Tropentag, September 14-16, 2010, Zurich

"World Food System —
A Contribution from Europe"

Soil Nitrogen Status and Nitrogen Mineralisation During Secondary Succession in a Subtropical Forest Ecosystem in China

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Abstract

The world's forest ecosystems deliver numerous services like carbon sequestration, erosion control, climate regulation and flood protection. Thus, the functioning of forest ecosystems plays a crucial role for livelihood, health and security of human populations. Chinese subtropical evergreen forests are so far underrepresented in biodiversity and ecosystem functioning research. This vegetation type is one of the most prominent biodiversity hotspots in the northern hemisphere and has experienced strong conversion into cropland and plantations in the past.

Within a recently initiated biodiversity ecosystem functioning experiment (BEF China) we investigated the influence of successional stage and woody plant species diversity on nitrogen (N) and carbon (C) cycling in natural subtropical broad-leaved forest stands. We aimed to identify impacts of stand age and tree diversity on biogeochemical transformation processes and pool sizes of N and C. Our study was conducted in the Gutianshan National Nature Reserve located in Zhejiang Province, East China. In 2008, 27 permanent vegetation plots were established in three successional forest states ranging from early (<20 years) to late successional (>80 years). Total N and C as well as seasonal changes of plant available ammonium (NH_4^+) and nitrate (NO_3^-) were measured in the mineral soil for five depth increments. In parallel, we determined net N mineralisation rates in the upper 10 cm of the mineral soil by *in situ* incubation of soil cores. We observed considerable seasonal variations of net N-mineralisation rates and plant available NH_4^+ and NO_3^-. Soil C and N concentrations were significantly influenced by successional forest stage. C concentrations increased during succession whereas total N was highest in young forests and lowest in middle-aged forest stands. Our first results indicated pronounced changes in N and C dynamics in the course of secondary succession and strong seasonal fluctuations of mineral soil N concentrations.

Keywords: BEF China, Gutianshan National Nature Reserve, nitrogen cycling, nitrogen mineralisation, secondary forest succession

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