# SOIL AND ATMOSPHERIC SCIENCES

Chairperson: David R. Smith
Department of Geosciences
Purdue University
West Lafayette, Indiana 47907
(317) 494-3285

Chairperson-Elect: Charles L. Rhykerd
Department of Agronomy
Purdue University
West Lafayette, Indiana 47907
(317)494-8101

## ABSTRACTS

**Land Cover Classification of Rupgang Thana Dhaka, Bangladesh Using Landsat MSS Data** M.F. Baumgardner, N.N. Chaudhuri and S.J. Kristof, Purdue University, West Lafayette, Indiana 47907.——In Bangladesh, the Rupgang Thana study area is located along the shore of the Lakhya River. It has a tropical monsoon climate. The soils are derived mainly from alluvial deposits. During the monsoon rain season most of the area is inundated. The major food crops are rice, wheat, and mustard; the cash crops include jute, tea, sugar cane and tobacco. Bamboo, jackfruit, mangoes and bananas are commonly grown on small areas in and around the villages.

The land cover of the study area was first spectrally classified by computer-implemented pattern recognition techniques using Landsat multispectral scanner (MSS) data collected on 3 January 1977 and 2 February 1980.

Ten spectral classes from the data of January 1977 and 12 classes from the February 1980 data were displayed in color-coded digital format on a digital image display. Different colors were assigned to each class. Grouping of classes was accomplished to avoid color discrimination difficulties. The area is relatively flat, and the fields are generally small, seldom larger than two or three hectares. Classification results of Landsat MSS data with a resolution of 60 x 80 m (< 0.5 Ha) were limited in delineating individual fields, but were successful in delineating soils with slight differences in elevation and internal drainages. The better drained soils are highly correlated with the cultivation of wheat and mustard; the poorly drained soils with rice.

**Air Temperature Fluctuation in Alabama During the Annual Solar Eclipse on 30 May 1984.** William R. Gommel, Douglas W. Poad and John W. Wicker, Department of Earth-Space Sciences, Indiana Central University, Indianapolis, Indiana 46227.——Using a sling psychrometer 7 statute miles north of Prattville, Alabama, in front of the Robert Murphy residence (which is also 3/4 mile south of Pine Level) on the east frontage of U.S. Highway 31, a reduction in air temperature of 5.0°F was observed from first contact (61.1°F at 9:49 A.M. or 14:49 GMT) to annularity (56.1°F at 11:17 CDT). The observations which were taken on the eclipse centerline registered a somewhat smaller wet-bulb temperature decrease of 2.8°F from 49.7°F to 46.9°F during the same period, and relative humidity increased from 42% to 48%. By the end of the partial phases at fourth contact (12:52 P.M. CDT), the air temperature had increased to 62.7°F, and relative humidity had decreased to 42% once again—the same value recorded at the beginning of the partial phases.

The sky was clear, and horizontal visibilities were greater than 10 miles throughout the eclipse. A brisk northerly surface wind of 15-20 knots during the early phase diminished dramatically by annularity. Electric lights suddenly lighted although it was near mid-day, and an eerie quiet briefly fell over the earth during the awe-inspiring event. By noon CDT, winds were increasing in velocity and once again reached earlier brisk speeds by 12:30 P.M. when the temperature recovered to 61.6°F—the same value recorded at first contact.

On the centerline, during this eclipse, the meteorological elements changed similarly (but with less magnitude) to changes observed throughout the night under the synoptic conditions. In other parts of the United States (including Indiana) where only partial phases occurred, the observed changes were not as dramatic.

**Engineering Properties of Indiana Peats and Mucks.** PAUL JOSEPH AND C.W. LOVELL, School of Civil Engineering, Purdue University, West Lafayette, Indiana 47907.——A study is currently under way at Purdue to investigate the problems associated with the use of peats and mucks as foundation materials. These materials pose problems to the foundation engineer because of their low shear strength, high compressibility, and time dependent behavior. The previous construction method was to excavate the peat or muck, and replace it with a better foundation material. Nowadays, however, due to ecological and financial reasons, this method is no longer popular. An alternative is to construct on the peat or muck itself. However, there appears to be some confusion as to the definition and classification of peats and mucks. Further, the undisturbed sampling and testing of these materials has proved difficult, because of their low strength and high water contents. The high variability of these materials also causes problems.

