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Soil Erosion in the Palouse River Basin: Indications of Improvement

USDA

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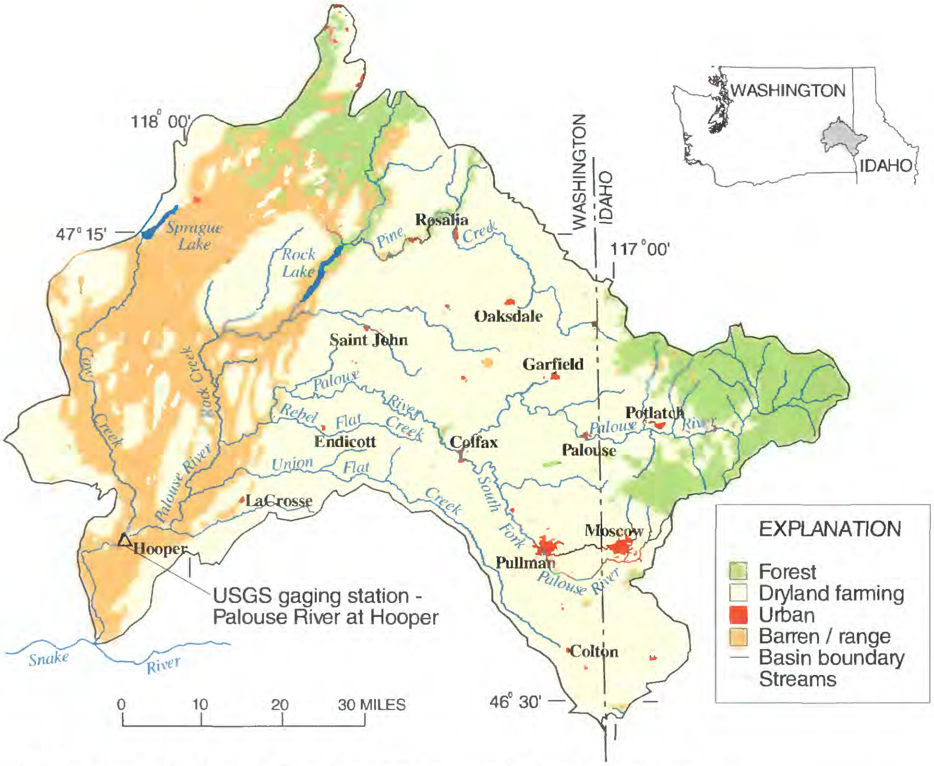

Figure 1. Land use in the Palouse River Basin is predominantly dryland agriculture. Sediment data discussed in this fact sheet were collected at Palouse River at Hooper.

Findings

- Erosion control practices instituted since the late 1970s have reduced erosion from cropland in the Palouse River Basin by at least 10 percent, according to model results.
- If monitoring continues to show a decrease in the amount of suspended sediment transported by the Palouse River, then erosion control practices are also helping to improve surface-water quality.

History of the erosion problem

Since the Palouse River Basin was first farmed in the late 1800s, soil erosion resulting from runoff water has been an ongoing problem. The erosion problem became particularly acute in the early 1900s when steep lands once used for hay and pasture were converted to grain production. It is estimated that 40 percent of the rich Palouse soils have been lost to erosion (Pimentel and others, 1995).

A U.S. Department of Agriculture (USDA) study reported that from 1939 through 1977, the average annual rate of soil erosion in the Palouse River Basin was 9.2 tons per acre (tons/acre) of available cropland, or about 14 tons/acre of cultivated cropland (USDA, 1978). The study concluded that without erosion control practices, the average annual rate of erosion would increase to 14 tons/acre as more cropland was put into production.

Strip-cropping is a widely used erosion control practice in the Palouse River Basin.

Innovative farmers and other agriculture professionals have been developing ways to reduce soil erosion in the Palouse River Basin since the 1930s. The first soil conservation district in Washington State was organized by a group of farmers at Palouse in 1940. In 1972, Public Law 92-500 mandated a water-quality management plan for dryland agriculture. The final plan, adopted by the Washington State Department of Ecology in 1979, recommended best management practices to control soil erosion and reduce runoff of nutrients and agricultural chemicals from cropland.

