Title: **Accounting for carbon and energy edge effects in forest boundaries: A collaboration with ORNL, NIST, and Boston University**

Jeffrey Warren,[1,*] Melanie Mayes,[1] Peter Thornton,[1] Stan Wullschleger,[1]

[1]Oak Ridge National Laboratory, Oak Ridge, TN; [*]presenting author

Contact: (warrenjm@ornl.gov)

Project Lead Principle Investigator (PI): Melanie Mayes

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Project Abstract: The world's forests are highly fragmented, with 70% of forest area within a kilometer of an edge, and nearly 60% of North American forests within 100 m of an edge (Haddad et al. 2015). Forest edges as legacies of disturbance can have 50-100% greater productivity than the interior forest (Reinmann and Hutyra 2017). Yet, the increased productivity and changes in nutrient cycling, hydrology and soil carbon dynamics at forest edges are not well understood at the process level, and subsequently have not been adequately included in earth system modeling efforts. Beginning in 2016, researchers from Boston University and the National Institutes of Standards and Technology (NIST), began intensive, primarily aboveground ecophysiological observations of edge effects in a 67-ha forest remnant adjacent to meadow at the NIST campus in Gaithersburg, MD. In 2019, ORNL researchers added additional capacity with investigation of belowground hydrological, biogeochemical and biotic observations across meadow to interior forest transects, particularly soil C and nutrient concentrations, microbial and enzyme activities, autotrophic/heterotrophic respiration, root biomass and vertical profiles of soil water content and temperature. Results indicate increased rates of activity at the forest edge as compared with the interior forest and meadow locations. Soil pH declined and soil dissolved N and C increased from the forest interior into the meadow, and the large variation in NH4 and NO3 near the forest edge indicated some biological hotspots. While heterotrophic respiration dominated soil CO2 efflux across the transects, the forest edge and interior locations revealed a large autotrophic component that comprised 20% of total soil CO2 efflux. Throughout the soil profile, volumetric water content was driest at the forest edge and wettest 25 m away in the open meadow. In addition, there was strong evidence for hydraulic redistribution at the forest edge, based on a daily increase in water content in the absence of precipitation. Root trait distribution analysis is underway. Data will be used to test ELM and MEND model application to this unique interface, and to develop novel parameterization to improve representation of edges.

Haddad NM, et al. 2015. Sci Adv 1(2): e1500052

Reinmann, AB, Hutyra LR. 2017. Edge effects enhance forest carbon uptake. PNAS 114:107-112