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Evaluating Soil Health Using Remotely Sensed Evapotranspiration on the Benchmark Barnes Soils of North Dakota

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The benchmark Barnes soil series is an extensive upland Hapludoll of the northern Great Plains that is both economically and ecologically vital to the region. Effects of tillage erosion coupled with wind and water erosion have degraded Barnes soil quality, but with unknown extent, distribution, or severity. Evidence of soil degradation documented for a half century warrants that the assumption of productivity be tested. Soil resilience is linked to several dynamic soil properties and National Cooperative Soil Survey initiatives are now focused on identifying those properties for benchmark soils. Quantification of soil degradation is dependent on a reliable method for broad-scale evaluation. The soil survey community is currently developing rapid and widespread soil property assessment technologies. Improvements in satellite based remote-sensing and image analysis software have stimulated the application of broad-scale resource assessment. Furthermore, these technologies have fostered refinement of land-based surface energy balance algorithms, i.e. Mapping Evapotranspiration at High Resolution with Internalized Calibration (METRIC) algorithm for evapotranspiration (ET) mapping. The hypothesis of this study is that ET mapping technology can differentiate soil function on extensive landscapes and identify degraded areas. A recent soil change study in eastern North Dakota resampled legacy Barnes pedons sampled prior to 1960 and found significant decreases in organic carbon. An ancillary study showed that evapotranspiration (ET) estimates from METRIC decreased with Barnes erosion class severity. An ET raster map has been developed for three eastern North Dakota counties using METRIC and Landsat 5 imagery. ET pixel candidates on major Barnes soil map units were stratified into tertiles and classified as ranked ET subdivisions. A sampling population of randomly selected points stratified by ET class and county proportion was established. Morphologic and chemical data will be recorded at each sampling site to test whether soil properties correlate to ET, thus serving as a non-biased proxy for soil health.