# Nitrogen cycling in regional grain production and consumption and its export to the environment

**Kai yue Xue**
**Guangdong Light Industry Vocational and Technical College**

**Abstract:** Global warming, eutrophication, and acidification are serious ecological and environmental problems faced by humans. Research has shown that these problems are caused by an increase in nitrogen and carbon cycling and an increase in environmental output. Especially, the input of nitrogen into farmland is increasing year by year, and the occurrence of N2O and N-NO is rapidly increasing, which has an increasingly serious impact on the atmosphere and groundwater. Based on the current research status of nitrogen cycling, this article focuses on explaining the constituent elements of the nitrogen circulation revenue and expenditure model, how to estimate the remaining and abandoned nitrogen in farmland based on the nitrogen circulation revenue and expenditure model, and briefly explains the process and mechanism of nitrogen output to the environment causing red tide, global warming, and acidification.

**Keywords**: nitrogen cycle; Grain production; Nitrogen load; environmental monitoring

Global warming, eutrophication, and acidification are serious environmental problems faced by countries around the world. Research has shown that the emergence of these problems is related to the carbon and nitrogen cycle, especially the increasing amount of nitrogen input in farmland every year, although it plays an important role in increasing food production. However, in some areas, excessive nitrogen fertilizer application leads to an increase in the annual surplus of nitrogen in farmland, and the occurrence of N2O and N-NO is also rapidly increasing, which has an increasingly serious impact on the atmosphere and groundwater. Currently, people are monitoring the actual situation in various ecosystems and analyzing the nitrogen and carbon cycling mechanisms of each ecosystem. For example, the proportion of farmland is related to the concentration of nitrate nitrogen in river water, and the amount of nitrogen absorbed by crops remaining in farmland is also related to the rate of increase in nitrate nitrogen concentration in river water. The leaked nitrogen causes eutrophication in areas with less silicon. The decomposition of organic matter and the increase in nitrogen fertilization lead to an increase in N2O production, further contributing to global warming. Due to insufficient phosphorus in forest soil, even a small amount of nitrogen deposition can cause nitrogen to flow out of streams. The disposal of human and animal manure and residual nitrogen in farmland are the main causes of nitrogen pollution in surface water and groundwater. The nitrogen pollution of surface water such as groundwater and rivers not only brings health problems to people and livestock who use these polluted water, but also brings negative environmental impacts. Provide a brief introduction to the constituent elements of nitrogen budget models at the field and regional scales, and briefly explain the occurrence of red tide and global warming caused by nitrogen outflow.

## 1. The outflow of nitrogen into rivers and red tide

River water flows from mountainous water sources through farmland and cities, gathering agricultural drainage and domestic water, providing nutrients along the coast while also causing pollution and eutrophication. Nitrogen pollution causes health problems such as hemoglobinemia in humans and animals, carcinogenesis caused by nitrosamines, and a decrease in rice yield and quality. Nutrients flow out of rivers and into lakes and coastal areas, resulting in eutrophication.

Eutrophication brings about abnormal proliferation of phytoplankton, which is the first producer. Its remains are decomposed, leading to a state of oxygen deficiency and the formation of red tide.

In addition, harmful effects such as dead fish and shellfish poisoning are caused by the discharge of toxins from flagellates in phytoplankton. In nature, from winter to spring, the cold surface water sinks in the ocean, causing convection of seawater. Nutrient rich deep water mixes into the surface layer, leading to a large proliferation of plant plankton and a prosperous scene of spring warmth and blooming flowers. This spring prosperity has become the cornerstone of the food chain, expanding the affluent fishing grounds in the surrounding waters. Spring prosperity is generated by diatoms that use silicon as an essential element, and their reproduction continues until silicon is depleted. In cold areas with snow accumulation, the nitrogen outflow during the snowmelt period will inevitably increase due to the increase in river water volume. The water quality of rivers during the snowmelt period will have double-sided effects, with beneficial effects in spring prosperity and negative effects such as shellfish poisoning. It is generally believed that diatoms are prone to overpopulation under conditions suitable for the growth of plant plankton. However, due to the significant absorption of silicon by diatoms, their proliferation often stops due to the depletion of silicon in seawater. At this point, once sufficient nitrogen and phosphorus are present in seawater, the composition of plant plankton populations will shift towards flagellate algae that do not require silicon. Because freshwater is lighter than seawater, the supply of nutrients from river water to seawater has a significant impact on the proliferation of plant plankton. If a large amount of nitrogen continues to be supplied to seawater after silicon depletion, flagellate algae that do not require silicon will continue to proliferate, leading to red tide and shellfish poisoning, which will have a negative impact. However, with the weathering of soil and leaching of silicon, the balance between the supply to rivers and the supply of nitrogen and phosphorus can affect the composition of plant plankton populations. During the warm spring season, diatoms are the dominant species of plant plankton, and their elemental composition was measured to contain 18 · 9 mmol of C per 1g dry weight in the South Spitfire Bay of Hokkaido, N 2·8 mmol ,P 0·12 mmol ,Si 8·3mmol。The calculated Si/N molar ratio of algal elements is 2 · 7, and the Si/P molar ratio is 64 · 3. Therefore, when the ratio of silicon to nitrogen and phosphorus in seawater is less than this ratio, it is speculated that after silicon depletion, the proliferation of flagellate algae and red tide will occur due to the residual nitrogen and phosphorus. Therefore, if the Si/N and Si/P molar ratios of river water are greater than this value, it is considered that the river water contributes to the proliferation of diatoms; if they are less than this value, it is considered that the river water contributes to the proliferation of flagellates.