Erosion in the Palouse: A Summary of the Palouse River Basin Study

United States Department of Agriculture

Soil Conservation Service
Forest Service
Economics, Statistics, and Cooperatives Service

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Complex topography increases erosion hazard on dry cropland of the basin.

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Introduction

In January 1976, three agencies of the U.S. Department of Agriculture initiated a study of the Palouse River Basin in Washington and Idaho. The massive amount of data, observations, projections, and conclusions produced by the study have been consolidated and published as the Palouse River Basin Study Report. This publication is a summary of that report. The study was undertaken at the request of Washington State Department of Ecology (DOE). Making the study were the Soil Conservation Service, Forest Service, and Economics, Statistics, and Cooperatives Service.

DOE requested the study to provide factual information and data it needed for water quality planning to comply with the Federal Water Pollution Control Act Amendments of 1972. The amendments call for fishable, drinkable, swimmable waters in our nation's streams by 1985. This has provided new impetus for the planning and installation of conservation practices.

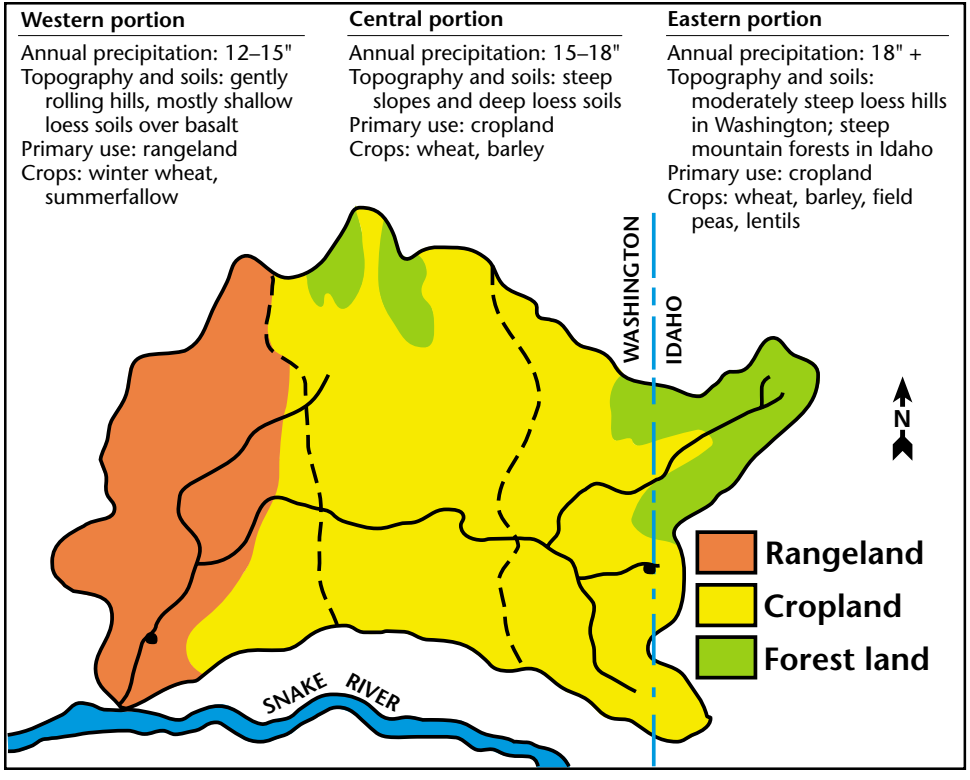
The primary use of the Palouse study data is getting conservation on the land and improving the quality of water in the basin:

- Local water quality committees organized under Section 208 of the Clean Water Act of 1977 can use the study results as a basis for selecting best management practices and developing water quality plans.
- DOE can use the study in evaluating those plans and practices.
- Individual farmers can relate study information to their own farming conditions and cropping systems.
- Conservation districts and agencies assisting farmers can use data and information from the study to guide their advice and assistance.
- The general public can achieve a better understanding and perspective of the complex conditions and problems—and therefore have a basis for supporting attempts to arrive at solutions.

Help in getting the conservation job done can be obtained from several agencies. Technical assistance is available from local soil and water conservation districts, the Soil Conservation Service, and the Extension Service. Financial assistance may be received from Agricultural Stabilization and Conservation Service and the Farmers Home Administration.

For a copy of the complete study report or more information about it, contact the Soil Conservation Service, Room 360, U.S. Courthouse, Spokane, WA 99201.

