SOIL AND ATMOSPHERIC SCIENCES

Chairman: WILLIAM R. GOMMEL, Department of Earth Sciences, Indiana Central College, Indianapolis, Indiana 46227

DARREL W. NELSON, Department of Agronomy, Purdue University, West Lafayette, Indiana 47907, was elected Chairman for 1974

ABSTRACTS

Mapping Soil Patterns with Multispectral Data from the Earth Resources Technology Satellite. STEVAN J. KRISTOF and MARION F. BAUMGARDNER, Agronomy Department, Purdue University, West Lafayette, Indiana 47907.——Within the past decade, significant steps have been made in the development of airborne and space-borne sensor systems which gather data by imaging the earth surface in several spectral bands simultaneously. Such data coupled with computer-implemented programs serve as a reservoir for more effective study of the earth's surface.

Our objective was to present the results of analysis of data obtained in 1972 over Lamb County located in the southwestern part of the Panhandle of Texas.

Most of the county is a nearly level to gently undulating plain. Two thirds of the area is irrigated and the other part is rangeland. Cotton and grain sorghum are the main crops. Other crops grown are corn, soybeans, alfalfa, vegetables, and some grasses.

The satellite data were obtained on July 6, 1973 at an altitude of approximately 900 kilometers by a 4-band scanner operated in the spectral wavelength region of 0.5 to 1.0 micrometers. Most of the county is used as a site from which a clustering algorithm is ordered to sort the data into 14 separable categories with different spectral responses. Each spectral category is then used to train the computer (LARSYSAA pattern classifier) to perform a classification on the rest of the area of the county.

From the spectral map and statistics obtained by computer, using the ratio between the relative reflectance in the visible portion of the spectrum, the relative reflectance from the reflective near infrared, and also reading the magnitude of spectral responses, it was possible to identify spectral categories with the features on the ground. Soil patterns, sands and outcrop formations have been delineated between ratio values of 1.15 to 1.40; and vegetation between 0.50 to 1.10 ratio values.

Tivoli-Brownfield fine sandy soils move through the county from west to east. They are light colored sandy soils. They show much higher spectral response than the Amarillo-Olton loamy soil on the north or the Amarillo-Portales loams on the south. The Amarillo-Olton

soil association also differs spectrally from the Amarillo-Portales association which are calcareous and lighter in color than the Amarillo-Olton association.

During the time the data were collected, the studied area was covered with vegetation. However, our results show that it is possible to separate spectrally major soil associations over large geographic areas.

Growth Results of Black Walnut (*Juglans nigra*) Seedlings of Different Seed Sources on Soils of East-Central and Southeastern Indiana 1967-1972. D. R. HENDRICKS and D. O. WATERS, Hayes Regional Arboretum, Richmond, Indiana 47374.——In 1967 and 1968, black walnut (*Juglans nigra*) seedlings of six different seed sources were planted on eight soil types in east-central and southeastern Indiana. The purpose of this planting was to determine the optimum conditions needed to grow black walnut for veneer. Measurements of heights and diameters of these trees were kept for each successive year and computerized. These measurements were tested for significance at a 0.05 level to determine differences in growth of: 1) different seed sources on the same soil types; and 2) each seed source in different soil types.

Five-year results from different seed sources on the same soil types indicated little significance between the different seed sources. Results from different soil types with the same seed source showed that Eel silt loam gave the best growth on 50% of the sites. There was little significance after 5 years between Cincinnati, Fox, Miami, Sloan, Rossmoyne, Russell and Westland.

Studies for next year will combine all seed sources on each soil type to give larger sample sizes and include four more soil types.

Effect of Nitrogen and Herbicides on Oat Grain Protein Content. H. W. OHM, Agronomy Department, Purdue University, West Lafayette, Indiana 47907.——Two oat cultivars, 'Stout' (genetically lower-protein) and 'Diana' (genetically higher-protein) were subjected to treatments of nitrogen and sub-toxic levels of simatryne and tenoran. Nitrogen was applied at 0 and 105 pounds per acre. Available N on unfertilized plots was 40 pounds per acre. Each chemical was foliar applied at 0.1 and 0.2 pounds per acre at the late boot and completely headed stages. The experiment was grown at Lafayette, Indiana, in 1972 in a split plot design with three replications where nitrogen levels were the whole unit treatments; varieties, rates of chemicals and stages of application were the sub-unit treatments.

Diana and Stout produced 19.1 and 17.1 per cent protein in their grain, respectively. Application of nitrogen tended to increase yield, per cent protein and protein yield. The two chemicals slightly increased the per cent protein—18.1 per cent without chemicals *vs.* 18.3 per cent with simatryne or tenoran. However, application of the chemicals decreased yield 3.7 per cent resulting in a reduction of protein yield. Simatryne reduced yield and protein yield significantly more than did tenoran. Protein content was similar with both chemical treatments.

