E-16 Management practices for controlling soil erosion.

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Degradation of Iowa's soil resources due to erosion is a major problem. Control of soil erosion will maintain the integrity of soil resources and prevent or minimize the movement of sediment and associated pollutants into surface waters to enhance the use of such waters for domestic, industrial and recreational purposes. Soil erosion is the detachment and movement of soil particles through the action of water and wind. Soil erosion by water is a function of rainfall, soil, topography and management practices. For a given tract of land, an operator has little direct control over rainfall, soil and topography. However, the effects these factors have on soil erosion can be modified by management techniques including, but not restricted to, crop rotations, conservation tillage, contouring, strip cropping, terraces, grassed waterways, fertility management and row spacing. Some of these measures are agronomic and cultural in nature, while others are structural. These practices are not necessarily mutually exclusive. Where the erosion hazard is minimal, the use of a single practice can provide adequate control. However, a combination of measures is often used to obtain the desired level of control.

E-17 Field to stream processes in sediment transport

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The sediment delivery ratio is defined as the change in quantity per unit area of the downstream movement of sediment from the source to any given point in a stream. The ratio is useful in making estimates for planning dams and water control structures, however, generalized delivery relationships are not available. Estimations are based on sediment transport measurements and soil erosion calculations. Field studies of watersheds up to 20 square miles indicate attenuation of sediment, nutrient and pesticide loads as the material moves from the field to the stream.

E-18 Use of soil survey and land use data for identifying and evaluating potential soil losses

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The original intended application of the universal soil loss equation was to aid in the selection of conservation practices for specific sites. Other applications for which the equation was designed and field tested include predicting average annual soil loss under specified conditions and evaluation of the effect of alteration of other variables in the equation. The equation can also be properly used to compute the total average annual soil loss from sheet and rill erosion within a particular watershed. Increased concern about non-point pollution has stimulated interest in this approach. However, a major problem in working with larger areas is the selection of representative values of the C, L, and S factors in the equation. In identifying, evaluating, and ranking areas of potential soil loss, soil survey and land use data are important parameters. Computerization of this information and integration of the other factors in the soil loss equation can be efficiently accomplished using a computer. Recent studies in Iowa that have utilized this approach will be presented and discussed.

E-19 A geologic perspective on erosion

B. E. HOYER

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Minimum erosion rates computed over the past 10,000 years from a 62 acre basin near Cherokee, Iowa are generally greater than natural erosion rates predicted by the Universal Soil Loss Equation. This reminds us that erosion is a natural process which must be considered in evaluating our environmental problems. Erosion, sediment transport and deposition, each of which may be associated with non-point environmental problems, are all a part of the sedimentation process. The Holocene sedimentation record reveals that the process is complex and episodic rather than simple and steady. Thus what, when, where and how soil erosion problems are measured will influence the results. Based on the sedimentation record, environmental problems such as gully erosion and high sediment loads in Western Iowa may be increased by the thick, silty, alluvial fills pre-existing in small valleys. These accumulated over the past 2000 years following an earlier episode of scour. Natural, complex processes make these deposits readily available to be eroded and moved at the present time.

E-20 Wind and water soil erosion climatology

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A description of wind and precipitation thresholds associated with soil erosion, including probabilities, summaries, analyses and examples of applied soil erosion climatology.

HISTORY & PHILOSOPHY OF SCI.

L-1 Systems Philosophy: useful and compatible to scientists.

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Science is sometimes called "natural philosophy", but scientists are often indifferent or hostile to comprehensive philosophies. This estrangement developed when modern science had to struggle against the philosophies dominant at its inception, and continues when scientists consider even modern philosophies irrelevant to their interests. "Systems Philosophy" is now developing as a formalization of the modern scientific world view, using language familiar to scientists and incorporating the scientific understanding of the universe; it can profit from the insights and criticisms of all scientists. Systems Philosophy holds that we know and understand only by pondering our experience with reality. It views the universe as though through a zoom lens, seeing any system and its properties in terms of subsystems and supersystems. Classical philosophies looked through a panoramic lens, putting primary emphasis on classifying and naming. In systems thought, even unusual systems with especially interesting properties (cells, trees, people, societies) are understood in terms of composition and participation rather than of "essential nature." Acquaintance with Systems Philosophy facilitates grasping and expressing how one's own field relates to other sciences and to all other fields of intellectual endeavor.

L-2 Mechanism, vitalism, and organicism.