The Land Called Palouse



An early pioneer, writing about 1900, said this about the Palouse River:

I have followed its cool, winding currents to their birthplace in the mountains...traveled through its shady forests and over its grassy meadows...and sought its shady banks in quest of trout. At that time, its waters were pure...the meadows and woods were unmarred by civilization and it was a very paradise for the sportsman. Since then, numerous herds have been driven to its meadows to graze. As far up as logs can be floated upon its surface, the hillsides have been made to contribute their wealth of timber—fir, pine, cedar and tamarack—to feed the mills on the river as far down as Colfax. And the water has been polluted from its source by the search for gold in the Hoodoo mines.

The quest for gold continued only for a relatively short period. But the quest for ever-increasing yields of golden wheat goes on—at the cost of millions of tons of fertile soil each year.

The Palouse River heads in the Clearwater Mountains of north-central Idaho. From there it winds through forested foothills, undulating cropland, and craggy scablands, plunging over Palouse Falls and into the Snake River.

Geological events that occurred millions of years ago created the Palouse country with its many variations in topography: channeled scablands and gently rolling loess hills in the western part of the basin, very steep to rolling hills in the central basin, more gently rolling loess hills in the east, and steep forested mountains in the upper watershed.

The basin drained by the Palouse River and its tributaries encompasses more than 2 million acres in parts of five counties in eastern Washington and two counties in northern Idaho.

The basin is noted for some of the highest grain production in the world. It is also noted for some of the worst erosion in the country.

More than half the basin is highly productive cropland. Approximately 28 percent is rangeland and 11 percent is forested. A major producer of winter wheat, peas, and lentils, the Palouse supplies more than 10 percent of the soft, white winter wheat grown in the United States.

Annual precipitation ranges from less than 12 inches in the west to more than 35 inches in the east. Most of it occurs in winter and spring.

Rapid settlement of the Palouse did not begin until the 1860's. Although the deep soils were capable of high yields, the market for grains was limited until railroads were constructed in the 1880's. The railroads brought in newer, better equipment and the farmers began working and planting the hillsides. From then on, soil erosion has been a continuous and increasing problem.

The coming of the tractor brought further changes. Steeper slopes could be worked. As tractors replaced horses, the extent of soil-protecting crops—pasture and hay—diminished, erosion accelerated.

During the 1930's, the Soil Erosion Experiment Station, soil conservation districts, the Soil Conservation Service, and Civilian Conservation Crops made headway in getting landowners to put conservation on the land. But World War II fostered all-out production. And since then, economic fluctuations, allotments, and other factors have created other obstacles to soil conservation.

Erosion in the Palouse: How Bad Is It?

Frozen surface soil in early spring is highly erosive.

Since 1939, total erosion on Palouse cropland has averaged 360 tons per acre—more than 9 tons per acre per year.

Erosion rates on rangeland and forested areas average less than 1 ton per acre per year. On cropland, however, annual rates of 20 to 30 tons per acre are common and losses of 100 to 200 tons frequently occur on some steep slopes.

Erosion has consistently been highest in the intermediate 15-to-18 inch precipitation zone, averaging 20 tons per acre per year. The rates are usually less in the low-precipitation zone of the western basin (13 tons per acre per year) and in the high-precipitation zone of the eastern basin (12 tons).

Gully erosion accounts for only a minor part of soil erosion in the basin. Stream channel erosion accounts for less than 1 percent of total erosion in the basin, but it is serious in the mountain forests, where it accounts for 50 percent of the total.

The high erosion rates on cropland leave the land less productive. All the original topsoil has been lost from 10 percent of the cropland in the basin; one-fourth to three-fourths has been lost from another 60 percent.

Estimated average annual sediment yield in source to stream system—Palouse River Basin

Source	Sediment produced by erosion—tons	Delivery ratio	Sediment Yield—tons
Cropland	17,471,000	30%	5,167,000
Noncropland*	1,646,000	11%	184,000
Stream channels	21,000	90%	19,000
Total	19,138,000		5,370,000

*Includes forest, rangeland, roads and other areas.

Effects of erosion

The millions of tons of topsoil that erode from cropland each year represent not only the loss of an irreplaceable resource but also a major source of silt and water pollution. Silt smothers crops in bottomland areas, and it fills stream channels, waterways, and drainage ditches, increasing flood problems.

In late winter and spring, Palouse Falls is brown with sediment. From there the suspended sediment is carried downstream, where it fills reservoirs of hydroelectric plants, destroys fish habitat, ruins recreation areas, and pollutes other waters, making them unfit for many uses.

Annual erosion on cropland in the Palouse Basin is now estimated to be more than 17 million tons. Unless farming systems change, the rates are expected to increase. The Palouse study shows, however, that the problems of erosion, sedimentation, and water pollution can be greatly reduced.

