



## Rates of Soil Erosion

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**In response to a published letter from the president of People for the Ethical Treatment of Animals about another animal rights group mailing razor blades to medical researchers, the president of the Foundation for Biomedical Research writes, "When members of these groups condone violence as an acceptable means to an end, and their more moderate counterparts encourage them, anyone who contributes to an animal rights cause is helping to underwrite terrorism." Data on the soil erosion rates in the United States and their implications are discussed. And the idea of evolution as an analogy for the creative process is further elaborated.**

## Biomedical Attacks

It comes as little surprise that a group of animal rights activists is getting violent—this time mailing razor blades in letters to 87 medical researchers. [The mailings are described in the News of the Week article "Booby-trapped letters sent to 87 researchers" (5 Nov., p. 1059) by Jocelyn Kaiser.] We have been fortunate in the United States to have experienced so little violence and terrorism by the animal liberation movement. In Great Britain, where animal rights violence has become commonplace, there have been dozens of incidents annually in recent years: mail and car bombings, razor blade letters, arsons, and violent demonstrations at scientists' homes.

What does seem surprising is a statement from the leader of the largest "nonviolent" animal rights organization in the United States about these latest mailings. Referring to the razor blade letters, Ingrid Newkirk, president of People for the Ethical Treatment of Animals (PETA), wrote, "Perhaps the mere idea of receiving a nasty missive will allow animal researchers to empathize with their victims for the first time in their lousy careers" (1).

PETA and other large animal rights organizations have tremendous resources, largely from well-meaning contributors who see themselves as being friends of animals. But contributors need to question where their money is actually going. Does the group tacitly condone activist violence? Many groups encourage acts of extremism to advance the movement's agenda, even while remaining less than outspoken on the issue.

When members of these groups condone violence as an acceptable means to an end, and their more moderate counterparts encourage them, anyone who contributes to an animal rights cause is helping to underwrite terrorism.

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1. I. Newkirk, Letter to the Editor, *Atlanta Journal and Constitution*, 1 November 1999, p. A10.

## Rates of Soil Erosion

In his report "Decreased rates of alluvial sediment storage in the Coon Creek Basin, Wisconsin, 1975–93" (20 Aug., p. 1244), Stanley W. Trimble presents the significant findings that there is a relatively constant supply of sediments released to the Mississippi River from Coon Creek and that enormous amounts of eroded sediments are stored in the creek. In 1989, the U.S. Department of Agriculture (USDA) (1) also reported that large amounts (2.7 billion tons) of eroded sediments are transported to small streams each year, and the total quantity per year has probably declined somewhat (2).

The study by Trimble would have been more informative if he had reported what proportion of the 360-km<sup>2</sup> area he studied was in agriculture from 1930 to 1993; what types of crops were grown during this period; how the crop culture technology changed; and how much of the region was reforested, especially along the creek margin—all factors that would influence the amounts of erosion and sediments being deposited in Coon Creek.

Trimble states that "General and substantial increases of soil erosion in the United States are not borne out by measurements of sedimentation in Coon Creek." Contrary to Trimble's suggestion in this statement that U.S. soil erosion outside of Coon Creek has increased, erosion rates in the United States generally have declined from an average of 17 megagrams per hectare per year (Mg ha<sup>-1</sup> year<sup>-1</sup>) (3) to about 13 Mg ha<sup>-1</sup> year<sup>-1</sup> (2, 4) (a

megagram is equal to a metric ton). For the 1994 USDA (4) study, investigators sampled 800,000 sites in the United States. A further decline in erosion rates to slightly less than 12 Mg ha<sup>-1</sup> year<sup>-1</sup> was recently reported by the USDA (5). However, this erosion rate is a factor of 12 higher than soil sustainability, on the basis of the average rate of soil formation (6). Uri and Lewis (5) also reported that the social costs of erosion remain high and are estimated to be \$29.7 billion annually.