Relationship of Soil Fertility Practices to the Nitrate Content of Drainage Water from Indiana Soils.[1] D. W. Nelson and R. K. Stivers, Agronomy Department, Purdue University, West Lafayette, Indiana 47907.——Water samples were collected from subsurface tile lines draining commercial cropland and from two depths in the profile of soils treated with varying rates of nitrogen fertilizer. The nitrate content of tile drainage water appeared to be directly related to the prevailing soil fertility of the area drained. Although the nitrate concentration was fairly constant throughout the year, the bulk of nitrate-N lost occurred during late winter and spring when tile lines were flowing at maximum rate. Nitrate N in tile drainage water was found to be equivalent of 10 to 15% of the fertilizer N applied to some tile drained soils. The nitrate-N content of drainage water or soil solution of soils moderately fertilized is relatively low (10-15 ppm); however, some nitrate is detected in drainage water from unfertilized or uncultivated soil. The leaching of nitrate was found to promote mobilization of calcium and magnesium and subsequent loss of these basic cations in drainage water.

Determinations of the Atmospheric Electric Conduction Current. C. R. Church and M. D. Abel, Department of Atmospheric Sciences, Purdue University, West Lafayette, Indiana 47907.——Factors which influence the magnitude of the atmospheric electrical resistance include the elevation of land areas, cloud cover, atmospheric pollution, atmospheric radioactivity, and natural sources of nuclei. Previous estimates of the global atmospheric electrical conduction current have neglected these effects. They are taken into account in the present calculations, which attempt to provide a more accurate determination of the conduction current.

Treating each effect as independent, the global areas affected and the columnar resistances for those areas were calculated. The influence of each effect on the previously given fine weather value of global conduction current were expressed as percentage changes. The elevation of terrain calculation showed a 14 per cent increase in total conduction current. The effects of cloud cover and air pollution showed a 10 per cent and a 4 per cent decrease, respectively. Atmospheric radioactivity and effects such as dust storms and forest fires were estimated to have negligible influence. Considering all the effects together, the net change was substantially zero, so that the previously given value of 1,400 amperes for the global conduction current remains unaltered by these calculations.

Air Temperature Fluctuation Aboard the *Massalia* During the Eclipse of 30 June 1973. William R. Gommel and Ruth A. Gommel, Department of Earth Sciences, Indiana Central College, Indianapolis, Indiana 46227.——Using a Princo sling psychrometer off the Coast of Mauritania a reduction in air temperature of approximately 2.9 degrees Fahrenheit was observed from 15 minutes after first contact (70.5° F at 9 hours

[1] This work was carried out under AES Project 01453.

40 minutes (Greenwich Mean Time)) to the end of totality at third contact (67.6° F at 10 hours 40 min 38 sec GMT). Wet-bulb temperature fell 1.2° F from 67.0° F to 65.8° F during the same hour, and relative humidity increased from 83 per cent to 90 per cent. By the end of the eclipse at fourth contact (12 hours 2 min GMT), the temperature had increased to 72.3° F.

At totality onset (10 hours 35 min 10 sec GMT) the ship was located at 20° 2.5'N, 17° 15.7'W and headed due south at 11 knots. Sky was clear throughout the eclipse, and horizontal visibilities were approximately 5 miles to starboard (westward) and 3 miles to port (toward the sun) with haze and light dust layers aloft. The surface wind was from 340° (NNW) 12-14 knots which resulted in a relative wind of 1-3 knots. For approximately 1/2 minute before totality, the relative wind increased perceptibly by several knots. Shadow bands (apparently an interference of light phenomenon) appeared to have a wave length near 1 centimeter and moved with a relative speed of 4 meters/second.

H. Tomioka of Ibaraki-ken, Japan, observed a reduction in temperature of 4.7° Centigrade, and R. A. Richards of Guildford, England, noted a reduction of around 10° F. These instruments were located close to ship structural surfaces and probably reflect somewhat the temperature changes of these surfaces. Actual changes in the free air temperature over the ocean should be close to those observed by the author away from such surfaces. Under similar eclipse conditions over inland areas such as Indiana, air temperature fluctuations should be several times larger than those observed over oceans.

OTHER PAPER READ

Fixed Ammonium Content and Ammonium Fixing Capacities of Selected Indiana Soils. G. R. WAGENMAN and DARREL W. NELSON, Agronomy Department, Purdue University, West Lafayette, Indiana 47907.