Islands of silt deposited in the mouth of the Palouse River.

Pioneer relic and wheat covered with sediment.

Cropland sediment
fills road ditch.

Sediment reduces
Snake River Reservoir
capacity.

What Can Conservation Do?

Fall chiseling preserves surface residues.

Some beneficial conservation practices

Farmers can't change the weather, the kind of soil, or the slope of their land, but they can change the way they farm the land. They can reduce acreages of summer fallow, till the soil less, retire steep areas from cultivation, change cropping systems, divide long slopes with two or more crops, and install terraces on long, gentle slopes.

Summer fallow, especially in the higher rainfall portions of the central and eastern basin, is a major contributor to soil erosion. When fields are summer fallowed, uncropped land is clean tilled during the summer to control weeds and store moisture for growth of the next year's crop. Erosion rates on summer-fallow fields average 25 to 30 percent higher than those on nonfallow fields.

Excessive cultivation also increases erosion. Minimum tillage for seedbed preparation on annually cropped land or stubble mulching on summer-fallow fields can reduce erosion rates 35 percent.

More than 50 percent of the erosion in the basin comes from the steepest 25 percent of its cropland. Retirement of this land from cultivation would significantly reduce erosion and sediment.

Fields planted to small grain crops, such as wheat or barley, erode the least. Increasing the acreage planted to these crops can reduce erosion significantly.

Divided-slope farming and field stripcropping can reduce erosion rates 15 to 28 percent. Terraces can reduce erosion rates an average of 8 to 13 percent. On some long slopes, terraces can reduce erosion rates by as much as 50 percent.

Annual cropping reduces soil moisture as well as erosion hazard.

Level terraces keep water where it falls.

Stripcropping divides a slope to reduce runoff and erosion.

Using appropriate combinations of practices

The Palouse study evaluated the effects of applying combinations of these conservation practices with different cropping systems. It concluded that erosion rates on nearly level and gently sloping lands can be reduced to less than 5 tons per acre if the right combinations are used.

Erosion on steeper slopes can also be reduced significantly, but on the steepest slopes it will remain high if cultivation is continued. Erosion on steep land can best be controlled by retiring it from cultivation and establishing a permanent plant cover.

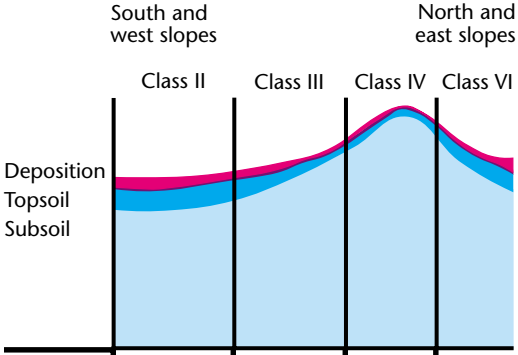
There is no single "best conservation practice" for all farms. Combinations of various practices that meet the needs of the land are the most successful. The Palouse study can guide (individual and group) efforts to select the proper combinations.

Applying various levels of conservation treatment to the land will affect the economy of the basin. But erosion rates can be reduced by 40 percent in the low and high precipitation zones and 60 percent in the intermediate precipitation zone—without decreasing farm income.

The erosion rate can be reduced 80 percent through maximum levels of conservation practices and retirement of 35,000 acres of steep, erodible land. Achieving this level of reduction would cost more than $29 million in reduced productivity and increased operating costs.

As erosion rates are reduced through conservation, less sediment will be delivered to stream systems. Cropping instead of summer fallowing increases fuel and fertilizer use but reduces erosion. Reducing erosion improves water quality greatly by reducing sedimentation. Retiring very steep, erodible land from cultivation can increase wildlife habitat values 4 to 18 percent and decrease fuel and fertilizer use.

Percent of erosion on cropland by percent of slope*



	Class II	Class III	Class IV	Class VI
Range of slope	0–12%	12–30%	0–30%	30–45%
Average slope	8%	16%	12%	36%
Cropland area	7%	71%	15%	7%
Percent of erosion	**2%**	**46%**	**25%**	**27%**

*Source:
Idaho, Oregon, and Washington Agricultural Experiment Stations and Agricultural Research Service, USDA. Economics of cropping systems and soil conservation in the Palouse. Bulletin No. 2. August 1961.

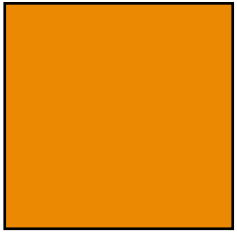
To reduce erosion...

reduce summer fallow...

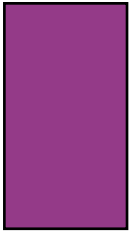
and increase use of conservation practices...

