EXHIBIT 10 (AR L.3)

crop land and woodland. Climate along the coast is modulated by ocean temperatures, which are much warmer on average along the Gulf of Mexico and South Atlantic regions than along the Pacific Coast and North Atlantic regions (Figure 3.4c). The annual mean temperatures also reflect this modulating influence. The number of frost days mirrors regional temperature differences; the North Atlantic region has 156 frost days per year, the northern Pacific Coast region 79 and the Gulf of Mexico region just 12 frost days per year (Table 3.1).

Nutrients

Although both phosphorus and nitrogen can cause nutrient enrichment problems in estuaries, only nitrogen inputs are included in this assessment because nitrogen is typically the limiting nutrient in estuaries and coastal water bodies. For this reason, nitrogen values were used for primary estimates of nutrient inputs. These estimates were based on participant entries to the online survey as well as load estimates from the Watershed Assessment Tool for Evaluating Reduction Strategies for Nitrogen (WATERSN, Castro et al. 2001) model. WATERSN is a numerical model of inputs to coastal systems, taking into account nitrogen inputs from sewage, urban and agricultural runoff (crops and animals), atmospheric deposition, and forest runoff (see *Chapter 2: Approach*).

While nitrogen input data and load estimates were available for only 64 systems, some patterns were notable. With a few exceptions (i.e., San Francisco Bay North, Mississippi River), nitrogen loads were highest in the mid-Atlantic region, correlating with high populations (Figures 3.5 and 3.6). In the Gulf of Mexico region, high loads corresponded with high agricultural activity and the Mississippi River outflow (Figure 3.6). An analysis of these loads was performed in order to identify whether the loading source is primarily the watershed and is related to human activities, or if it comes from ocean inputs. With the exception of systems in the North Atlantic region, more than 75% of the systems evaluated have nutrient loads derived mainly from the watershed.

Jane Thomas, University of Maryland Center for Environmental Science

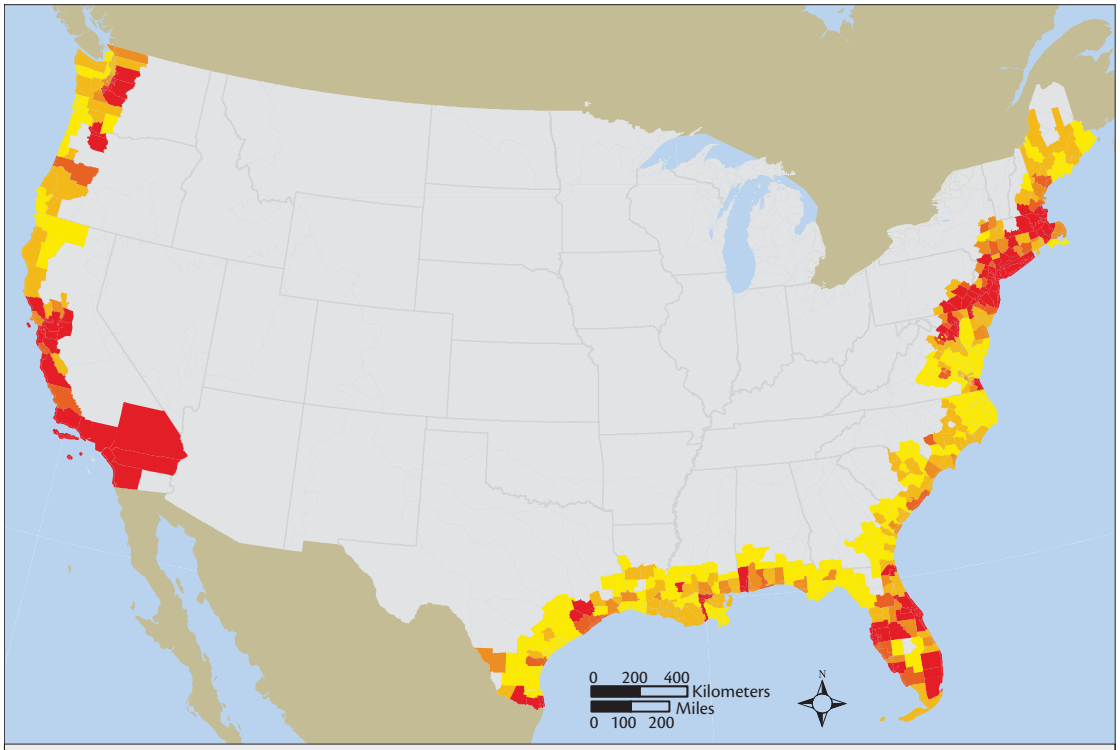
Wastewater treatment plants (point sources) such as the one pictured above can be a large source of nutrients to estuaries.

Caroline Wicks, EcoCheck (NOAA/University of Maryland Center for Environmental Science)

Nutrient loads to the subtropical systems of southern Florida are highly variable.