Effects of erosion control practices

Many farmers voluntarily implemented erosion control practices that were appropriate for the slopes, soil types, and climatic conditions of their fields. These practices have reduced erosion by about 1.7 million tons annually according to model results (see table); this represents about a 10 percent reduction in the annual rate of erosion when compared with erosion controls applied to the 1.2 million acres of cropland in the Palouse River Basin (USDA, 1978).

Monitoring erosion by sampling suspended sediment

Erosion rates represent the amount of soil displaced from slopes, not the amount transported to streams. However, because some of the eroded soil is transported to streams, a relation would be expected between basin-wide erosion rates and loads of suspended sediment carried by streams. Ten years of data on annual yields (loads per unit area) of suspended sediment from the Palouse River (USGS, 1962-1971) were plotted against annual estimates of field erosion (Kaiser, 1967) for winter wheat and barley cropland in the Palouse River Basin. The correlation between the data sets (fig. 2) indicates that long-term sediment sampling can help *substantiate* estimates of erosion rates.

Erosion control practices in the Palouse River Basin

Erosion control practice	Acres under erosion control[1]		Predicted average annual reduction in erosion[2]	
	1979	1994	Tons per acre	Total tons[3]
No-till seeding	600	56,000	9	500,000
Crop Reserve Program	6,400	60,600	5	270,000
Stripcropping divided slopes	0	239,000	1	240,000
Terraces	680	4,500	2	7,600
Grass waterways	[4]82	[4]1,550	[5]1	1,500
Planting trees and shrubs	0	3,670	10	37,000
Conservation tillage	0	81,000	8	650,000
Totals[3]	7,680	445,000		1,700,000

[1] U.S. Department of Agriculture progress records for 1979 and 1994.
[2] Prediction based on Universal Soil Loss Equation (Wischmeier and Smith, 1978). For grass waterways, based on gross erosion prediction method (Renard and others, 1997).
[3] Numbers have been rounded.
[4] Linear feet.
[5] Tons per linear foot.

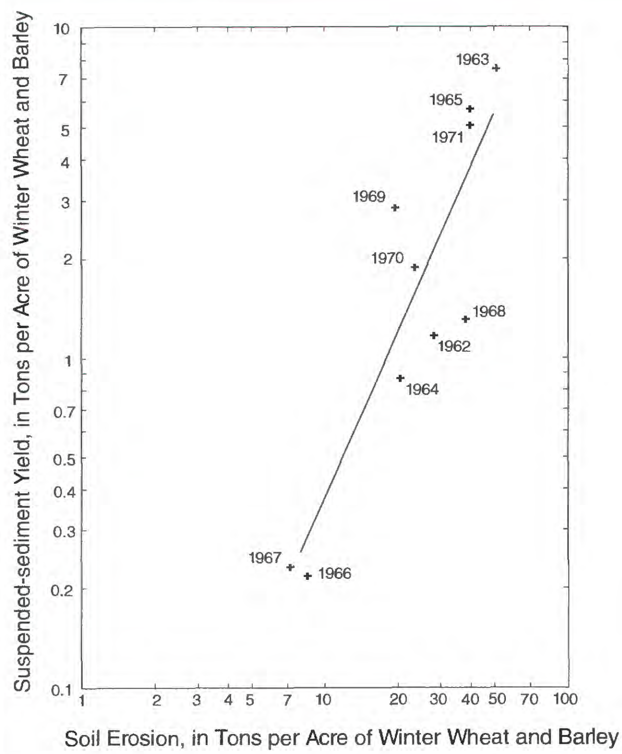

Figure 2. Soil erosion estimates correlate with yields of suspended sediment from the Palouse River, 1962-71

Until 1981, soil erosion rates were estimated annually; currently they are estimated every five years (USDA, 1988). When estimates are not available, sediment data can be used to *infer* trends in erosion. For example, comparing historical with recent year-to-year variations in annual average concentrations* of suspended sediment in the Palouse River reveals that the average concentration for the years 1993-96 is *one-half* the average for the years 1962-71 (fig. 3). These data are in general agreement with model results that indicate reduced erosion from fields during recent years (see table). However, the difference in annual averages of suspended sediment is explained partially by a skewed average for 1962-71 that resulted from a large storm in February 1963 (fig. 4). Frozen ground and other conditions that preceded this storm caused extremely high erosion rates (Boucher 1970), and these conditions did not occur in 1993-96.

