

SOIL AND ATMOSPHERIC SCIENCES

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ABSTRACTS

Soil Moisture Regimes in a Wooded Toposequence in Tippecanoe County. C. J. EVANS AND D. P. FRANZMEIER, Department of Agronomy, Purdue University, West Lafayette, Indiana 47907. — Characterization of soil moisture regimes provides one basis for a genetic interpretation of soil properties, so that soil morphological properties can then be used as indicators of the wetness characteristics of soil. In this way, gray (≤ 2 chroma) mottles in the soil have been used as indicators of soil saturation. However, the predictive value of gray colors is not quantitative. A soil zone which is periodically saturated may not always have gray mottles, and, conversely, the absence of gray color cannot always be interpreted as an absence of saturation.

Soil scientists have seen that, within a toposequence, the presence or absence of gray mottles will be related to slope position. It has not been certain, however, whether topography influences only the persistence of the water table itself, or whether it controls the other factors which must combine with saturation to cause gray mottles. The purpose of this study was to characterize the moisture regimes of soils in a toposequence. Three sites were selected in a woods where soils formed a loess over loamy glacial till—Miami soil in a backslope position, Fincastle soil in a swell position, and Treaty soil in a swale position. We measured water table levels, dissolved oxygen content of soil water, redox potential, and hydraulic conductivity.

Both slope position and gray colors predicted water table levels in a relative fashion along the toposequence; however, the Miami soil, which had no ≤ 2 chroma mottles, was occasionally saturated to within 55 cm of the soil surface. Length of saturation within 1.5 m of the surface also varied with slope—the Treaty soil was saturated 62.0% of the time, Fincastle was saturated 59.0% of the time, and Miami was saturated 32.0% of the time. Dissolved oxygen increased from swale to backslope. Low oxygen levels (< 5 ppm) occurred 43.0% of the time in the Treaty soil, 32.0% of the time in the Fincastle soil, and 12.0% of the time in the Miami soil. Expressed as a percentage of saturation time, oxygen levels less than 5 ppm occurred 69.0% of the time in Treaty, 54.0% of the time in Fincastle, and 38.0% of the time in Miami. Redox potential was monitored only at the Fincastle and Treaty sites, and Treaty had values less than +200 mV 54.0% of the time, while measurements in Fincastle were below +200 mV only 12.0% of the time. In contrast, Treaty had values greater than +600 mV 13.0% of the time, while 48.0% of the measurements at Fincastle were above +600mV. Hydraulic conductivity also trended along slope lines.

A Wind-Resource Prospecting Study for Indiana. STEPHEN A. JUSTHAM, TORU OTAWA, AND DAVID A. SCHOEN, Department of Geography, Ball State University,

Muncie, Indiana 47306. — The major objective of this study is to provide wind data requisite to planning for the placement of wind energy conversion systems (WECS) in the State of Indiana. Available wind data are usually recorded at locations such as weather stations and airports; therefore, the wind characteristics of intermediate areas are not well known due to the sparsity of data sources. This study provides a quantitative estimate of wind power potential for Indiana via a computer model. The model is based upon the theory of the conservation of mass and interpolates point-source wind data to produce statistically meaningful data for areas where wind recording stations do not exist. This approach will help WECS planners and users to pinpoint potential sites for the installation of meteorological instruments in order to obtain site-specific wind data.

Radar Signatures Associated with Damaging Straight Line Winds. RON W. PRZYBYLINSKI, National Weather Service, Indianapolis, Indiana 46204. — Approximately nine cases of severe weather occurring in the state of Indiana during the last three years (1980-81-82) have been examined and related to the bow echo configuration on radar. Similarities between the bow echo and damaging straight line winds have been noted. Case studies relate each of the occurrence of damaging winds in excess of 60 mph over scales ranging from only one convective cell to convective lines or clusters. Concentration on the recognition of the bow echo on radar during severe weather warning operations at the National Weather Service Forecast Office has resulted in small increases in warning lead time and decreases in the false alarm rate.

Objective Analysis of Mesoscale Disturbances Using Surface Meteorological Observations. DAVID R. SMITH AND JOHN T. SNOW, Department of Geosciences, Purdue University, West Lafayette, IN 47907. — Surface meteorological data can provide an important source of information concerning mesoscale disturbances due to the spatial (less than 100 km) and temporal (hourly) resolution of the data. For example, the systems responsible for severe convective activity can penetrate undetected through the synoptic upper air network. This makes the forecasting of severe weather very difficult. However, the frequency of the surface observations in a data dense region such as the Upper Midwest can provide important clues for areas of potential convective development some two to four hours in advance. Because of the large amount of data and the short time frame in which it must be processed and analyzed, a numerical objective analysis scheme is a necessity. The *Purdue Regional Objective Analysis of the Mesoscale* (PROAM) is such a scheme. PROAM was especially designed to interpolate the randomly distributed surface observations onto a uniform grid in order to analyze variables (observed and computed) which help identify mesoscale disturbances.

Recent modifications to PROAM to improve its flexibility and performance to include a multiple iteration correcting technique, are discussed. Results involving both analytic distributions (to establish error limits) and actual observations (to demonstrate its utility in a nowcasting situation) are presented to demonstrate its effectiveness in identifying mesoscale disturbances.

Use of Sewage Sludge in Establishment of Northern Red Oak Seedlings on Adverse Sites. DOUGLAS M. STONE, North Central Forest Experiment Station, Bedford, Indiana 47421. — Northern red oak (*Quercus rubra* L.) was direct seeded on two acidic coal spoil areas in southern Ohio. Planting spots were prepared to reduce compaction and rock content; processed paper mill sewage sludge was used as a soil amendment. Treatments were: 1) scalping a 30 x 30 cm planting spot, 2)

boring a 30 cm diameter planting hole 30 cm deep, 3) planting hole + 10 l.(0.35 ft³) of sewage sludge mixed with spoil material, and 4) planting hole + 20 l.(0.7 ft³) of sludge. Treatments were applied to 14-tree plots replicated four times on each site. Four stratified acorns were sown at each planting spot and covered with 2-3 cm of spoil in early May 1982.

Spoil on one site was highly acid (pH 2.7); germination averaged 17.0%, growth and vigor of seedlings was low. The other site was less acid (pH 4.5); 25 to 95.0% of the planting spots had one or more living seedlings after the first growing season. Germination rate averaged 95.0% on scalped spots, 50.0% on spoil without sewage sludge; 66.0% on the spoil-sludge mixture and 25.0% with the high rate of sludge. Germination inhibition at the high sludge rate is attributed to nitrite toxicity. Revegetation of extremely acid spoil will require liming in addition to organic amendment. Incorporation of sewage sludge on moderately acid sites shows promise in establishment of red oak by direct seeding.

