The Hills Are Sagging

(D283-2)

Hills on the Skogstad family farm in western Minnesota have light-colored hilltops where topsoil has eroded and darker low spots where soil has been deposited.

There's a reason why farmer Don Skogstad's hilltop knobs have lighter colored soil and less lush, green wheat than the bases do—and it's not lack of soil moisture.

The hilltops on the Skogstad family farm are typical of those farms found in western Minnesota and throughout the North American prairies' rolling landscape; they're relatively flat—not peaked, like mountains.

Two ARS soil scientists have studied one of Skogstad's sloping fields and found that gravity and erosion from annual plowing are largely to blame for the pallid soil and low wheat yields.

Mike Lindstrom started the 4-year study. When he retired from the ARS North Central Soil Conservation Laboratory, in Morris, Minnesota, Sharon Papiernik took over where he left off, but Lindstrom remained as a collaborator.

"Tillage and gravity erode soil the most where there's a change from a slight slope to a steeper one," Papiernik says. "This occurs at these knobs, where the soil surface changes from a relatively flat hilltop to a steep drop. Then, near the bottom of the hill, the steepness decreases and the land becomes relatively flat or forms a depression, where topsoil accumulates."

The researchers found that tillage erosion in some parts of the field moved more than 27 tons of soil per acre per year, and water erosion moved another 9 tons per acre per year. After 40-plus years of annual plowing, topsoil on the knob has migrated down the hill, exposing lighter colored subsoil rich in calcium carbonate.

This topsoil movement makes a big difference in the farmer's wheat yields, the researchers note. In each of the study's 4 years, they found that yields from the knob were, at best, half those from the rest of the field. Yields were highest in the depressions at the bottom of the hills, where the dark, rich topsoil has settled.

Papiernik and Lindstrom are doing this collaborative research with scientists at South Dakota State University and the University of Manitoba, in Canada.

Papiernik's expertise is on pesticide movement in soil and water, so she plans to relate this landscape research to movement of pesticides across farmlands.

"This also points to the possibility that landscape restoration could increase yields enough to justify the expense," she says.

A few area farmers are trying to do just that, using earth-moving equipment to move topsoil back up the hill. In a follow-up study, Papiernik is working with ARS agricultural economist Dave Archer, ARS soil scientist Don Reicosky, soil science professor Tom Schumacher at South Dakota State University, and colleagues at the University of Manitoba to investigate the economic and environmental impacts of this approach.

The researchers will conduct farm-scale research to investigate multiple processes occurring simultaneously in these landscapes, including carbon storage, soil water storage, soil compaction, and nutrient and pesticide movement.—By **Don Comis,** ARS.

This research is part of Soil Resource Management, an ARS National Program (#202) described on the World Wide Web at www.nps.ars.usda.gov.

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