

trends, but the increase in nitrates is inconsistent with the stable levels of nitrogen emissions and deposition. The study suggests that the vegetation and land surrounding these lakes have lost some of their previous capacity to use nitrogen, thus allowing more of the nitrogen to flow into the lakes and increase their acidity. Recovery of acidified lakes is expected to take a number of years, even where soil and vegetation have not been "nitrogen saturated," as EPA called the phenomenon in a 1995 study.<sup>88</sup> This situation places a premium on reductions of SO<sub>x</sub> and especially NO<sub>x</sub> from all sources, including nonroad diesel engines, in order to reduce the extent and severity of nitrogen saturation and acidification of lakes in the Adirondacks and throughout the U.S.

The SO<sub>x</sub> and NO<sub>x</sub> reductions from today's action will help reduce acid rain and acid deposition, thereby helping to reduce acidity levels in lakes and streams throughout the country and help accelerate the recovery of acidified lakes and streams and the revival of ecosystems adversely affected by acid deposition. Reduced acid deposition levels will also help reduce stress on forests, thereby accelerating reforestation efforts and improving timber production. Deterioration of our historic buildings and monuments, and of buildings, vehicles, and other structures exposed to acid rain and dry acid deposition also will be reduced, and the costs borne to prevent acid-related damage may also decline. While the reduction in sulfur and nitrogen acid deposition will be roughly proportional to the reduction in SO<sub>x</sub> and NO<sub>x</sub> emissions, respectively, the precise impact of today's action will differ across different areas.

### 3. Eutrophication and Nitrification

Eutrophication is the accelerated production of organic matter, particularly algae, in a water body. This increased growth can cause numerous adverse ecological effects and economic impacts, including nuisance algal blooms, dieback of underwater plants due to reduced light penetration, and toxic plankton blooms. Algal and plankton blooms can also reduce the level of dissolved oxygen, which can also adversely affect fish and shellfish populations.

In 1999, NOAA published the results of a five year national assessment of the severity and extent of estuarine

eutrophication. An estuary is defined as the inland arm of the sea that meets the mouth of a river. The 138 estuaries characterized in the study represent more than 90 percent of total estuarine water surface area and the total number of U.S. estuaries. The study found that estuaries with moderate to high eutrophication conditions represented 65 percent of the estuarine surface area. Eutrophication is of particular concern in coastal areas with poor or stratified circulation patterns, such as the Chesapeake Bay, Long Island Sound, or the Gulf of Mexico. In such areas, the "overproduced" algae tends to sink to the bottom and decay, using all or most of the available oxygen and thereby reducing or eliminating populations of bottom-feeder fish and shellfish, distorting the normal population balance between different aquatic organisms, and in extreme cases causing dramatic fish kills.

Severe and persistent eutrophication often directly impacts human activities. For example, losses in the nation's fishery resources may be directly caused by fish kills associated with low dissolved oxygen and toxic blooms. Declines in tourism occur when low dissolved oxygen causes noxious smells and floating mats of algal blooms create unfavorable aesthetic conditions. Risks to human health increase when the toxins from algal blooms accumulate in edible fish and shellfish, and when toxins become airborne, causing respiratory problems due to inhalation. According to the NOAA report, more than half of the nation's estuaries have moderate to high expressions of at least one of these symptoms—an indication that eutrophication is well developed in more than half of U.S. estuaries.

In recent decades, human activities have greatly accelerated nutrient inputs, such as nitrogen and phosphorous, causing excessive growth of algae and leading to degraded water quality and associated impairments of freshwater and estuarine resources for human uses.<sup>89</sup> Since 1970, eutrophic conditions worsened in 48 estuaries and improved in 14. In 26 systems, there was no trend in overall eutrophication conditions since 1970.<sup>90</sup> On the New England coast, for example, the number of red

and brown tides and shellfish problems from nuisance and toxic plankton blooms have increased over the past two decades, a development thought to be linked to increased nitrogen loadings in coastal waters. Long-term monitoring in the U.S., Europe, and other developed regions of the world shows a substantial rise of nitrogen levels in surface waters, which are highly correlated with human-generated inputs of nitrogen to their watersheds.

Between 1992 and 1997, experts surveyed by National Oceanic and Atmospheric Administration (NOAA) most frequently recommended that control strategies be developed for agriculture, wastewater treatment, urban runoff, and atmospheric deposition.<sup>91</sup> In its Third Report to Congress on the Great Waters, EPA reported that atmospheric deposition contributes from 2 to 38 percent of the nitrogen load to certain coastal waters.<sup>92</sup> A review of peer reviewed literature in 1995 on the subject of air deposition suggests a typical contribution of 20 percent or higher.<sup>93</sup> Human-caused nitrogen loading to the Long Island Sound from the atmosphere was estimated at 14 percent by a collaboration of Federal and State air and water agencies in 1997.<sup>94</sup> The National Exposure Research Laboratory, U.S. EPA, estimated based on prior studies that 20 to 35 percent of the nitrogen loading to the Chesapeake Bay is attributable to atmospheric deposition.<sup>95</sup> The mobile source portion of atmospheric NO<sub>x</sub> contribution to the Chesapeake Bay was modeled at about 30 percent of total air deposition.<sup>96</sup>

Deposition of nitrogen from nonroad diesel engines contributes to elevated nitrogen levels in waterbodies. The proposed standards for nonroad diesel

<sup>91</sup> Bricker, Suzanne B., *et al.*, National Estuarine Eutrophication Assessment, Effects of Nutrient Enrichment in the Nation's Estuaries, National Ocean Service, National Oceanic and Atmospheric Administration, September, 1999. Available in Docket A-99-06, Document No. IV-G-145.

<sup>92</sup> Deposition of Air Pollutants to the Great Waters, Third Report to Congress, June, 2000. Available in Docket A-99-06, Document No. IV-A-06.

<sup>93</sup> Valigura, Richard, *et al.*, Airsheds and Watersheds II: A Shared Resources Workshop, Air Subcommittee of the Chesapeake Bay Program, March, 1997. Available in Docket A-99-06, Document No. IV-G-144.

<sup>94</sup> The Impact of Atmospheric Nitrogen Deposition on Long Island Sound, The Long Island Sound Study, September, 1997.

<sup>95</sup> Dennis, Robin L., Using the Regional Acid Deposition Model to Determine the Nitrogen Deposition Airshed of the Chesapeake Bay Watershed, SETAC Technical Publications Series, 1997.

<sup>96</sup> Dennis, Robin L., Using the Regional Acid Deposition Model to Determine the Nitrogen Deposition Airshed of the Chesapeake Bay Watershed, SETAC Technical Publications Series, 1997.

<sup>88</sup> Acid Deposition Standard Feasibility Study: Report to Congress, EPA 430R-95-001a, October, 1995.

<sup>89</sup> Deposition of Air Pollutants to the Great Waters, Third Report to Congress, June, 2000. Available in Docket A-99-06, Document No. IV-A-06.

<sup>90</sup> Deposition of Air Pollutants to the Great Waters, Third Report to Congress, June, 2000. Great Waters are defined as the Great Lakes, the Chesapeake Bay, Lake Champlain, and coastal waters. The first report to Congress was delivered in May, 1994; the second report to Congress in June, 1997. Available in Docket A-99-06, Document No. IV-A-06.