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Evaluation of Electromagnetic Induction to Characterize and Map Sodium-Affected Soils in the Northern Great Plains of the United States

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Sodium-affected soils (SAS) cover over 4 million hectares in the Northern Great Plains of the United States. Improving the classification, interpretation, and mapping of SAS is a major goal of the United States Department of Agriculture-Natural Resource Conservation Service (USDA-NRCS) as Northern Great Plains soil surveys are updated. Apparent electrical conductivity (ECa) as measured with ground conductivity meters has shown promise for mapping SAS, however, this use of this geophysical tool needs additional evaluation. This study used an EM-38 MK2-2 meter (Geonics Limited, Mississauga, Ontario), a Trimble AgGPS 114 L-band DGPS (Trimble, Sunnyvale, CA) and the RTmap38MK2 program (Geomar Software, Inc., Mississauga, Ontario) on an Allegro CX field computer (Juniper Systems, North Logan, UT) to collect, observe, and interpret ECa data in the field. The ECa map generated on-site was then used to guide collection of soil samples for soil characterization and to evaluate the influence of soil properties in SAS on ECa as measured with the EM-38MK2-2. Stochastic models contained in the ESAP software package were used to estimate the SAR and salinity levels from the measured ECa data in 30 cm depth intervals to a depth of 90 cm and for the bulk soil (0 to 90 cm). This technique showed promise, with meaningful spatial patterns apparent in the ECa data. However, many of the stochastic models used for salinity and SAR for individual depth intervals and for the bulk soil had low R-squared values. At both sites, significant variability in soil clay and water contents along with a small number of soil samples taken to calibrate the ECa values to soil properties likely contributed to these low R-squared values.