SOIL RESPIRATION AS RELATED TO ABIOTIC AND REMOTELY SENSED VARIABLES IN VARYING OVERSTORIES AND UNDERSTORIES IN A HIGH ELEVATION SOUTHERN APPALACHIAN FOREST

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Extended abstract—Forests capture carbon dioxide through the process of photosynthesis. However, forests also respire carbon dioxide into the atmosphere. Soil respiration (R_s) is a significant source of atmospheric carbon dioxide. A portion of R_s comes from the process of microorganisms breaking down carbon sources in the soil while another portion is from respiring roots (Gough and others 2008). Even small changes in R_s can have a significant impact on whether a forest will behave as a carbon source or a carbon sink (Schlesinger and Andrews 2000). Therefore, considerable attention has recently been focused on accurate predictions of R_s.

Vegetation affects the soil microclimate, the amount and quality of litter deposited, and the rate of root respiration (Akburak and Makineci 2013). Recent studies have developed relatively good predictions of R_s and carbon cycling in managed forest systems, including pine plantations. There are substantially fewer studies focused on natural hardwood systems. Hardwood systems often have mixtures of species that abruptly change across small spatial scales, adding a level of complexity we have yet to understand.

Our study compared R_s, soil temperature, and soil moisture under four different vegetation types: eastern hemlock (*Tsuga canadensis* L. Carriere)-dominated overstory, mountain laurel (*Kalmia latifolia* L.)-dominated understory, hardwood-dominated overstory, and cinnamon fern (*Osmundastrum cinnamomuem* (L.) C. Presl.)-dominated understory with four replications of each. We calculated vegetation indices (normalized difference lignin index, normalized difference vegetation index, photochemical reflectance index, and normalized difference nitrogen index) on remotely sensed data from the National Ecological Observatory Network.

We found strong seasonal differences in R_s rates among our vegetation types (fig. 1). In the growing season, cinnamon fern had the highest R_s rate. Cinnamon fern was in abundance during the growing season; therefore, there was more belowground activity during this time. In the cooler dormant months, the hemlock plots had the highest R_s rate. Hemlock are evergreens and thus their needles persist in the dormant months which could lead to higher activity belowground as compared to other vegetation plots. The indices were weakly correlated with R_s rates in August and September. The spatial differences between the vegetation indices and R_s could explain the weak correlations we observed. Studies may want to focus on examining vegetation indices' ability to predict processes under broader spatial scales as well as get a better understanding of vegetation indices' spatial accuracy. Overall, vegetation type had a secondary effect on R_s rate seasonally.

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Citation for proceedings: Bragg, Don C.; Koerth, Nancy E.; Holley, A. Gordon, eds. 2020. Proceedings of the 20th Biennial Southern Silvicultural Research Conference. e–Gen. Tech. Rep. SRS–253. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 338 p.

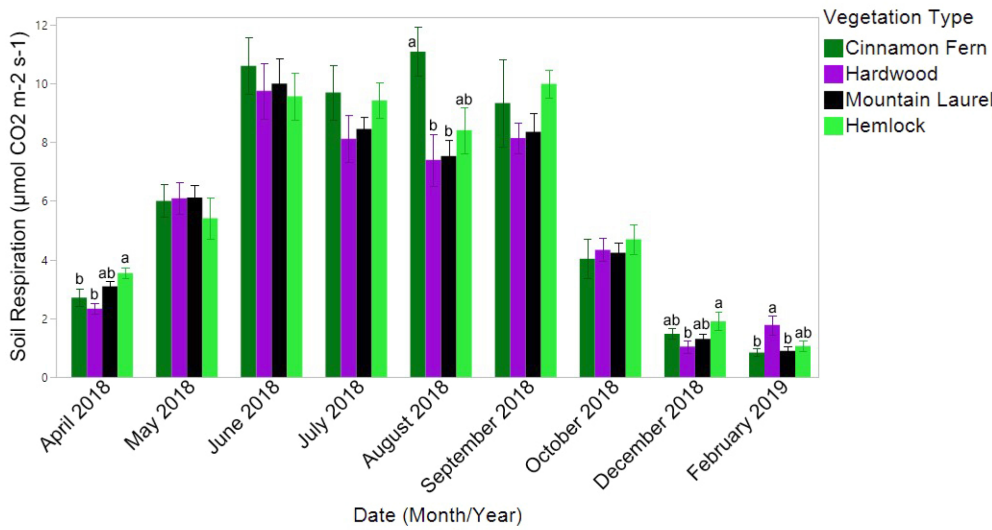

Figure 1—Average soil respiration (R_s) by sampling date for cinnamon fern, hardwood, mountain laurel, and hemlock vegetation types. Different letters signify a significant difference among vegetation types within sampling date.

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