Spatial and statistical variability of soil properties for fields in BMPs in the Steppler sub-watershed, South Tobacco Creek Watershed, research design and preliminary results.

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Key Words

Beneficial Management Practices (BMP's)

Abstract

Spatial and statistical relationships will be used to map soil series and to assess within-field distribution of soil properties in the context of Beneficial Management Practices (BMP's).

Introduction

Experimental research and models have been used to assess BMP's with respect to environmental and economic impact (Li et al 2011), but the application and interpretation of this information at the watershed or micro-watershed scale is limited due the absence of quantitative relationships for spatial and statistical variability of soil properties and landforms at the field scale.

The objective of this project is to develop quantitative relationships and maps for soil properties such as organic carbon and soil test N and P in the Steppler sub-watershed near Morden, Manitoba, with new methods based on a combination of field research, landform analysis of digital elevation data, remote sensing and existing soil survey maps.

Methods

Landform attributes (surface curvature, slope, aspect) and derivatives (upper, middle, lower slope positions and depressions) were calculated from digital elevation data (LIDAR) with LandMapR software (Macmillan 2003). Grids of 50 or 100 points at a 20 m interval were located in selected fields (Fig 1), to include each landform derivative. Soil samples (0-5, 5-15, 15-30, 30-60, 60-100 cm) and related data (thickness of A and B horizons, depth to C horizon) were collected for each sample site in July and August 2012. Soil series were also mapped at a scale of 1:20000.

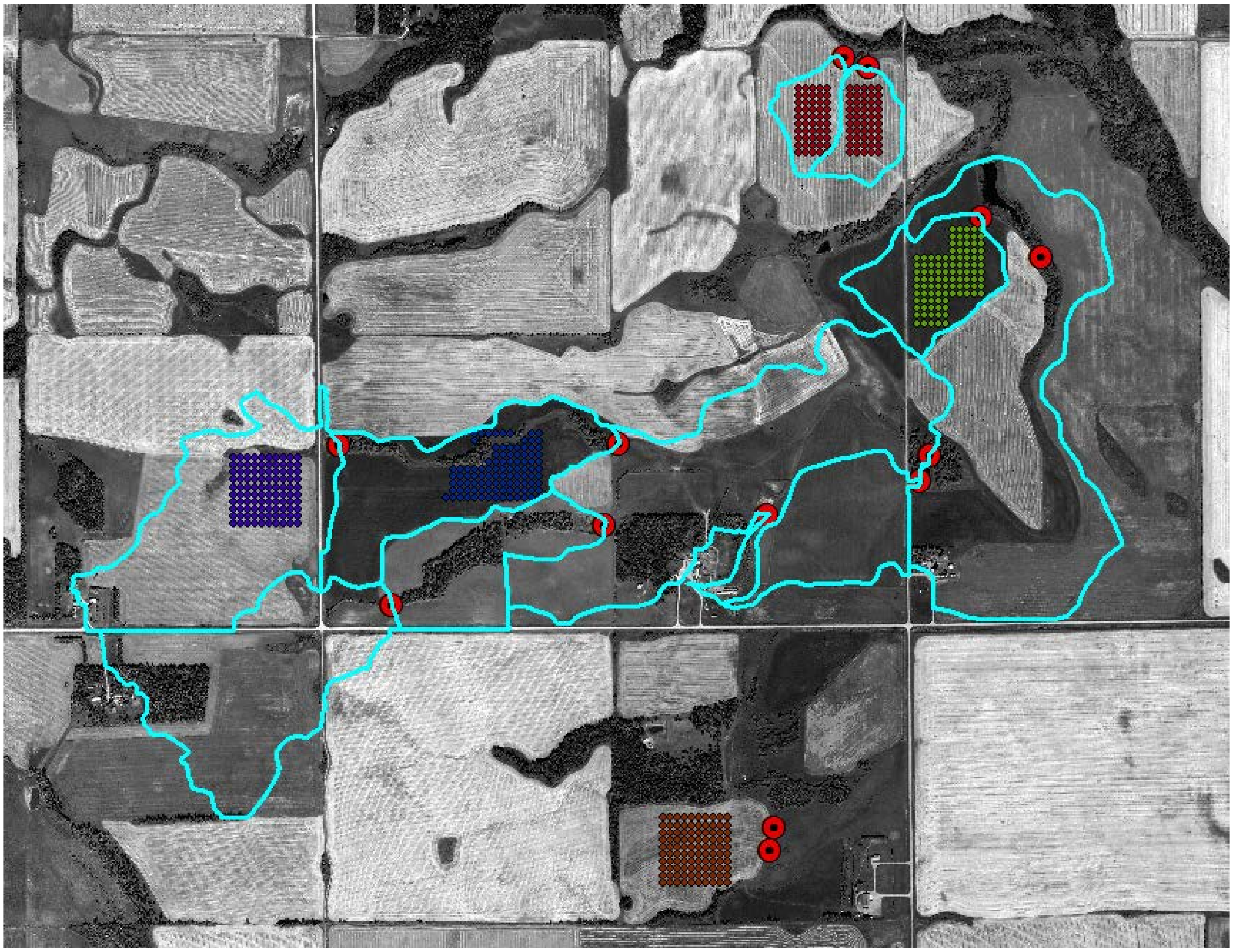

Figure 1. Soil sample grids and water quality collection sites by field, Steppler sub-watershed. Red circles are water quality collection sites.

Laboratory analyses include soil test N and P for all sample sites, soil texture, pH, electrical conductivity, soil organic carbon and total nitrogen for a subset of sites. Water soluble carbon and phosphorus will be determined if laboratory resources are available.

Statistical relationships between landform attributes and soil properties will be assessed with partition, random forest analysis, and partial least squares analyses. Statistical distributions of horizon thickness and soil properties will also be determined.

Preliminary Analyses

Thickness of A and B horizons, and depth to C horizon varied considerably between and within fields. Statistical distributions of thickness for the A and B horizons in each field, included Johnson Si and Su, Weibull, lognormal, normal 2 mixture, and normal. The coefficient of variation for thickness of A and B horizons varied from 26.6 to 65.3%.

Future Analyses

The relationship of soil properties and horizon thickness to surface curvature and landform in the fields will be determined following completion of laboratory analysis. These data will be assessed in the context of the potential for overland flow within fields, and from the field edge, based on analysis of digital elevation.

These data will be used to develop statistical relationships between soil properties, remote sensing, and landform attributes, which will be used to scale up soil maps to areas in South Tobacco Creek with similar soil series.

References

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