

Evidence of Accelerated Nitrogen Deposition over China

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Introduction

Nitrogen (N) deposition as an important component in the global N cycle threatens the stability and biodiversity of both terrestrial and marine ecosystems (1-3). However, the magnitude and distribution of N deposition are essentially unknown in China, the one of the most polluted regions on Earth. Here we provide evidence that N deposition and plant foliar N content have increased substantially in China since the early 1980s, reflecting accelerated atmospheric N pollution.

Materials and Methods

Bulk deposition of inorganic N. A nationwide monitoring network for bulk N deposition has been established across China since 2004. Based on our own monitoring data (4) and nationwide published data, we constructed a bulk deposition database for China from 1980 to 2006.

Plant foliar N. A total of 1074 observations of plant foliar N content were collected from 660 terrestrial plant species in 130 families from 1980 to 2006 across China (5). Leaf samples were collected mainly during the growing season (July to September). Mean foliar N was calculated for each species at the same sites within the same year.

Anthropogenic emissions of NH₃ and NO_x. The NH₃ and NO_x emission inventories in China were calculated according to the method from the Regional Emission inventory in Asia (5).

Results

1. Both inorganic N bulk deposition (Fig. 1A) and plant foliar N concentrations (Fig. 1B) show strong increasing trends with time ($p < 0.001$) in China between 1980 and 2006, consistent with anthropogenic reactive N emission during the same period (Fig. 1C).

2. Compared with the Tibetan Plateau, higher bulk N deposition and greater annual increase in deposition in the North China Plain (NCP, Fig.2) suggested spatial variation of anthropogenic reactive N enrichment over China.

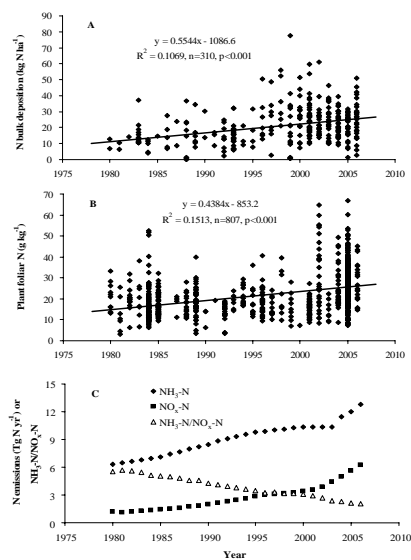


Fig. 1. Trends in N bulk deposition (A), plant foliar N(B), and NH₃ and NO_x emissions as well as their molar ratios (C) in China from 1980 to 2006.

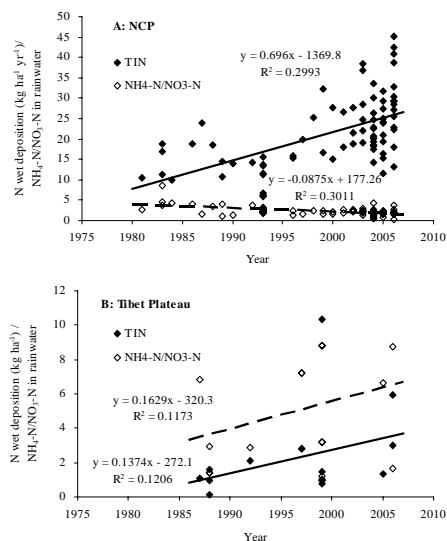


Fig. 2. Dynamics of bulk deposition of total inorganic N (TIN) and ratios of ammonium-N to nitrate-N in precipitation in the NCP (A) and the Tibetan Plateau (B).

Conclusion

Our results suggest that China has been experiencing increasingly serious atmospheric reactive N pollution since the 1980s. This increase is largely attributed to the expansion of agricultural and industrial production as well as urbanization, all of which have been part of the rapid economic growth in China over the last 30 years.

Acknowledgement

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