New UN soil survey: The dirt on erosion

Since World War II, more than 3 billion acres of agricultural land — an area larger than China and India combined — have been damaged by human actions and may prove costly or impossible to reclaim. This and related findings presented in a new United Nations report "confirm our worst fears about the degree to which soils are eroding and being degraded around the planet," says James G. Speth, president of the World Resources Institute (WRI) in Washington, D.C. If topsoil erosion continues at post-World War II rates, feeding an exploding world population could prove extremely difficult, he says.

"Each year the world's farmers are trying to feed 92 million more people with 24 billion tons less topsoil," comments agricultural economist Lester R. Brown, president of the Worldwatch Institute in Washington, D.C. "You don't have to have a Ph.D. in agronomy to understand that those two trends can't both continue indefinitely."

WRI released the UN-sponsored survey — the first ever to chart soil health globally — last week. The findings indicate that nearly 22 million acres of the world's land can no longer support vegetation and may have little hope of recovery. Another 740 million acres will require a restoration effort larger than most developing nations could organize. Some 2.3 billion acres more — an area about the size of the United States — require major and costly reclamation efforts, such as installation of drainage ditches.

In addition to erosion from wind and water, the survey mapped soil degradation from chemical sources, such as excessive levels of salt or pollution, and from physical sources, such as livestock or heavy machinery. The UN team of roughly 200 analysts attributes:

- 35 percent of soil erosion to livestock overgrazing, a problem that appears most widespread in Africa and Oceania. Not only can animals strip away plant cover, leaving topsoils erodible, but their trampling can also compact soil, reducing its ability to hold moisture.
- 30 percent of soil damage to deforestation. Although deforestation is occurring most rapidly in Asia, the survey finds it most prevalent in South America.
- 28 percent of soil degradation to harmful agricultural practices, such as overfertilization or ignoring fallow periods. In North America, the survey fingers poor agricultural practices as the prominent cause of soil damage.

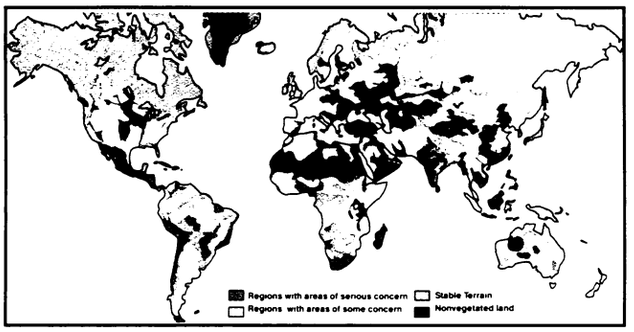
Parts of Africa, Asia and South America have been especially hard hit by soil degradation — a problem that may be tied to poverty, according to Allen L. Hammond, WRI's program director for resource information. "Without economic growth, [the poor] have no choice but to destroy their own environment in the search for daily sustenance," Hammond says.

Brown notes that many villages can no longer grow enough food to subsist, let alone to make a profit. "You see villages that used to be inhabited but no longer are because the topsoil has washed away. When the soil goes, the people eventually have to go."

Meanwhile, in the United States, 25 percent of croplands are eroding faster than they can be preserved, according to estimates by the U.S. Soil Conservation Service.

Restoring badly damaged topsoil may require more resources than some nations can muster, says Speth. This June, the UN Conference on Environment and Development will convene in Rio de Janeiro to discuss global policies — and possible treaties — on soil protection, desertification and deforestation. Through these discussions, "the opportunity is at hand to do something to address, rectify and remedy these appalling trends," says Speth.

— M. Stroh and J. Raloff



WRI

Blowin' in the wind: Soil degradation cuts across agricultural boundaries, damaging farms, rangelands and forests. Map shows where UN survey found significant damage.

Brain clues to energy-efficient learning

The smart brain may operate on the principle that "less is more," at least when it comes to learning new material. Preliminary data indicate that learning a complex task spurs marked drops in the brain's energy consumption, particularly among people who score highly on a standard intelligence test.

"It's possible that the brain learns over time what neural circuits *not* to use to perform a task, eventually relying only on certain important circuits," says neuropsychologist Richard J. Haier of the University of California, Irvine. "Learning and intelligence may share some important information-processing components in the brain."

Haier's group reports the link between intelligence and learning-induced energy conservation in an article accepted for publication later this year in INTELLIGENCE.

The researchers employed positron emission tomography (PET) scans to chart brain metabolism. PET scans measure the intensity of brain activity directly, based on the quantity of a minute amount of a harmless, radioactively labeled substance — such as glucose or oxygen — injected into volunteers and absorbed by their brain cells. A previous PET-scan study conducted by the same research team revealed reduced brain metabolism among people who scored highly on an intelligence test that taps into abstract, nonverbal reasoning abilities (SN: 2/27/88, p.137).

In the new study, 24 men received injections of a radioactively tagged glucose compound. Eight of them then played a computer game for the first time. The game required players to use the computer keyboard to rotate and move floating shapes, each consisting of four blocks, in order to create solid rows of blocks across the computer screen. The remaining participants served as controls, passively watching single-digit numbers flashed on the computer screen.

After 35 minutes, which allowed for absorption of the glucose by brain cells, the researchers took PET scans of each man. Those practicing the computer game displayed a substantially greater average rate of glucose consumption throughout their brains than did the controls.

But following four to eight weeks of daily practice with the game, the average rate of brain metabolism decreased significantly for computer players — to a level slightly less than that seen in the controls.

Those players with the highest scores on a nonverbal intelligence test of abstract reasoning showed the largest decreases in overall brain metabolism.

However, a few areas of the brain consumed more glucose after practice, Haier notes. These regions, such as the right side of a small inner-brain structure called the hippocampus, may play key roles in memory and learning, he asserts.

Research with larger samples and different learning challenges must confirm the findings, Haier acknowledges. For now, his team theorizes that practice with a novel task, combined with innate intelligence, forges energy-saving neural pathways in the brain.

— B. Bower