

University of New Hampshire

University of New Hampshire Scholars' Repository

Earth Sciences Scholarship

Earth Sciences

1-29-2009

Reply to Fisher: Nitrogen–albedo relationship in forests remains robust and thought-provoking

Scott V. Ollinger

University of New Hampshire - Main Campus, scott.ollinger@unh.edu

Steve Frolking

University of New Hampshire - Main Campus, steve.frolking@unh.edu

Andrew D. Richardson

University of New Hampshire, andrew.richardson@unh.edu

M E. Martin

University of New Hampshire - Main Campus, mary.martin@unh.edu

David Y. Hollinger

USDA Forest Service

See next page for additional authors

Follow this and additional works at: https://scholars.unh.edu/earthsci_facpub

Recommended Citation

Ollinger S, S Frolking, A Richardson, M Martin, D Hollinger, P Reich, L Plourde. 2009. Reply to Fisher: Nitrogen-albedo relationship in forests remains robust and thought-provoking, Proc. Nat. Acad. Sci. doi:10.1073/pnas.0900137106

This Article is brought to you for free and open access by the Earth Sciences at University of New Hampshire Scholars' Repository. It has been accepted for inclusion in Earth Sciences Scholarship by an authorized administrator of University of New Hampshire Scholars' Repository. For more information, please contact Scholarly.Communication@unh.edu.

Authors

Scott V. Ollinger, Steve Frolking, Andrew D. Richardson, M E. Martin, David Y. Hollinger, Peter B. Reich, and Lucie Plourde

Reply to Fisher: Nitrogen–albedo relationship in forests remains robust and thought-provoking

Fisher's (1) primary concerns have overlooked important methodological aspects of our study (2), whereas other concerns are consistent with our own presentation of the findings. We did not exclude photosynthetically active radiation (PAR) wavelengths, as Fisher states. Instead, we related canopy nitrogen to mean reflectance across the entire imaging spectrometer detection range of 400–2,500 nm and to independent estimates of shortwave albedo from the Moderate Resolution Imaging Spectroradiometer (MODIS), which include both PAR and near-infrared (NIR) wavelengths. Snowfall was not a factor because our analysis only included imagery from the midgrowing season to match our field sampling. Given the size of MODIS pixels, there is undoubtedly some influence of canopy gaps or nonvegetative surfaces, but their effect was minimized by focusing on large tracts of closed canopy forest.

Moreover, we did not report that nitrogen itself is driving variation in albedo but rather suggested that one or more of a suite of plant traits that covary with nitrogen apparently have

a strong enough effect on canopy reflectance to influence trends in albedo. Resolving underlying mechanisms is indeed an important next step because different mechanisms will respond differently to altered N availability. Thus far, available evidence points toward leaf-level traits, which raises the possibility that N cycling can influence climate in ways that have not previously been considered. We agree that this is a hypothesis that can be confirmed or rejected through additional measurements. Regardless of the outcome, the observation of a strong nitrogen–albedo relationship in forests is novel and thought provoking, and we hope it continues to generate new ideas and discussion.

Scott Ollinger^{a,1}, Steve Frohking^a, Andrew Richardson^a, Mary Martin^a, David Hollinger^b, Peter Reich^c, and Lucie Plourde^a

^aComplex Systems Research Center, Institute for the Study of Earth, Oceans, and Space, University of New Hampshire, Durham, NH 03824; ^bU.S. Department of Agriculture Forest Service, Northern Research Station, Durham, NH 03824; and ^cDepartment of Forest Resources, University of Minnesota, St. Paul, MN 55108

1. Fisher, JB (2009) Canopy nitrogen and albedo from remote sensing: What exactly are we seeing? *Proc Natl Acad Sci USA* E:16.

2. Ollinger SV, et al. (2008) Canopy nitrogen, carbon assimilation, and albedo in temperate and boreal forests: Functional relations and potential climate feedbacks. *Proc Natl Acad Sci USA* 105:19335–19340.

Author contributions: S.O., S.F., A.R., M.M., D.H., P.R., and L.P. wrote the paper.

The authors declare no conflict of interest.

¹To whom correspondence should be addressed. E-mail: scott.ollinger@unh.edu.