Trends

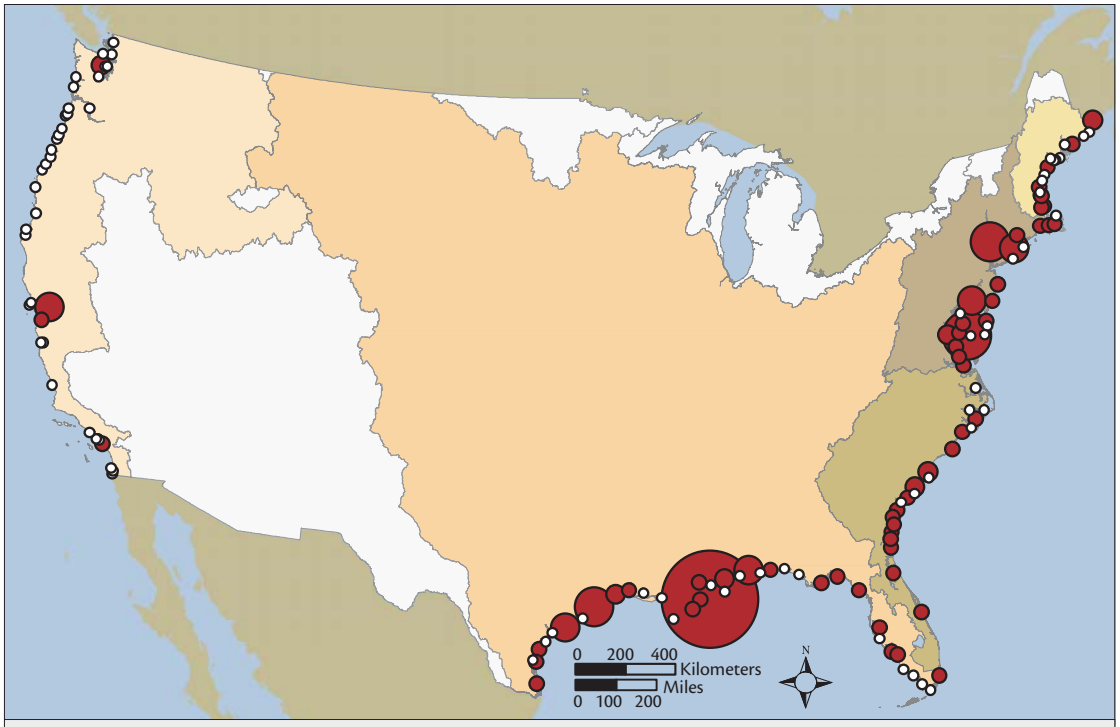
In the 1999 report, nitrogen load estimates from the USGS SPARROW model were used to determine an influencing factors score (Smith et al. 1997). Unfortunately, the updated SPARROW model estimates were not available in time to use in this analysis. Therefore, workshop participant estimates and results of the WATERSN model were used for systems with available data. When the WATERSN model results were statistically compared to load data contributed by individual participants, the results were not significantly different. Due to the difference in time frames and methods used by the SPARROW model, the WATERSN model, and participant estimated loads, a trend analysis was not possible.



2003 United States coastal population (x 1000)

3–50 | 51–150 | 151–250 | 251–350 | 351 +

Data source: NOAA's Spatial Trends in Coastal Socioeconomics website, a product of the Coastal and Ocean Resource Economics Program (http://marineeconomics.noaa.gov/socioeconomics/)



Nitrogen loads (x 10^6 tonnes $year^{-1}$)

Unknown | <20 | 20–40 | 40–60 | 60–80 | 80–100 | 100–400 | 400–800

Data sources: Castro et al. 2001 and NEEA online survey (www.eutro.us)

EXHIBIT 10 (AR L 3)

ASSESSING EUTROPHICATION ON A NATIONAL SCALE

Influencing factors

- The majority of systems assessed were highly influenced by human-related activities.
- The North Atlantic region was the least influenced.

The majority of systems assessed (36 of 64) had high influencing factors ratings, indicating that these estuaries received a large amount of nitrogen compared to their capacity to dilute or flush nutrients. However, no estuaries in the North Atlantic region had a high rating. Low influencing factors in this region are likely due to relatively low nitrogen loads and strong tidal flushing. In contrast, high ratings in the mid-Atlantic region resulted from high nitrogen loads relative to susceptibility (Figure 3.7).

Estuaries with low influencing factors ratings were located in regions other than the North Atlantic region and interestingly, were often in close proximity to estuaries with high influencing factors ratings. The high geographic variability of nitrogen loading and susceptibility indicates the need for locally tailored management action.

While the relationship between influencing factors and eutrophic condition is discussed later in this chapter, there are notable patterns existing between the two. For example, of the 15 estuaries with high overall eutrophic condition scores (OEC), 13 had high susceptibility scores. In contrast, of the 35 systems with moderate low or low OEC scores, 31 had low or moderate susceptibility. Eleven of these 31 systems had a low or moderate low OEC rating despite high nutrient loads. These systems seem able to naturally suppress eutrophication. The relationship between influencing factors and eutrophic condition is not entirely predictable at a national level, reiterating a need for local management.

Figure 3.7. Factors influencing eutrophication on a national scale.