SOIL AND ATMOSPHERIC SCIENCES

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ABSTRACTS

Indiana Karst. Francis T. Adams, Purdue University, West Lafayette, Indiana 47907.——Much of the south-central portion of Indiana consists of limestone and dolomite bedrock at or near the surface. The terrain is characterized by classic karst features such as sinkholes, uvalas, caves, and subterranean cutoffs. These landforms present unique challenges for the geotechnical engineer when planning a transportation route or engineering structure in such an area.

Current research at Purdue University is being conducted to determine the best techniques for site investigation in karst regions. Remote sensing and geophysical techniques can be combined for an efficient investigation. Existing methods for sinkhole repair have been examined, and new techniques are being developed. Some of these techniques will be discussed in this presentation. Much of the current state-of-the-art practice will be reviewed so that the engineer can have insight into the unique problems and construction techniques required when working in karst regions.

Preliminary studies, such as consulting engineering soils, pedologic and geologic maps, as well as aerial photographs, can be used to locate areas where more detailed exploration should be conducted. Electrical resistivity and seismic refraction methods have been found to be the most efficient techniques for detecting subsurface cavities and soil-bedrock interfaces, respectively. However, this is not so in all situations, which will be emphasized. New techniques of sinkhole repair, such as using a reinforced earth wall as a slab to bridge over subsurface cavities, will be examined. All of the techniques, advantages and limitations, will be presented in a concise form.

Air Temperature Fluctuation in Indonesia During the Eclipse of 11 June 1983. William R. Gommel and Vivian P. Gommel, Department of Earth-Space Sciences, Indiana Central University, Indianapolis, Indiana 46227.——Using a sling psychrometer on the northeast coast of Java in Paciran, a reduction in air temperature of approximately 6.5° F from first contact (89.1° F just before 10 A.M. LST or 3 A.M. GMT) to the beginning to totality (82.6° F at 11:32 A.M. LST or 4:32 GMT). Wet-bulb temperature fell 3.9° F from 81.1° F to 77.2° F during the same period, and relative humidity increased from 70% to 79%. By 1 P.M. LST or 6 A.M. GMT, the temperature had increased to 88.2° F, as the partial phases were ending.

Duration of totality was approximately 5 minutes from 11:32 LST to 11:37 LST when the sun was high in the northern sky. Clouds were 0.3 cumulus, 0.2 cirrocumulus and 0.4 cirrus at the beginning of the partial phases. The cumulus diminished to only a few by the onset of totality while the cirrus remained essentially unchanged during the eclipse. By 1 P.M. LST, 0.4 cumulus had again reformed based at 2,000 feet. Excellent visibilities prevailed throughout the various phases of the eclipse. Surface

winds were generally from the southeast quadrant and less than 10 knots. Although surface winds were strongest during the hour preceding totality (accompanying a definite lack of onset of the sea breeze), a sudden increase in the surface winds or a compression wave was not observed as noted by the authors during the Norwegian and African eclipses of 30 June 1954 and 1973 respectively. Shadow bands (apparently an interference of light phenomenon) also were not as distinct as during the African eclipse of 30 June 1973.

Under similar total eclipse conditions over inland areas such as Indiana, air temperature fluctuations should be somewhat larger than those observed during this eclipse on the island of Java.

Digitized Soil Map of Fairfield Township, Tippecanoe County, Indiana. S. J. KRISTOF, S. K. HUNT and T. L. PHILLIPS, Purdue University, West Lafayette, Indiana 47907.——The process of converting soil maps to digital form is called digitizing. The software used for digitizing the soil maps described in this paper is written for an Apple II Plus computer and includes the capability of digitizing points and lines (ARCS), storing these data on disc and transferring it to the IBM 370/158.

The Fairfield Township data were digitized from USGS and soil maps, and merged to form a single map in latitude/longitude format. The soils of Tippecanoe County surveyed from 1939 to 1946 contain 179 codes which are stored with their definition in the computer. The soil image is stored as a series of pixels. Each pixel is 25 x 25 meters and contains one of the codes indicating the dominant soil type of the pixel. Therefore, the computer-stored soil data form a very useful base from which it is very easy to generate maps based on soil characteristics. In this study the soil properties considered in designing individual soil map units are: soil internal drainage, slope, parent material, taxonomic classification, soil productivity, organic matter content, soil color, wind and water erosion. The computer also provides information about the cumulative acreage (hectares) of the individual soil mapping units needed for publication of the soil survey. Each interpretive map is relevant to agricultural planners, farmers, economists, and other users interested in the evaluation of soil resources.

Environmental Effects on Ammonia Volatilization from Surface-applied Urea to *Dactylis glomerata* L. J. W. LIGHTNER, C. L. RHYKERD, D. B. MENGEL and T. P. MEYERS. Department of Agronomy, Purdue University, West Lafayette, Indiana 47907.——Purdue University recommendations for nitrogen (N) fertilization of forage grasses have been based on research using ammonium nitrate primarily as the N source. Since the energy crises of the 1970s the economic advantage of producing solid nitrogen fertilizers has shifted towards urea. For many areas throughout the state of Indiana, urea is the only dry nitrogen source available to the forage producer.

The problem with using urea on grass pastures is that it cannot be incorporated into the soil unless it rains immediately after it is applied. Consequently, some of the nitrogen may be lost as ammonia gas to the atmosphere when urea undergoes hydrolysis. This loss is referred to as ammonia volatilization.

Ammonia volatilization resulting from topdressings of urea on grass depends on a number of conditions. A field experiment was conducted to estimate this type of nitrogen loss. Weather data were taken to account for environmental influences on ammonia volatilization. Under field conditions it was found that the rate of ammonia loss increased with increasing temperature. Furthermore, rapid drying of the soil-plant environment was a major factor influencing ammonia loss from surface-applied urea.

Induced Soil Compaction Alters Soil Physical Properties and Seedling Root Growth. GERRY L. SIMMONS, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana 47907.——The decline in site productivity following the use of heavy equipment is often linked to soil compaction and its associated increases in bulk density and soil strength, decreases in total and macroporosity, and alterations in water and gas fluxes. The degree to which soil properties are influenced by compaction is dependent primarily upon texture and soil moisture content during trafficking. Changes in soil properties associated with compaction are greatest on well-graded soils with moisture contents near field capacity, but critical levels at which changes in these properties inhibit root growth have not been well defined for forest tree species. Simulation of a soil-tree-weather system by means of a bio-physical model is proposed as a method for describing soil compaction under different management practices and to predict whether the effects of a practice might be detectable in seedling root growth. Components of the model would include soil variables (bulk density, resistance, pore size distribution, infiltration rate, aeration), plant variables (root growth patterns, root geometry, size and distribution of feeder roots, root regeneration potential), and weather variables (precipitation, evaporation, air and soil temperatures). These components could be used in various combinations to identify levels in soil compaction suitable for plant growth and to predict seedling root growth responses for a range of soil conditions.