# USE OF THE SOIL MANAGEMENT ASSESSMENT FRAMEWORK IN SPATIALLY VARIABLE FIELDS

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#### Methods

A field in SE Nebraska was selected for this study. Soil at the site is a Muir silt loam. The ECa survey was conducted using an EM38 mounted on a non-metalic cart and pulled behind an ATV (Fig. 1). The ECa data was georeferenced and data logged every 5 seconds. Survey data was processed using the ESAP sofware package (Lesch et al., 2000). Soil samples were collected at 20 locations using a sampling design calculated by ESAP. Cores were sectioned into 0- to 15-cm, 15- to 30cm, 30- to 60-cm, and 60- to 90-cm increments. Water content, topsoil depth, bulk density, pH, total dissolved solids, clay content, organic matter content, and Bray-available P were determined.

Regression equations relating ECa to measured soil data were calculated using ESAP and resulting equations were used to estimate soil properties for 1938 ECa sample locations. Soil samples from 20 random ECa sites were used to validate estimated values.

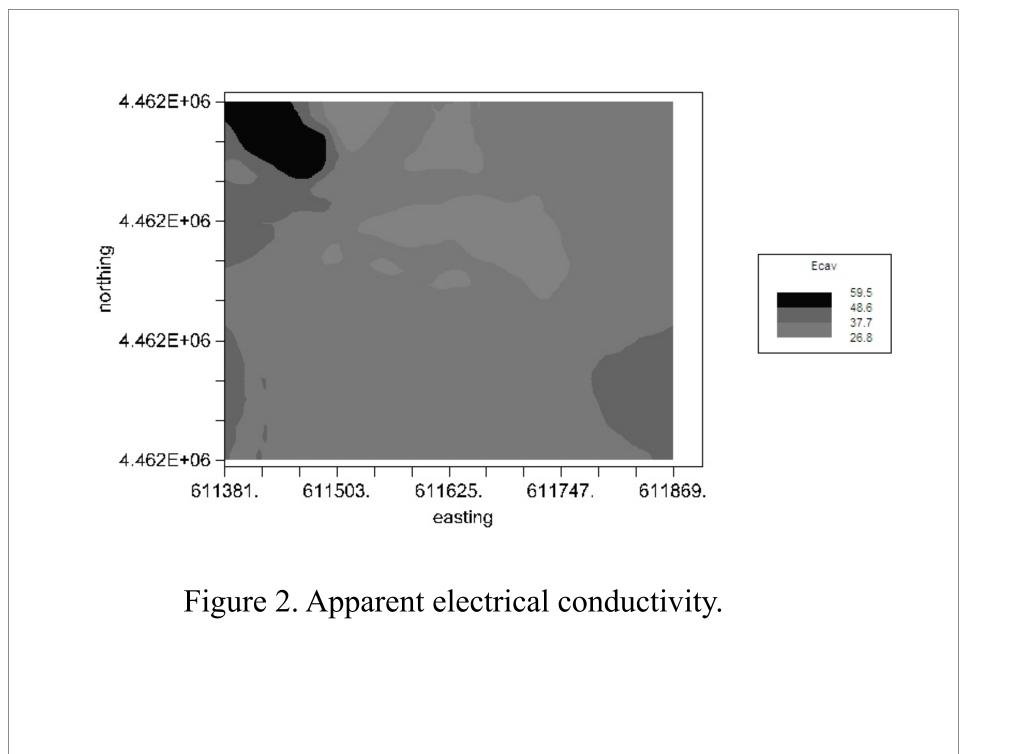
The SMAF was used to calculate Bray P scores for the 1958 locations within the field. Maps for ECa, Bray P, and SMAF Bray P scores were generated by kriging indicator values and scored values.

## Introduction

Land managers need assessment tools to help determine the affect practices they implement have on the soil resource. The Soil Management Assessment Framework (SMAF) has been developed to satisfy this need. A limitation to the SMAF is that it requires measured soils data which can be labor intensive and costly to collect. In addition, management practices are often implemented uniformily to fields that vary spatially. Apparent electrical conductivity (ECa) is a measure that can be collected rapidly, at a high density, and economically. A number of physical, chemical, and biological soil properties correlate well with ECa. This study was conducted to determine if ECa could be used to estimate soil properties for use as input data into the SMAF to assess soil properties within a spatially variable field.



Figure 1. Equipment used to collect ECa data.



