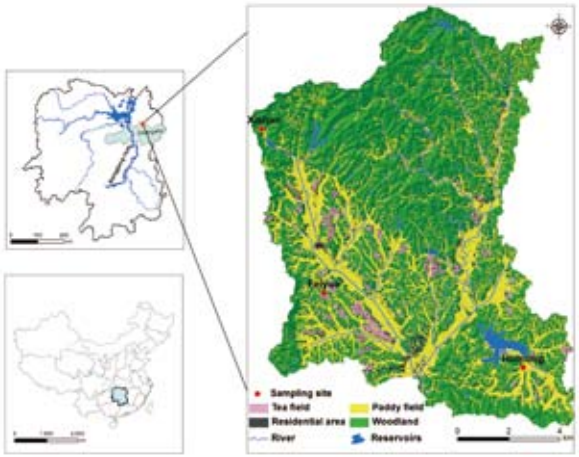
Experts Call For Reducing N Emissions in Subtropical Central China

Since the 1980s, atmospheric reactive nitrogen (N) emissions have more than doubled in China due to the rapid economic development and increasing population. According to recent modeling studies, China is now a hotspot for N deposition. In situ monitoring also showed that N deposition rates are very high at dozens of observation sites in different regions of China. High N deposition will cause negative effects like eutrophication, biodiversity loss and acidification in natural or semi-natural ecosystems.

Recent investigations conducted at some sites in China's subtropical region have showed that atmospheric wet/bulk N deposition ranges from 11 to 53 kg N ha^{-1} yr^{-1}. However, there has been very little research into dry N deposition in subtropical central China to date. A research team made up of scientists from the CAS Institute of



Map of the three sampling sites in the Jinjing catchment. (Image by ISA)

Nitrogen deposition monitoring at the paddy field site. (Photo courtesy Dr. SHEN)

Subtropical Agriculture (ISA) and China Agricultural University used denuder/filter pack systems, passive samplers and wet-only samplers to quantify the total N depositions at three sites with different land use types (forest, paddy field and tea field) in a 135-km^2 catchment in subtropical central China.

The researchers found that at the three sampling sites, the annual mean concentrations of total N (the sum of NH_4^+, NO_3^- and DON) in rainwater were 1.2 to 1.6 mg N L^{-1}, showing small variation across sites. The annual mean concentrations of total N (the sum of NH_3, NO_2, HNO_3, particulate NH_4^+ and NO_3^-) in the air were 13 to 18 μg N m^{-3}. High NH_3 concentrations in the air were observed at the agricultural sites of tea and paddy fields, indicating significant NH_3 emissions from N fertilizer application; and the high NO_2 concentrations were found at the upland sites of forest and tea field, suggesting high NO emissions from soils due to high N deposition and high N fertilizer input.

The scientists estimated the annual total N deposition for the three sites of paddy field, tea field and forest as 21, 34 and 55 kg N ha^{-1} yr^{-1}, in which the dry N deposition component contributed to 21%, 36% and 63 % of the annual total N deposition, respectively. By using land-use specific N deposition rates, the estimated annual total N deposition over the catchment was as high as 594 tonnes N yr^{-1}.

"This high N deposition in the catchment may be the main reason for the high N_2O emission at a masson pine site and high nitrate content in stream water at the edge of a masson pine forest within the catchment", said Dr. SHEN Jianlin, a researcher from ISA. "To minimize the adverse effects of atmospheric N deposition on natural or semi-natural ecosystems, it is crucial to reduce the reactive N emissions from anthropogenic activities, for instance the use of N fertilizers, animal production and fossil fuel combustion in subtropical central China", he added.

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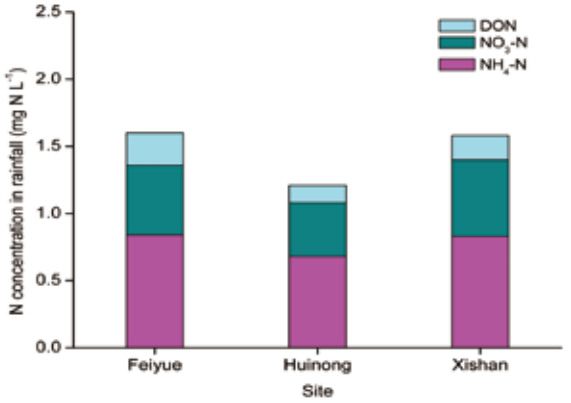

Figure 1. Annual volume-weighted mean concentrations of NH_4^+, NO_3^-, and DON in rainwater.

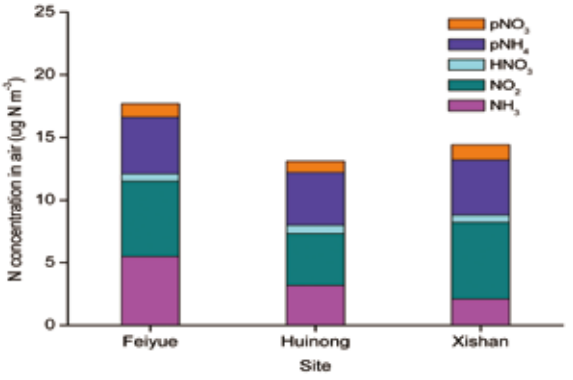

Figure 2. Annual mean concentrations of gaseous and particulate reactive nitrogen species in the air.

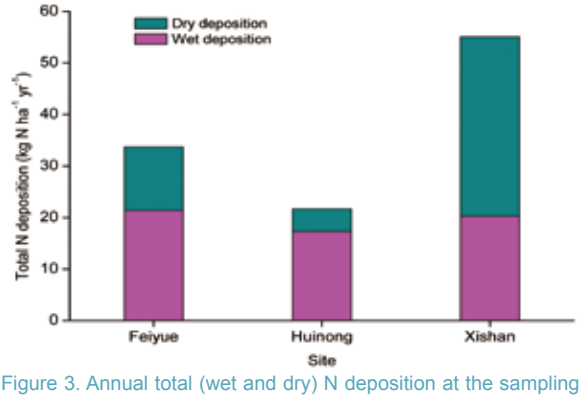

Figure 3. Annual total (wet and dry) N deposition at the sampling sites. (Images by courtesy of Dr. SHEN Jianlin)