Spatial and Temporal Variation of Anthropogenic Nitrogen Inputs to the Agricultural Lands in China

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The anthropogenic nitrogen (N) inputs to the agricultural lands are the major non-point sources of water eutrophication. In order to make clear both spatial and temporal variation of the anthropogenic N inputs in China, we collected the statistical data of agricultural land use, crop production, population and livestock from 1980 to 2010. Based on these datasets, we estimated both spatial and temporal variation of N inputs to the agricultural lands, including the atmospheric deposition, synthetic N fertilizer, biological N fixation and recycling reactive N inputs, such as N from human waste and animal excrement, crop residue recycled as manure, and N emission from burning crop residue.

The results showed that the annual total N inputs increased by 1.5 times from 3,550 kg/km² in the 1980s (1981-1990) to 5,281 kg/km² in the 2000s (2000-2010). The synthetic N fertilizer dominated the N source and showed a 1.7 times increase from 1,361 kg/km² in the 1980s to 2,328 kg/km² in the 2000s. The animal excrement was the second important N source and showed a 1.4 times increase from 1,007 kg/km² in the 1980s to 1,415 kg/km² in the 2000s. The third important N source was human waste, which increased by 1.1 times from 443 kg/km² in the 1980s to 491 kg/km² in the 2000s. The most rapidly increased N source was the atmospheric deposition, which increased by 1.9 times from 170 kg/km² in the 2000s.

Regionally, some provinces in the eastern part of China like Shanghai, Jiangsu, Henan, Shandong, Anhui, Tianjin and Hebei, where the total amount of N inputs was over 15,000 kg/km² in the 2000s. However, those provinces in the western part of China like Xizhang, Qinhai, Xinjiang, Neimeng, Gansu and Ningxia, where the total amount of N inputs was less than 5,000 kg/km². The spatial distribution of its change rate during the last 3 decades shows that, some provinces like Tianjin, Neimeng, Henan, Ningxia, Xinjiang and Heilongjiang, where the total amount of N inputs increased by more than 2 times, only 3 provinces: Shanghai, Zejiang and Qinghai, where the total amount of N inputs decreased. In most part area of China, the total amount of N sources increased more than 1 to 2 times. According to the theory of the mass balance, we could make sure that the nitrogen outputs to the environment, such as water bodies, atmosphere and soils might increase by more than 1 to 2 times from 1980 to 2010 in the most part area of China.

Keywords: Nitrogen input, N fertilizer, Atmospheric deposition, Agricultural lands, China







Changes in the percentage of each component of N input from the 1980s to 2000s