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4. *Summary Report: 1992 National Resource Inventory* (USDA, Soil Conservation Service, Washington, DC, 1994).
5. N. D. Uri and J. A. Lewis, *J. Sustainable Agric.* **14**, 63 (1999).
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## Response

As Pimentel and Skidmore state, land use and soil conservation measures are primary independent variables. For my report it was sufficient to state only that the land use of Coon Creek is generally representative of the region. For details, however, readers were directed to (1), wherein land use and conservation practices have been reconstructed from

1860 to the present. The analysis in that study showed a hysteretic relationship caused by a lag in the response of erosion and sedimentation rates to changes of land use.

With regard to erosion rates in the United States, the values Pimentel and Skidmore refer to of 17 and 13 Mg ha<sup>-1</sup> year<sup>-1</sup> are not measurements, but are estimates from models, and they do not predict movement of sediment to streams. If U.S. soils have indeed been eroding at such rates over the last two or so decades, where are the detritus and efflux?

In regard to soil-loss tolerance (sustainability), Pimentel and Skidmore state that the current average rate of erosion of 12 Mg ha<sup>-1</sup> year<sup>-1</sup> is "a factor of 12 higher than soil sustainability," citing the study by Troeh *et al.* (2), which would suggest that the tolerance is



**Accumulated sediments in Coon Creek covered an old mill dam.**

only 1 Mg ha<sup>-1</sup> year<sup>-1</sup>. Yet, Troeh *et al.*, on the basis of USDA information, state that the soil-loss tolerances for U.S. soils range from 2.2 to 11.0 Mg ha<sup>-1</sup> year<sup>-1</sup> (2, p. 115). U.S. agriculture is mostly on soils with a soil-loss tolerance of 11 Mg ha<sup>-1</sup> year<sup>-1</sup> or more (3, p. 678). Hence, there appears to be little disparity between soil-loss tolerance and what Pimentel and Skidmore say is the rate of erosion. Even according to the USDA study cited by Pimentel and Skidmore (4), only one-third of U.S. agricultural land is eroding faster than the sustainable rate—a statement that remains to be proven. Although erosion rates may be periodically high in some regions, U.S. soil erosion remains a problem but does not seem to be a crisis.

Pimentel and Skidmore also mention a USDA study for which 800,000 sites were sampled, seeming to imply a high degree of accuracy. However, these are not physical measures of soil erosion, but are data-gathering sites for models. Moreover, according to Uri and Lewis (5), who they cite, there were only 300,000 such sites. And the annual “social costs” of \$29.7 billion in (5) are only asserted; it is not clear what evidence was used to arrive at that figure.

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### Meme's the Word

In our Essay on Science and Society “Creative sparks” (Jacob Goldenberg, David Mazursky, Sorin Solomon, *Science's Compass*, 3 Sept., p. 1495), we proposed that certain implicit regularities (termed templates) guide the emergence of creative ideas. In her letter commenting on our Essay (*Science's Compass*, 1 Oct., p. 49), Alice Hudder suggests that “Perhaps we can learn something about creative processes by studying evolution.”

The ex nihilo axiom (1) in creativity—the emergence of something out of nothing—has been a main obstacle in creativity research. Attempts to draw a parallel between creative thinking and evolutionary processes are naturally related to their complexity (2). Jacques Monod (3), a molecular biologist,

noted that ideas exhibit properties of organisms: They perpetuate their structure, breed, fuse, recombine, segregate their content, and evolve. In this evolution, selection must play an important role. R. Dawkins (4) termed the unit of idea replication “ideosphere,” suggesting that the soup in which memes (tunes, ideas) grow and flourish—the analog to the primordial soup (out of which life first emerged)—is the soup of human culture. Just as genes propagate in the gene pool by leaping from body to body, so memes propagate by leaping from brain to brain. Memes are susceptible to variation or distortion and are forced to compete for brain resources.

We posit that the analogy between evolution and creativity could be more constructive by conceptually pairing genes and templates at a deeper level, and species and ideas at a more discernible level. In the same way that changes in the genes control the behavior of species—indirectly and over long time scales—templates control the properties of ideas. Another distinction is that, for differential survival of entities, each entity must exist in the form of numerous copies, with some entities capable of surviving for extended evolutionary time. However, in the case of advertising ideas, technological innovations, and new product ideas (three do-

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