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^2 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^{-1} year^{-1}) (3) to about 13 Mg ha^{-1} year^{-1} (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^{-1} year^{-1} 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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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^{-1} $year^{-1}$ are not measurements, but are estimates from models, and they do not predict movement of sediment to streams. If U.S. **soil**s 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^{-1} $year^{-1}$ is "a factor of 12 higher than **soil** sustainability," citing the study by Troeh *et al*. (2), which would suggest that the tolerance is only 1 Mg ha^{-1} $year^{-1}$. Yet, Troeh *et al*., on the basis of USDA information, state that the **soil**-loss tolerances for U.S. **soil**s range from 2.2 to 11.0 Mg ha^{-1} $year^{-1}$ (*2*, p. 115). U.S. agriculture is mostly on **soil**s with a **soil**-loss tolerance of 11 Mg ha^{-1} $year^{-1}$ 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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