EVALUATING CARBON STORES AT THE EARTH-ATMOSPHERE INTERFACE: MOSS AND LICHEN MATS OF SUBARCTIC ALASKA

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Abstract—A fundamental goal of the forest inventory in interior Alaska is to accurately estimate carbon pools in a way that sheds light on the feedbacks between forests and climate. In boreal forests, moss and lichen mats often serve as the interface between soils and the atmosphere, therefore characterizing the biomass and composition of mats is essential for understanding how forest carbon exchange might interact with shifting climatic regimes. Previous estimation approaches did not permit volumetric estimates of moss mats and were based on inconsistent definitions distinguishing between soil, duff, and moss layers. We confronted these challenges by implementing a novel, non-destructive technique centered on three research questions. First, what is the pattern of biomass and carbon distribution for moss/lichen ground layers in subarctic, interior Alaska? Second, how do climatic and stand-level factors drive these patterns? Third, what are the functional consequences and ecosystem effects of moss/lichen ground layers? Moss and lichen species were assigned to functional groups based on the capacity to fix nitrogen, serve as wildlife forage, indicate disturbance, alter hydrology, or signal eutrophic conditions (among other ecosystem functions). Among 99 sites located in the Tanana River valley of interior Alaska, biomass averaged 12 934 kg ha^{-1} (SD: 8546), of which carbon was an estimated 5456 (3778) kg ha^{-1}. Biomass had a weakly negative relationship with plant litter depth, to which topoedaphic and climatic factors also contributed. On average there were 7.2 functional groups per site – most frequent and abundant were nitrogen-fixing mosses, which commonly formed extensive, thick carpets. Together, these findings imply that moss and lichen mats in the Tanana River area can contribute substantially to both forest nitrogen stores and organic carbon sequestration.

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