Using Spatial Multi-attribute Analysis to Develop a Field-based Relative Moisture Index

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Biogeographers have a long tradition of characterizing sites based on their moisture conditions, since soil moisture is a primary factor affecting species abundance and distribution in the landscape. Water balance methods have the ability to model fine-scale patterns of moisture demand and availability over broad geographic areas, yet are computationally demanding and need extensive geospatial data. However, scientists often need to rapidly assess soil moisture conditions "in the field." Typically, easily assessable topographic criteria such as slope, aspect, topographic position, and slope form are assigned weights to generate a relative moisture index, although these "proxy" variables do not directly incorporate biological response to site conditions. Moreover, the process of weight determination and site assessment is not standardized and strongly influenced by the subjective experience of scientists. The task is further complicated by the spatially variable nature of the relative weights. To address such limitations in the field-based moisture index generation process, this research uses spatial multi-attribute analysis techniques to propose an objective method for determining relative weights. Results from a GIS-based water balance model for different study sites are used to calibrate the weight determination methodology. Study sites were selected from three physiographic provinces in the Appalachian Mountains: Blue Ridge (35°N), Valley and Ridge (37°N), and Appalachian Plateaus (39°N). Results provide a refinement of earlier attempts at site characterization, and can be used for a rapid assessment of soil moisture conditions within the landscape.