Prediction and monitoring of grassland productivity patterns at various scales

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Abstract

Ecosystem modeling which includes both variability of driving variables as an input, and uncertainty and/or stability in their predictions are rare, especially outside of forest and cropland applications. Prediction and monitoring of management or global change effects on ecosystem functioning are priorities in Grasslands National Park, Saskatchewan. At the edge of the geographic range of C4 grasses, it is an important area for the study and monitoring of species diversity and stability. Ecosystem modelling and remotely sensed imagery can be valuable tools, since both provide means to non-destructively analyze regions over temporal and spatial scales that are difficult to study with site-based experiments. Obstacles to their direct use across large regions include aggregation biases or incompatibilities between measurements with varying spatial support.

To address these issues, we are employing a three-pronged strategy to gain understanding of the relationships between vegetation patterns in this region as measured or predicted at different scales. Detailed field studies since 1995 have
simultaneously captured phenological and spectral reflectance data at fine resolutions (0.05-1.0m). Nested sampling allows investigation into scaling relationships of these variables from fine resolution up to hectare levels, corresponding to Landsat pixels. This provides information on spatial patchiness of vegetation biophysical characteristics (e.g. LAI, surrogates of above-ground productivity, species diversity) at a range of observational scales, between and within seasons, vegetation associations or disturbance regimes. We use this information and satellite images as constraints to simulate productivity patterns, allowing the study of effects of different spatial pattern on processes related to productivity.