**United States Department of Agriculture**

**Natural Resources Conservation Service**

**c/o USDA Forest Service**
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**Date:** 17 April 2001

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I wanted to provide you with a preliminary product of the electromagnetic induction (EMI) field investigations that we conducted last week on your farm. John Kimble and I will be off to Alaska this weekend and it will be several weeks before the data is completely evaluated and the final trip report is prepared.

Enclosed are the first round copies of the fields that we surveyed last week with the Veris 3100 soil EC mapping system. All fields are located on field sheet 44 of the Soil Survey of Pickaway County, Ohio. All fields have been identified on the enclosed plots by the dominant soil map unit. These fields are labeled: Genesee silt loam, occasionally flooded (adjoins the Scioto River to the northeast of your farm structures), Warsaw and Wea soils (in irrigated field behind your farm structures) and Ross loam, occasionally flood (located directly across the road from your home).

The Veris 3100 implement is a towed, multi-electrode resistivity unit manufactured by Veris Technologies.[1] In homogeneous materials, conductivity is the reciprocal of resistivity. The Veris 3100 implement converts measurements of apparent resistivity (ohm-m) into measurements of apparent conductivity (mS/m). The Veris 3100 implement provides two depths of observation: one for the upper 0 to 30 cm (**shallow**) and one for the upper 0 to 90 cm (**deep**) of the soil profile. The depth of observation is dependent upon the spacing and type of electrode array. The electrode array is a modified Wenner array with 6 unequally spaced electrodes (coulter-electrodes). Voltage is applied to coulter-electrodes number 2 and 5. The wider-spaced coulter-electrodes (number 1 and 6) measure the current across the 0 to 90 cm depth interval; the more closely spaced coulter-electrodes (number 3 and 4) measure current across 0 to 30 cm depth interval. The Veris EC implement is pulled behind a pickup truck at speeds of about 5 to 10 m/hr. A Trimble 132 GPS receiver was used with the Veris 3100 implement.

Variations in apparent conductivity are caused by changes in the electrical conductivity of earthen materials. The electrical conductivity of soils is influenced by the type and concentration of ions in solution, the amount and type of clays in the soil matrix, the volumetric water content, and the temperature and phase of the soil water. The apparent conductivity of soils will increase with increases in soluble salts, water, and clay contents. On your farm, moisture and clay content (thickness of loamy surface sediments or depth to sand and gravel) are considered the dominant properties that influence apparent conductivity.

[1] Trade names are used to provide specific information. Their mention does not constitute endorsement by USDA- NRCS

Interpretations of EMI or resistivity data are based on the identification of spatial patterns within data sets. Though seldom diagnostic in themselves, lateral and vertical variations in apparent conductivity have been used to infer changes in soils and soil properties. Electrical resistivity and EMI integrate the bulk physical and chemical properties for a defined observation depth into a single value. As a consequence, measurements can be associated with changes in soils and soil map units. For each soil, intrinsic physical and chemical properties, as well as temporal variations in soil water and temperature, establish a unique or characteristic range of apparent conductivity values.

Identical color scales have been used in each of the enclosed plots. Green and yellow colors denote electrically resistive materials. These areas have thinner caps of loamy recent alluvium and shallower depths to sand and gravel. Orange and red colors denote more electrically conductive areas. These areas have thicker caps of loamy materials, greater depths to sand and gravel, and/or more moist soil conditions.

The Illinois "Veris Gang" and I were all very pleased with the similarities that you and your son noticed between your yield maps and the Veris maps of apparent conductivity. Your enthusiasm gave us great pleasure in the work that we did. We wish to thank you and your family for your warm hospitality and for allowing us to conduct these comparative EMI surveys.

With kind regards,

James A. Doolittle
Research Soil Scientist

cc:

