (fig. 1.11). Land use between these two sites is primarily forested wetlands. Samples were collected in the summer (low streamflows), winter (intermediate streamflows), and during storms (high streamflows). At low and intermediate streamflows, samples were collected daily at each of the two sites for 3 days. Storm-flow samples were collected daily on the rising limb of hydrographs and intermittently on the falling limb. Temperature, conductivity, dissolved oxygen, and acidity/alkalinity were measured in the field. Samples were collected and processed for analysis of nutrients, organic carbon, major ions, and suspended sediment. Stream stage was measured continuously at both sites. Streamflows during sampling ranged from 0.37 to 22.6 m^3 per second.

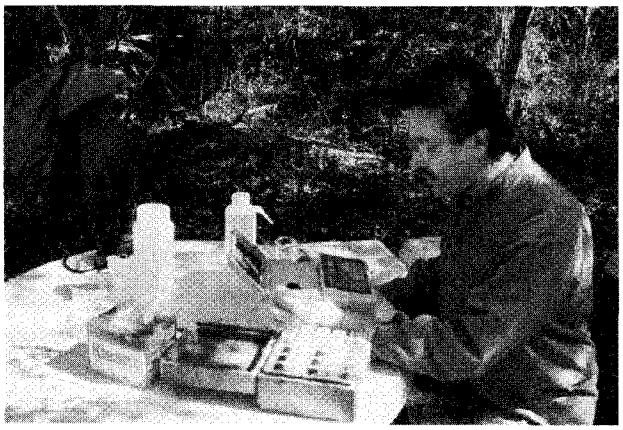

Photo by Brian Hughes

Some of the water-quality measurements were conducted in the field.

A comparison of the upstream and downstream sites indicated varying trends in water quality. Nutrient concentrations at both sites were highest during summer's low streamflows, and the downstream ammonia-nitrogen concentrations were higher than the upstream concentrations (fig. 1.13). Phosphorus concentrations were generally higher at the upstream site during intermediate and high streamflows and higher at the downstream site during low streamflows. Suspended organic carbon concentrations were higher downstream during low streamflows. Dissolved organic carbon concentrations were lowest at both sites during low streamflows. Dissolved oxygen saturation was lowest in the summer at both sites. As streamflow increased, iron, manganese, potassium, and magnesium concentrations decreased (data available at http://wwwsc.er.usgs.gov/nawqa/santhome.html).

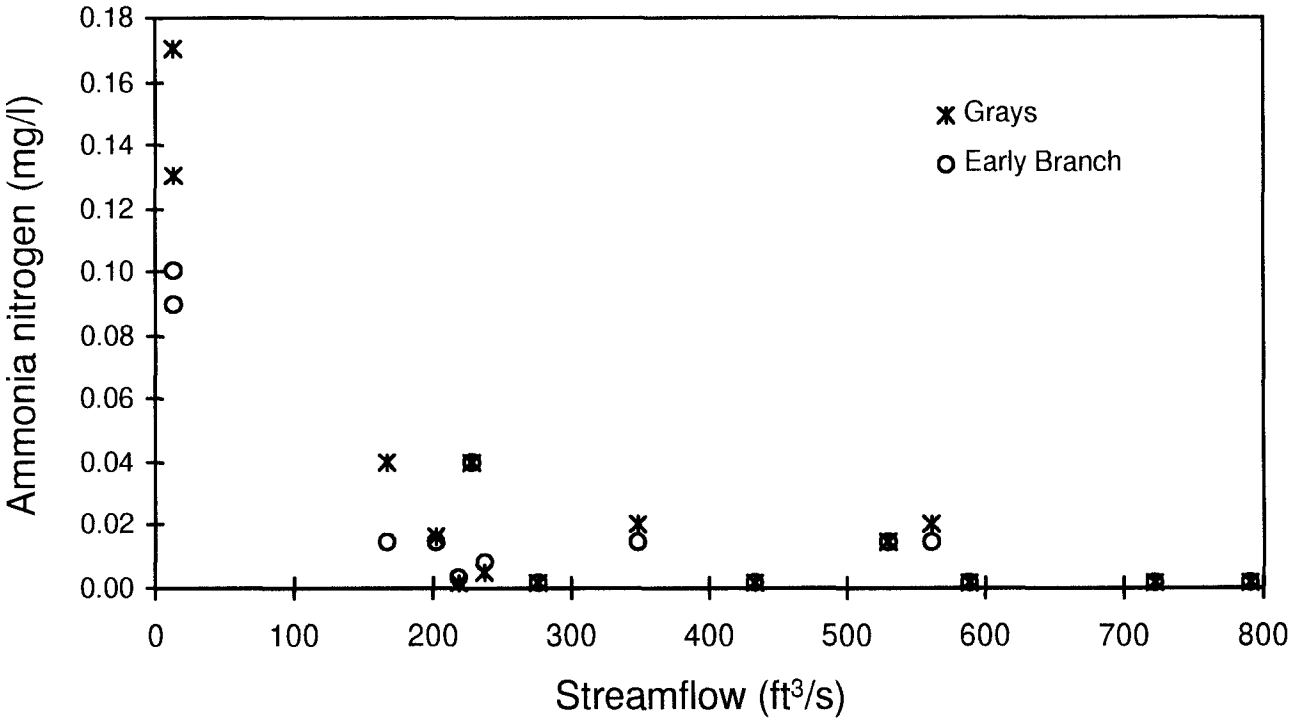

Figure 1.13—Ammonia nitrogen concentrations (individual data points) in the Coosawhatchie River above the study site near Early Branch, SC, and at Grays, SC, 1995–97 (multiply streamflow by 2.831 by 10^{-2} to obtain m^3 per second).