



Does N deposition affect canopy N status and global albedo?

M. Borghetti (1), A. Nolè (1), S. Raddi (2), and F. Magnani (3)

(1) DISCOFA, University of Basilicata, Potenza, Italy, (2) DISTAF, University of Firenze, Italy, (3) DCA, University of Bologna, Italy

Atmospheric nitrogen deposition over the last century has resulted in substantial changes in soil C:N ratios in many regions, with potentially important effects on site fertility and plant nutritional status. This is expected to reflect in forest leaf N concentration and forest productivity, and eventually in an increase in forest C sequestration. In a recent study (Ollinger et al. 2008. PNAS 105, 19335-19340) canopy N concentration and forest gross primary production have been found to be significantly correlated with canopy VIS-NIR albedo, as derived from MODIS imagery, paving the way for a global assessment of forest N status and its possible relationship with atmospheric N deposition.

Here we show that, on a global scale, forest albedo is indeed correlated with N deposition, as estimated by the TM3 atmospheric transport model. Although partly the result of inter-specific differences in leaf and canopy reflectance and of the chance correlation between N deposition and biome distribution, the relationship appears to hold true also for individual plant functional types. Canopy albedo is found to increase significantly with N deposition up to a threshold of about 10-15 kg N ha⁻¹ yr⁻¹, and to remain constant or slightly decline above this level. This would suggest a saturation of canopy N concentration (and potentially forest productivity and C sequestration) above this level. A shallower relationship is observed in tropical than in temperate and boreal forests, in good agreement with our current understanding of N saturation. Apart from the implications for the assessment of forest productivity and C sequestration, the new findings suggest a novel and potentially relevant effect of atmospheric N deposition on Climate Change, though its impact of canopy albedo itself.