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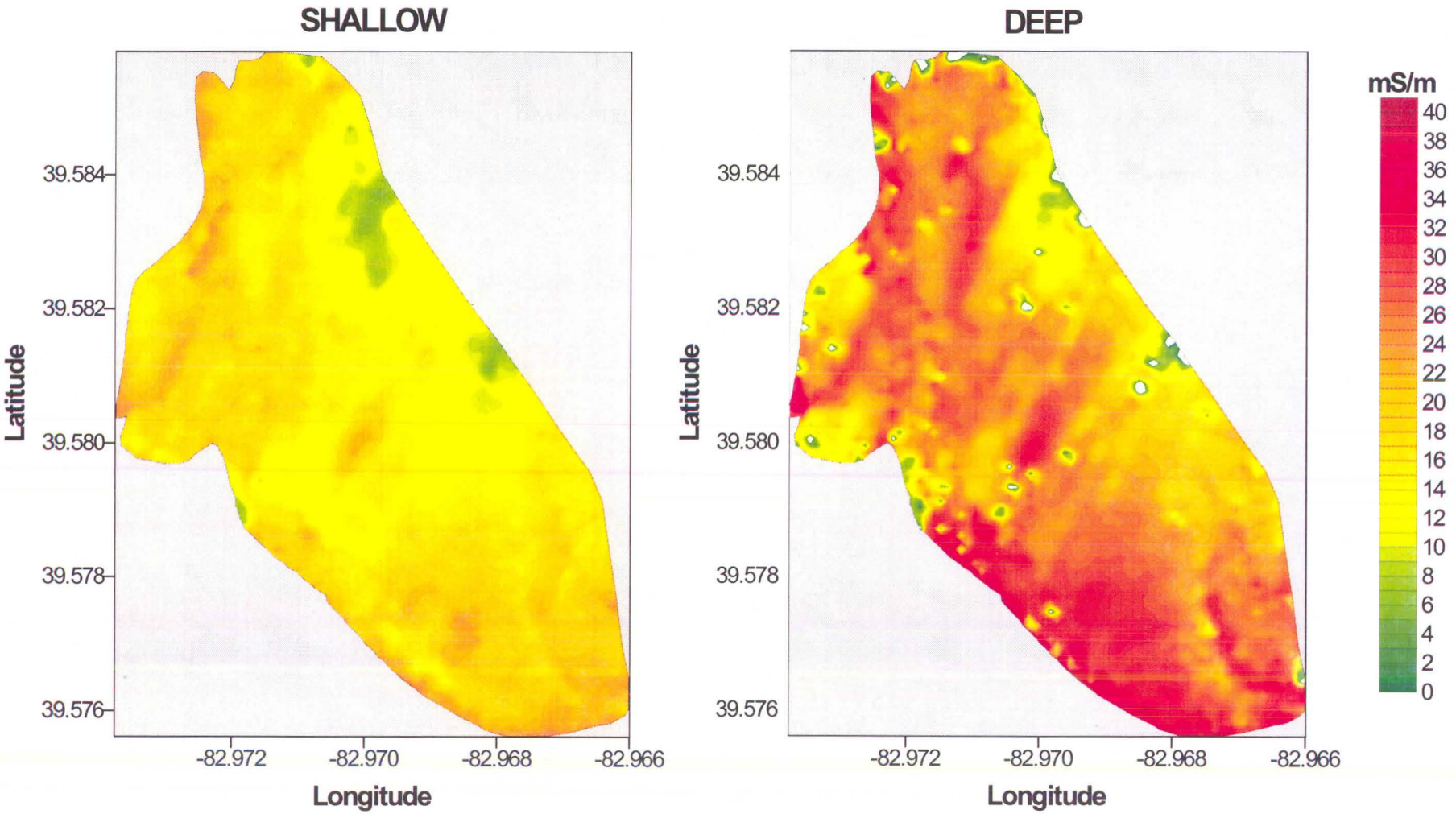
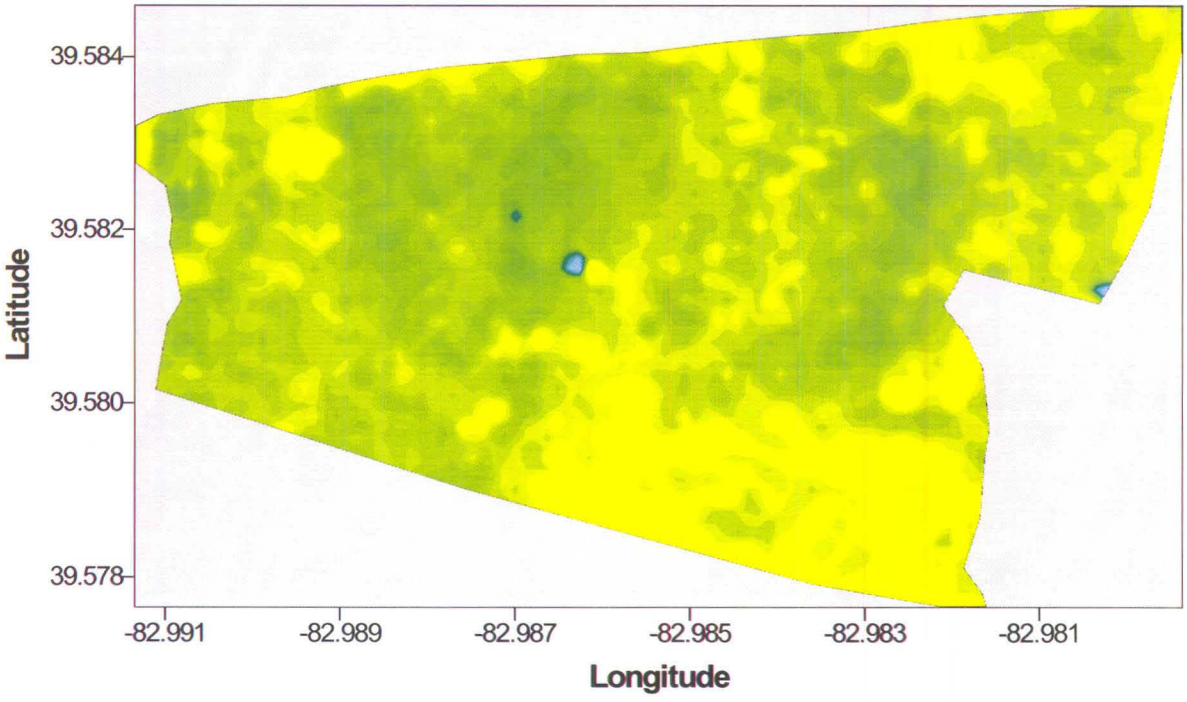
# EMI SURVEY
# GENESEE SILT LOAM, OCCASIONALLY FLOODED
# VERIS 3100 SOIL EC MAPPING SYSTEM

