Biogeosciences Discuss., 5, S202–S204, 2008
www.biogeosciences-discuss.net/5/S202/2008/

Biogeosciences Discussions

Interactive comment on "Unusually negative nitrogen isotopic compositions (δ^{15} N) ofmangroves and lichens in an oligotrophic, microbially-influenced ecosystem" *by* et al.

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Received and published: 23 March 2008

Overall quality of paper

This is an interesting paper reporting very negative plant nitrogen isotope values in a mangrove ecosystem. Supporting measurements of possible sources and fertilization experiments suggest direct assimilation of atmospheric ammonia under nutrient-limited conditions. Specific questions regarding the study are presented below but my overall impression is that the authors are very conservative in their discussion of the implications of this and supporting research. Our understanding of plant nitrogen dynamics (and plant nitrogen isotope composition) is evolving rapidly beyond the traditional

paradigm of soil ammonium and nitrate as the sole plant nitrogen sources. Unfortunately this view is still adopted in many models of ecosystem nitrogen dynamics that are being used to understand and predict responses to global change. The discussion of this paper is confined to the mangrove ecosystems under study but similar results have been reported in other ecosystems, suggesting uptake of nitrogen from the atmosphere has implications beyond the current study sites and may represent an important source in other ecosystems, especially with current increases in atmospheric nitrogen deposition.

Specific Comments

The current paper would benefit from a more in-depth discussion of the isotopic mass balance with specific reference to the amount and isotopic composition of atmospheric nitrogen needed to cause the observed shift in leaf values. The amount of atmospheric nitrogen needed for such a shift seems very large, especially when controlled studies find only 1 to 20 % of leaf nitrogen is derived from atmospheric sources (Vallano and Sparks 2008; New Phytologist 177:946-955). The low isotope values could be explained if fractionation occurs during ammonia uptake by leaves causing lower values while relying on relatively less input from the atmosphere. Results from this study are very similar to those of Frank et al. 2004 (Biogeochemistry 68:169-178) who also documented large increases in leaf nitrogen concurrent with the isotopic shift associated with uptake of atmospheric ammonia. Frank et al. (2004) also found that fine and course roots were 9 per mille enriched compared to shoots which also supports the conclusions in this paper.

I am admittedly confused why atmospheric ammonia is presented as a flux rather than the concentration of an atmospheric pool, similar to soil respiration being a flux into the larger atmospheric carbon dioxide pool. Isn’t concentration more appropriate for an open pool such as the atmosphere? Shouldn’t atmospheric concentration being somewhat constant? Further information on the ammonia-sensitive badges would help. What is their response time? How sensitive are they?

BGD

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I suggest the authors discuss in more detail the potential influence that microbial activity and shifting plant substrates may have on isotopic composition. The large increase in leaf nitrogen isotope values observed with phosphorous addition is consistent with an increase in microbial activity that can possibly enrich plant-available pools through immobilization (Billings et al. 2004; Global Biogeochemical Cycles 18:GB1011). Couldn’t the very negative values also potentially be due to uptake of organic nitrogen, and the short-term increase be caused by shifts between organic and inorganic nitrogen sources?

Technical Corrections

Table 2 is not necessary. Table 3 and associated results. This is interesting but results are from a single individual and can be removed from the paper. Figure 5. This appears to be the raw data; can a single flux be calculated from the slope of the relationship?

Interactive comment on Biogeosciences Discuss., 5, 937, 2008.