Nitrogen deposition produces great carbon benefits in Moso bamboo forest across China regardless offset by non-CO_2 greenhouse gases emissions

With the support by the National Natural Science Foundation of China and the Natural Sciences and Engineering Research Council of Canada, Prof. Song XinZhang (宋新章) at the State Key Laboratory of Subtropical Silviculture of Zhejiang A&F University and his colleagues uncovered Moso bamboo forests had greater net carbon uptake benefits with increasing atmospheric nitrogen (N) deposition, which was published in *Science Advances* (2020, 6: eaaw5790).

Atmospheric deposition of N accelerates the growth of plants because N is a fertilizer. This process intensifies the removal of CO_2 by plants, causing carbon sinks, but it can also increase the emissions of non-CO_2 greenhouse gases methane (CH_4) and nitrous oxide (N_2O). These emissions warm the climate and may negate the benefits of a larger carbon sink.

Moso bamboo (*Phyllostachys edulis*) is well-known for its extremely fast growth rate and strong regeneration ability and covers 4.43 million hectares in subtropical China. This region is today subject to much higher N deposition rates than Western European and United States.

The team, for the first time, conducted a four-year-long field experiment and synchronously quantified the effects of N deposition on biomass increment, soil organic carbon, and N_2O and CH_4 fluxes, and ultimately the net carbon budget at the ecosystem level of a Moso bamboo forest in China.

They found that N input not only significantly increased woody biomass and the decomposition of SOC, but also increased N_2O emission and reduced the soil CH_4 uptake. The proportion of carbon uptake offset by N_2O and CH_4 emissions was only 11%—12%, being far lower than 53%—76% derived from a meta-analysis at a global scale. The total annual net carbon benefits induced by current atmospheric N deposition over Moso bamboo forests across China were estimated to be of 23.8 Tg CO_2 eq.

The authors point out the carbon offset effect of N_2O and CH_4 fluxes induced by N deposition might be highly overestimated and call for paying more attention to the unique role of Moso bamboo forest in mitigating global warming instead of neglecting it.

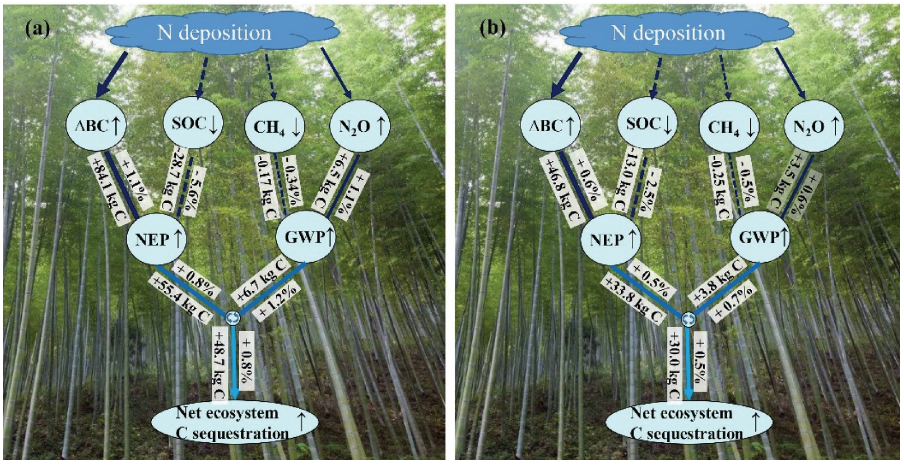

Figure The responses of the ecosystem carbon process to per unit nitrogen addition when nitrogen addition was not more than (a) 30 kg N ha^{-1} yr^{-1} and (b) 60kg N ha^{-1} yr^{-1}. Solid lines indicate positive responses; dashed lines indicate negative responses. ΔBC: woody biomass carbon increment; SOC: soil organic carbon; NEP: net ecosystem productivity; GWP: global warming potential of CH_4 or N_2O.