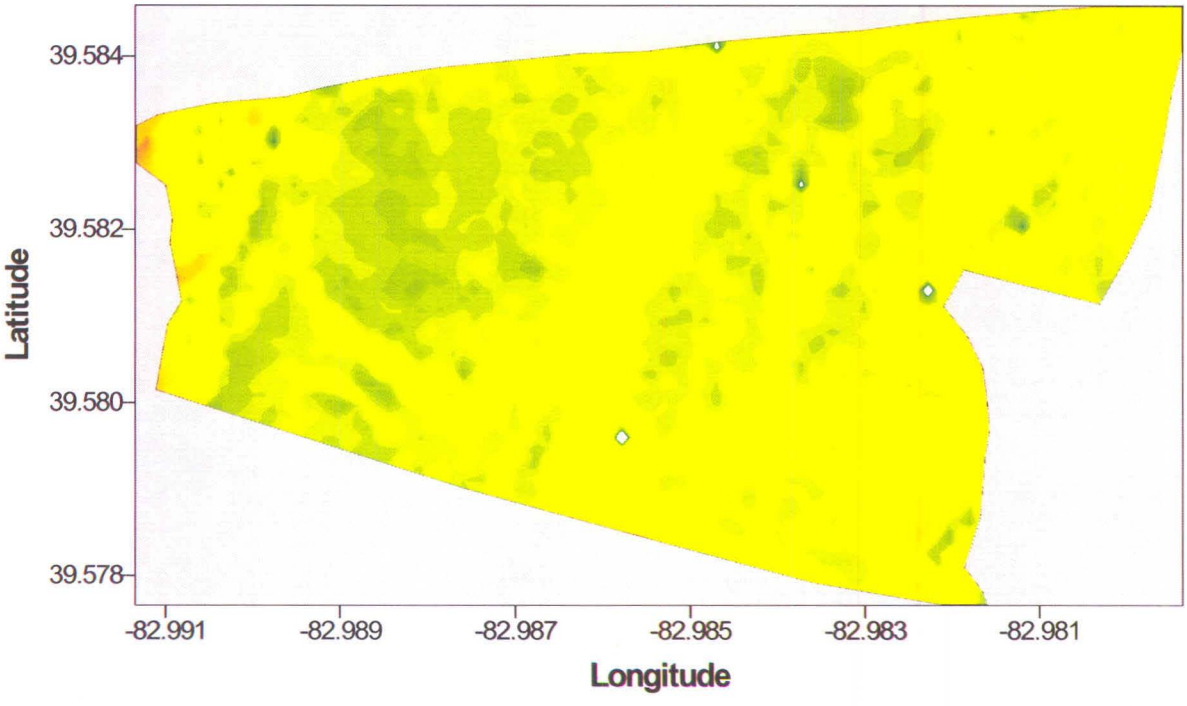


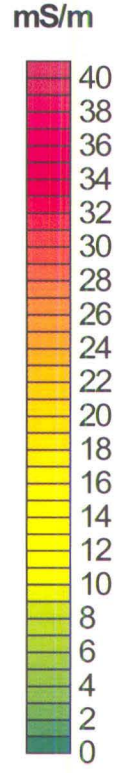
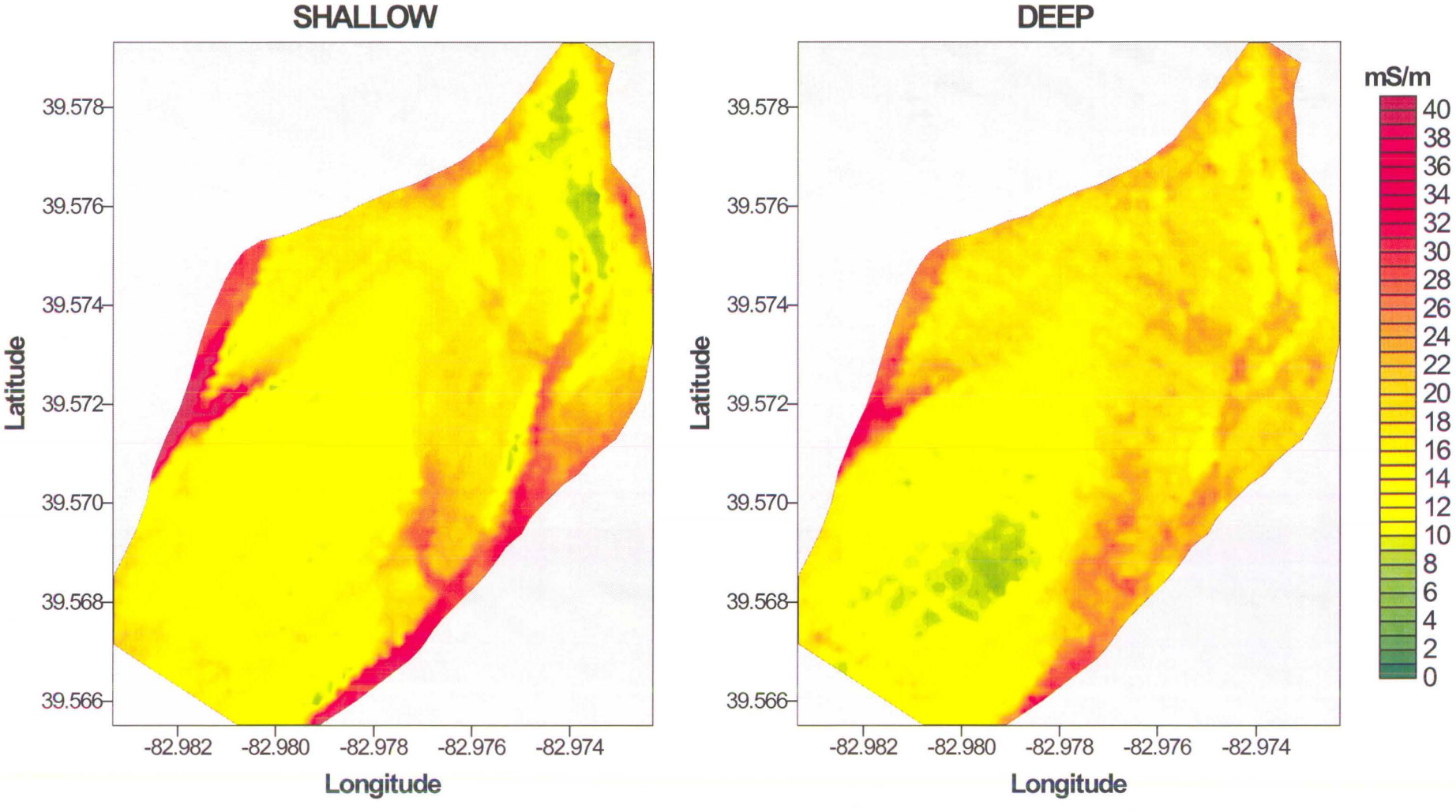
# EMI SURVEY
# WARSAW & WEA SOILS
# VERIS 3100 SOIL EC MAPPING SYSTEM

## SHALLOW




## DEEP






# EMI SURVEY
# ROSS LOAM, OCCASIONALLY FLOODED
# VERIS 3100 SOIL EC MAPPING SYSTEM