This paper looks into the definition of peat and muck and suggests a few tests that can be conducted in a highways research laboratory for accurate classification purposes. An undisturbed sampling technique and procedures for undisturbed testing are also presented.

The consolidation of peat is highly complex, in view of the large strains and time dependent deformations. Further this creep is not linear in most cases. The results of various tests on a typical Indiana peat and also a muck are presented.

**Characterization of Indiana Soils by Porosimetry.** C.W. LOVELL, School of Civil Engineering, Purdue University, West Lafayette, Indiana 47907.——All engineering characteristics and properties of soils and rocks are influenced by the distributions and arrangements of solids within the mass, i.e., the fabric. While direct measurement and quantification of the fabric is extremely complicated, the size distribution of the pores between the solids can be quickly determined. The common technique is mercury intrusion porosimetry, wherein the relationship between the pressure on the mercury and the pore size are intruded by incrementally increasing the pressure on the mercury and measuring the quantity intruded. Results are expressed in terms of either cumulative or differential frequency distributions of pore sizes.

These distributions have been simply correlated to a number of behavioral responses of soils (both sandy and clayey) and rocks. The most useful correlations are those involving permeability. It is believed that the porosimetry technique has many applications in understanding and predicting the behavior of earthen materials.

**Survey of the Mineral Composition of Forage Crops in Portugal.** C.L. RHYKERD, S.E. FOWLER, AFONSO DE ALMEIDA, A.M. FERREIRA, NUNO MOREIRA, C.H. NOLLER AND J.L. AHLRICHS, Departments of Agronomy and Animal Sciences, Purdue University,

West Lafayette, Indiana 47907, I.U.T.A.D., Vila Real, Portugal and University of Evora, Evora, Portugal.——Limited data are presently available concerning the mineral composition of Portuguese forage crops. The following experiment was conducted to determine the mineral concentrations in forage samples collected in Portugal from university-conducted experiments. Three major studies were made representing oats and vetch, corn, and common forage crops, with each addressing the following objectives:

1) to determine the mineral composition of the forage samples

2) to relate the mineral value to sufficiency levels for the various forage species

3) to compare the mineral values to mineral nutritional requirements of beef cattle, dairy cattle, and sheep

4) to evaluate the quality of the forage and make recommendations relative to its (nutritional) improvement.

Mineral analysis by means of an emission spectrograph of forage samples from Portugal revealed many low concentrations within the small grain crops, forage grasses, and forage legumes, when harvested as forage.

Data obtained in this study emphasize the importance of legumes to Portuguese livestock farmers. Legumes, if properly inoculated, are able to utilize atmospheric N and thereby eliminate the need for N fertilizer. In addition, legumes are high in protein and contain considerably higher concentrations of certain minerals, especially Ca and Mg, which are essential to proper mineral nutrition of growing and lactating ruminant animals.

**Soils an Important Component in a Digital Geographic Information System.** C.R. Valenzuela, T.L. Phillips, M.F. Baumgardner, and L.A. Bartolucci, Purdue University, West Lafayette, Indiana 47907.——There is an increasing use of Digital Geographic Information Systems to meet the demand for specific, accurate and rapid information of our resources. The degree of usefulness of this information depends on the accessibility and efficiency of the methods utilized for input, storage, analysis and retrieval of information.

The demand for accurate and rapid soil information is growing in our modern society, thus the element soil, because of its importance, is a basic component in a Geographic Information System.

The Indiana Soil Associations Map at a scale of 1:500,000, was manually digitized, projected to the Albers equal-area map projection, rasterized, and stored in a Geo-referenced Data Base created for the State of Indiana.

Using the digital soils data stored in the Geo-referenced Data Base, new sets of data were generated by changing the coding of the soils associations or by combining two or more of these new generated products. Among the new digital data generated from the soils data are: Prime Agricultural Lands, General Slope Information and Potential Erosion Data.

In addition, mapping and inventory errors were investigated in relation to the cellularization of spatially distributed soils data set, and an attempt was made to define an appropriate cell size, so that the mapping and inventory errors will be within the cartographic standards.