Highest concentrations of suspended sediment during storm runoff occurred from 1962 to 1971

Comparing sediment transport during periods of storm runoff is another way to infer trends in erosion rates. Most suspended sediment is transported during periods of storm runoff. Boucher (1970) found that from July 1961 through June 1965, 81 percent of the sediment transport from the Palouse River Basin occurred during storm runoff. Average concentrations of suspended sediment tend to be higher during storms producing large discharges, but the highest concentrations per unit discharge were observed during 1962-71 (fig. 4) when predicted erosion rates were higher.

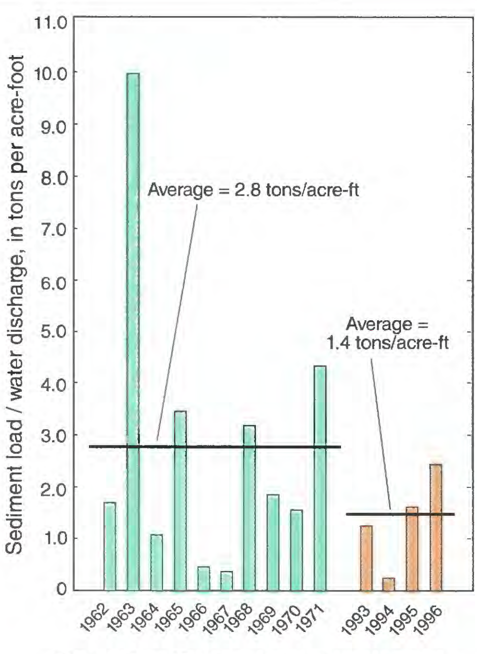

Figure 3. Comparing the historical record (1962-71) to recent years (1993-96) shows a decrease in the average annual concentration of suspended sediment in the Palouse River at Hooper.

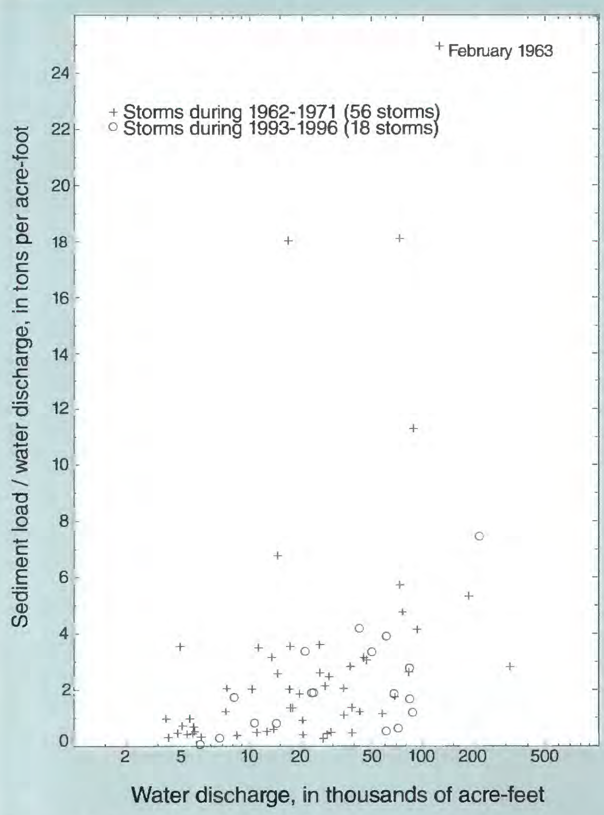

Figure 4. At the Palouse River at Hooper, highest average concentrations of suspended sediment were observed during 1962-71 storms.

Importance of long-term monitoring

Since the passage of the Food Security Act in 1985, farmers have been required to apply conservation measures in order to receive USDA program benefits. As attention is focused on the effects of farming on natural resources, farmers will be asked to apply measures to satisfy natural resource standards as well.

Long-term monitoring of discharge and suspended sediment, such as the USGS does at the Palouse River at Hooper, can help document trends resulting from the application of erosion control and other management practices.

*These annual average concentrations were computed by dividing annual sediment loads by annual water discharge at the Palouse River at Hooper.

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No-till seeding is another effective method of erosion control.

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