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The development of biology has often been viewed as a long debate between so-called mechanists and vitalists. According to this historical scheme modern biology emerged at the turn of the century when mechanism bolstered by "common-sense" materialism and sophisticated experimental techniques became a credible form of biological explanation. The discredited vitalism continued in attenuated form as organicism. Under scrutiny this account of the development of biology does not stand. Neither mechanism nor vitalism were coherent schools of thought. Mechanism in particular consisted of a large number of ideas, rarely well-defined and never universally held by mechanists. Organicists such as J.S. Haldane, E.S. Russell, and J.H. Woodger were careful to dissociate their ideas not only from mechanism but also from vitalism. A close look at early twentieth century biology indicates that the terms vitalism, mechanism, and organicism inadequately delineate whole constellations of ideas. Ideas which were not forged into a unified form of biological explanation.

L-3 Albertus Magnus and modern science

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Albert the Great (1200-1280) is a monumental figure in the history of western thought: in metaphysics, ethics, and theology, as well as in the natural sciences. His commentaries and paraphrases on the recently translated works of Aristotle set the stage for the revival of Aristotelian thought, and in particular Aristotelian science, throughout the Middle Ages - especially through the influence of his student, Thomas Aquinas. Albert's significance in the history of science is twofold: 1) he establishes the autonomy of the natural sciences with respect to mathematics and metaphysics on the one hand, and with respect to faith and Christian theology on the other; 2) he is a first-rate empirical scientist, investigating questions in physics, botany, biology, geography, mineralogy, ornithology, and the like. His observations of nature, carefully recorded throughout his voluminous writings, were made on his frequent travels on foot all over Western Europe. On the 700th anniversary of his death it is particularly fitting to discuss his importance in the growth of western science.

MATHEMATICS

No abstracts available for papers A-1, 3, 4, 5, 6.

A-2 Estimating remainders by geometry

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The estimates of remainders of series given by R. P. Boas (Math. Mag. 51(1978) 83-89) can be (im)proved using no more than the geometry of triangles, rectangles, trapezoids and chords or tangents of convex curves.

A-7 Interdisciplinary approach to programming courses

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Over the past several years, we have developed an introductory programming course at Grinnell College that serves an extremely diverse audience through problem sets in a wide variety of areas. Furthermore, the course format resolves potential staffing problems by allowing one instructor to deal effectively with many students in a reasonable length of time. Programming material, including basic syntax and semantics, is presented in a lecture format to all students, with examples being of general interest. However, each student can work on programming problems in any one of several areas, and these exercises can be coordinated with other courses. Thus, general programming techniques are practiced in areas oriented to each student's interests. Finally, the course uses one-hour labs to supplement the lectures, providing students with the opportunity to ask questions about programming or about the material in their specific problem packages.

A-8 Recruiting a Center for Iowa (with calculus)

S. R. PORTER

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The location of the 'center' of Iowa has been disputed by the two towns, State Center and Iowa Center. The Des Moines Register sponsored a project to answer the question: where is the center of Iowa? A computer analysis has been developed to resolve the issue. Data were collected from 1:240,000 series U. S. Geological Survey maps with a digitizer and a procedure was developed to splice together the pieces of the border. The calculation also took into account the curvature of the earth. The actual 'center' calculated from this model lies west of both towns. An error analysis yields an east-west error radius of 100 ft and a north-south error radius of .7 miles. This result will be compared with results obtained independently by two other groups.

Invited:

Mathematics and Computing Science in an Industrial Research Laboratory

N. L. SCHRYER

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In a large industrial research laboratory, mathematics and computing science have central roles and perform many diverse functions. This provides a very rich and stimulating environment. The organization of such a laboratory will be outlined with an eye to the way such organization affects the environment for mathematics and computing science. Finally, the resulting environment for such work will be illustrated by several real life examples.

PHYSICS

B-1 Utilizing Solar Energy to Convert Biomass into Energy Products: Alcohol from Farm Crops.

ARTHUR C. MEYERS III

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Current United States crop production techniques require three units of energy to provide one unit of food. In addition to transportation of materials, considerable amounts of energy are consumed in the form of fertilizer, seed, and farming activities. Oil, natural gas, and their by-products presently provide almost all agricultural energy needs. The increased costs and limited availability of petroleum requires the development of alternative fuels. Also, considerable crop waste in the form of unused biomass exists. Methods of energy production, based on these materials, would reduce both farm energy needs and net food production energy requirements. Alcohol is an energy by-product that can be produced