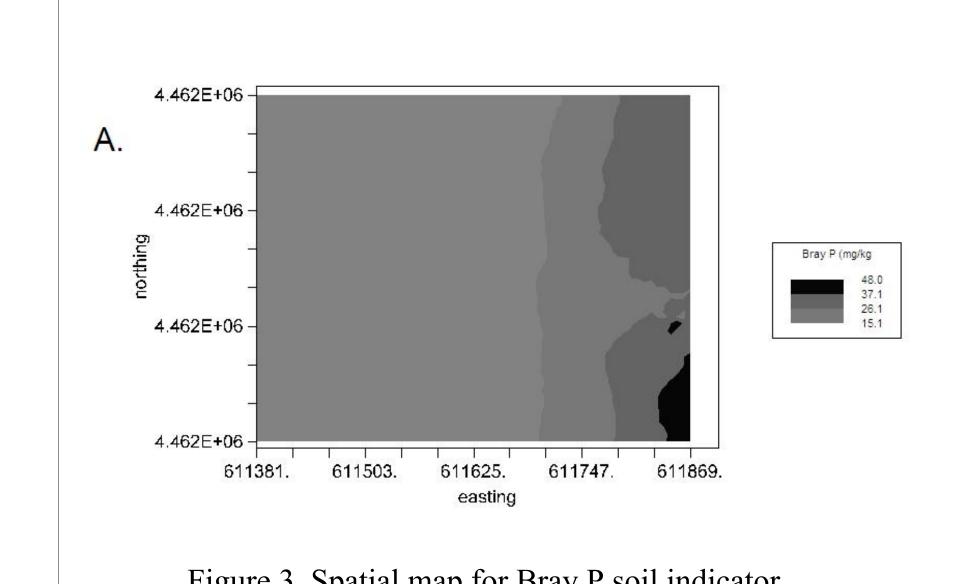
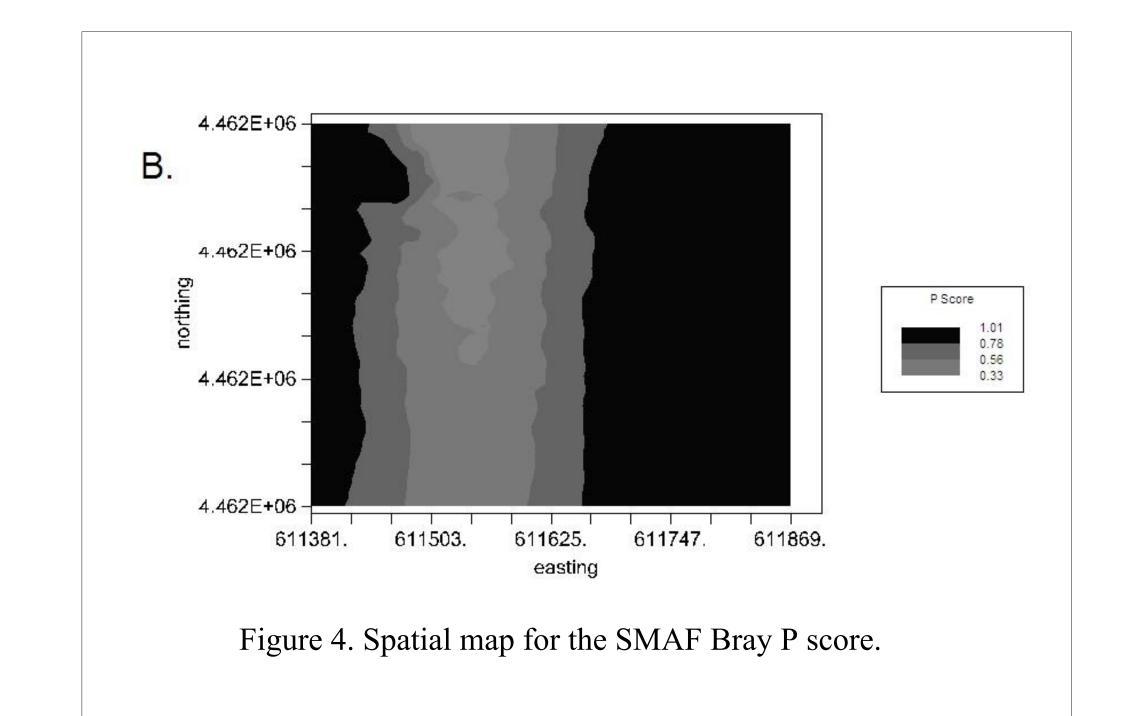


Figure 3. Spatial map for Bray P soil indicator.

# Table 1. Correlation between observed and predicted soil properties in the 0- to 90-cm depth used in the calibration run and validation run for the soybean field near Carleton,

Soil Property	Calibration		Validation	
	$r^2$	p-value	$r^2$	p-value
Water Content, kg m <sup>-2</sup>	0.55	0.006	0.14	0.230
Topsoil depth, cm	0.83	0.001	0.15	0.215
Bulk density, g cm <sup>-3</sup>	0.98	0.001	0.55	0.006
Total dissolved solids, g m <sup>-2</sup>	0.59	0.004	0.48	0.012
рН	0.72	0.001	0.28	0.079
Bray P, g m <sup>-2</sup>	0.68	0.001	0.56	0.005
Soil organic matter, kg m <sup>-2</sup>	0.82	0.001	0.28	0.076
Clay content, kg m <sup>-2</sup>	0.73	0.001	0.37	0.035



## RESULTS

Calibration equations between ECa and measured soil properties were all significant (Table 1).

Validation between estimated and measured soil properties were not significant for water content and depth of topsoil.

ECa ranged from 12 to 62 dS m<sup>-1</sup> with high values observed in the northwest and southeast portions of the field (Fig. 2).

Bray P ranged from 3.3 to 44.8 mg kg<sup>-1</sup> with high values in the east and west portions of the field and low values in the center of the field (Fig. 3).

Mapped values for SMAF Bray P scores delineated an area in the center of the field where P management is needed (Fig. 4).

### CONCLUSIONS

ECa directed soil sampling has potential for estimating soil properties within spatially variable fields.

The SMAF can aid in interpreting soil indicator data and delineate areas of a field where management efforts are needed.