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Hypoxia in the Gulf of Mexico

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The northern Gulf of Mexico receives the freshwater and constituent flux from the Mississippi River, which integrates 40% of the lower 48 United States. In the last half of the 20th century, the flux of nitrogen tripled, phosphorus concentration appears to have increased, and silicate concentration decreased. These changes result from landscape alterations over two centuries with an intensification of human activities that increased the flux of nitrogen and phosphorus particularly in the 1960s to 1980s. Evidence for eutrophication in the coastal ecosystem includes an increase in algal biomass, carbon accumulation from nutrient-enhanced production, worsening oxygen deficiency in the lower water column, and shifts in food web structure. The extent of the oxygen deficiency reaches 20,000 km^2 of the inner continental shelf over long periods in summer with the potential for affecting commercially important fisheries in the Gulf. There is daily, weekly and seasonal variability in currents and stratification on the shelf and, therefore, no simple description of the couplings between nutrient delivery, carbon production in surface waters and delivery to and cycling in bottom waters. There are, however, multiple lines of evidence to implicate changes in riverine nutrient loads with overall primary and secondary production, carbon accumulation at the seabed, and low oxygen conditions on the shelf. The change in nutrient loads and responses of the northern Gulf coastal ecosystem, including widespread, severe seasonal hypoxia, parallel similar conditions in the coastal ocean on a global scale.