Present condition

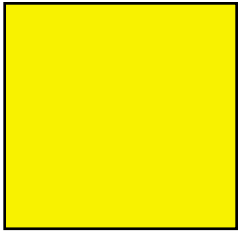
from:
14 tons per acre



from:
305,000 acres



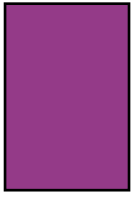
from:
546,000 acres
minimum tillage



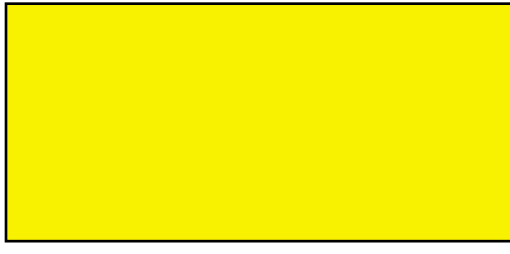
Alternative 1

to:
8 tons per acre

to:
246,000 acres

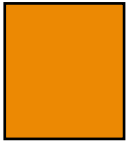


to:
1,221,000 acres
minimum tillage



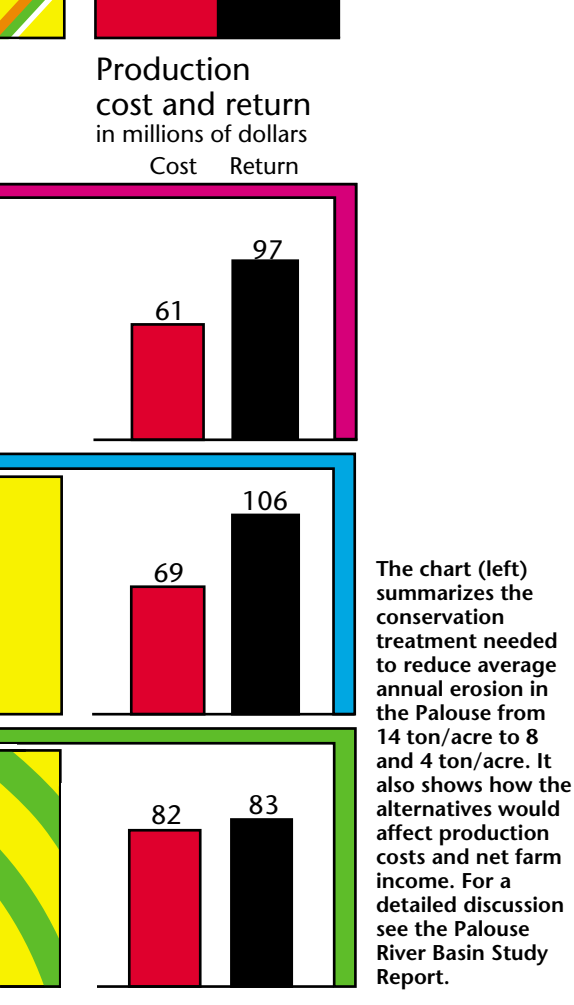
Alternative 2

to:
4 tons per acre



to:
114,000 acres

to:
1,221,000 acres
minimum
tillage and
stripcropping
with terraces on
517,000 of
those acres



The chart (left) summarizes the conservation treatment needed to reduce average annual erosion in the Palouse from 14 ton/acre to 8 and 4 ton/acre. It also shows how the alternatives would affect production costs and net farm income. For a detailed discussion see the Palouse River Basin Study Report.

Summary of Findings

The Palouse River Basin Study confirms what has long been suspected: Soil erosion threatens the future of farming in the basin and the quality of water flowing out of the basin. But it can be controlled and reduced.

- The basin's cropland will continue to lose at least 17 million tons of soil each year—14 tons per acre—unless effective conservation measures are practiced.
- Five million tons of sediment are produced in the basin each year by runoff— polluting water, silting in reservoirs, damaging fish habitat.
- Over 90 percent of the soil loss results from sheet and rill erosion. Over 50 percent occurs on the steepest 25 percent of the basin's cropland.
- Summer fallow, which leaves the soil bare, is a major contributor to erosion.
- Conservation practices can reduce erosion rates: minimum tillage, 35 percent; field stripcropping, 15 to 28 percent; terraces, 8 to 13 percent.
- Retiring steep, highly erodible land to grass or other protective cover would greatly reduce erosion and would benefit wildlife.
- Proper combinations of various practices could reduce erosion rates 40 to 60 percent without adversely affecting farm income. Erosion rates can be reduced up to 80 percent, but would result in farm income reduction.

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