ENERGY

Cultivating conservation

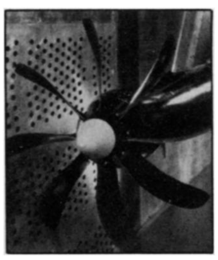
A computer program is being developed at the University of Illinois to save farmers money, energy and topsoil by determining how best to farm hilly land. The program will also make it more profitable to reclaim marginal lands for crop raising. Significant soil erosion occurs when the slope of farmland exceeds four percent. Preventing erosion requires special "land forming" such as contour farming (see photo) and terracing. Farm machinery is designed to work fields planted in long straight or rectangular patches; to do otherwise increases operating costs including energy expenditures, according to Donnell R. Hunt and Kwan Hee Ryu of the university's agricultural engineering department. Their program will use detailed information on varying land elevations for a particular farm to determine where and to what extent to terrace or contour, and how to till, Hunt says.

Hunt and Ryu attribute the total cost of cultivating sloping land to the cost of preparing land (such as surveying and leveling), the cost of reduced soil fertility, and the cost of operating equipment (based on time and fuel). The computer program interrelates these factors to determine how land forming can keep down total costs.

Hunt told SCIENCE NEWS that a major problem is setting a dollar value for erosion. Fertilizers can supplant almost any degree of soil loss, he said, so most farmers are not concerned about runoff—yet. But, he adds, as fertilizer costs (largely tied to energy costs) increase and as more states threaten to impose or enforce regulations that define eroded soil in streams as pollution, this will change.

The Illinois program, which tackles slopes ranging from 3 to 20 percent, should be completed within a year. Hunt says that for a small fee farmers should ultimately be able to tap this or a similar program through a local agricultural-extension service; obtaining detailed land-elevation data will be the major cost. Although any commercial farmer could potentially benefit from the service, those with particularly hilly land and marginal soil stand to benefit most.

Turboprop aircraft may stage comeback



The advent of commercial jet aircraft in the 1950s signaled the demise of propeller-driven planes for two reasons—jets could fly higher for a smoother ride and they could fly faster. A jet's major disadvantage was less efficient use of fuel, but appearing in an era when energy was cheap and appeared plentiful, airlines adopted jets readily. Now the National Aeronautics and Space Administration is looking for fuel-saving alternatives. One turboprop (propeller) design appears to be able to compete with the speed (roughly 525 miles per hour or Mach .8) and cruise altitude (around 30,000 feet) of jet-propulsion systems while surpassing their fuel efficiency by 10 to 40 percent.

As speed increases, so does drag. Engineers at NASA's Lewis Research Center are combating energy-robbing drag with propellers which are thinner, stronger and sweep a smaller circumference than do older models. Because thin metals can't withstand the increased stress placed on propeller blades by these engineering changes, composite (nonmetallic) materials have been substituted for metals used in blades, and the number of blades has been increased from 4 to 8 or 10. Noise, vibration and scale-up problems are still to be tackled, although two-foot-long prototypes have operated efficiently in wind-tunnel tests to Mach .8.

EARTH SCIENCES

Kendrick Frazier reports from Seattle at the annual meeting of the Geological Society of America

The rotation of western Oregon

Paleomagnetic studies of the rocks in the mountains along the west coast of Oregon indicate that these rocks were once considerably farther east than they are now. Robert Simpson and Allan Cox of Stanford University attribute this anomaly to the westward rotation of a block of the Oregon coast at least 225 kilometers in length, extending from the Klamath Mountains in the south to north of Newport, Ore.

Simpson and Cox propose models for the rotation and say that it probably is continuing today. In one of the models, the coastal block began to rotate westward about 45 million years ago, with the Klamath Mountains attached to the southern end, about a pivot near the Olympic peninsula at its northern end. Crustal holes left to the east were filled in with volcanic material. More than half the rotation probably occurred between 40 and 30 million years ago, with more recent rotation occurring at a slower rate. Simpson and Cox speculate that the rifting and rotation may have resulted from the North American plate overriding the mantle hotspot that is now beneath Yellowstone. "The Coastal Range block may still be extending to the west, pivoting on the north at the present time," the two conclude.

Turkey's future as Tibetan-type plateau

The Tibetan High Plateau, just north of the Himalayas, is characterized by thickened crust and very high average elevation: 4 kilometers. Now a scientist reports that eastern Turkey seems to be in the process of becoming a Tibetan-type high plateau.

Eastern Turkey is a dynamically maintained high region with an average elevation of 2 kilometers. The entire width of eastern Turkey has undergone squeezing by convergence of the Eurasian crustal plate and the northward-moving Arabian plate. Studies by A.M. Celal Sengor of the State University of New York at Albany show that eastern Turkey is internally deforming and appears to be thickening. Instead of a progressive thickening from south to north, the entire area is thickening at once. All of eastern Turkey, Sengor says, is going up as a block.

Eastern Turkey is the site of numerous hot springs and widespread volcanic activity. Comparing the Tibetan High Plateau and eastern Turkey with respect to volcanic geochemistry, style of volcanicity, deformation and tectonic setting, Sengor concludes that eastern Turkey may be at the initial stages of becoming a Tibetan-type high plateau. "It appears that it is beginning to be Tibetanized."

Human-caused crustal uplift

A relative crustal uplift of roughly 6 centimeters between 1948 and 1967 in the Lower Santa Cruz River basin in south-central Arizona may be due to removal of groundwater. This is the conclusion of Thomas J. Holzer of the U.S. Geological Survey in Menlo Park, Calif. Large-scale pumping out of groundwater began after World War II. Since then, 43.5 trillion kilograms of water have been removed from an area of 8,070 square kilometers. Holzer finds that the amount of observed uplift of land connected to basement bedrock is almost exactly that expected theoretically from removal of that much weight from the land. Also, the uplift began about the time large-scale groundwater removal began, reversing a half century of tectonic subsidence. Finally, the amount of uplift compares favorably with the 17-centimeter crustal depression caused by the filling of Lake Mead, when allowances for Lake Mead's larger size are made.