



Erosion has battered and washed away soil particles on all sides of this piece of crop residue, creating a soil pedestal.

So unless there is runoff water, raindrops cannot do much damage. But by the same token, unless raindrops are hitting the ground, runoff water cannot do much damage. (One exception is when runoff moves in a concentrated flow.)

A thin sheet of water flowing across the land does not easily break apart soil particles on its own. This can be demonstrated by running a stream of water down a bare soil surface. The water will look relatively clear because it will only be carrying away soil particles that already were loose. However, if you send a stream of water across a soil surface while raindrops are striking the ground, the water will quickly become muddied with dislodged particles.

Rain and runoff water work together like a pair of thieves. In a bank robbery, one crook performs the actual hold-up while another prepares the getaway car. In a soil robbery, raindrops dislodge soil particles and runoff water carries them away.

Not only that, but runoff water makes it easier for raindrops to break apart even more soil crumbs or clods. If natural soil granules—groups of soil particles—are wet, they are more easily broken apart than if they are dry.

Sheet Erosion

The stage of erosion when runoff water begins to move is called the sheet erosion stage. However, water doesn't really flow downhill in a smooth, level "sheet" as the name might imply—unless the soil surface is extremely smooth. Water detours around clods and spills out of small depressions. In general, it is a slow, but irregular flow.

Sheet erosion is difficult to see, but its damage can go deep. The destruction is more obvious when a plow turns up light-colored subsoil on sloping land. That means much of the topsoil has been scoured away.

A typical silt loam soil is made up of clay, silt, and sand particles. Erosion has a greater tendency to carry away the finest material, the clay, than it does the coarsest material, the sand particles. But the problem is that most plant nutrients are attached to the fine, clay particles. So erosion, a selective process, steals the most valuable part of the soil, as well as important organic matter. (See Table 2.)

Table 2. Mean composition of surface soil and eroded material

	Organic Matter	Nitrogen (N)	Phosphorus (P_2O_5)	Potassium (K_2O)	Limestone ($CaCO_3$ and $MgCO_3$)
	% by weight				
Surface horizon	3.33	0.158	0.051	0.010	1.02
Eroded material . . .	4.13	0.275	0.093	0.073	1.52

This table shows the composition of the surface horizon—the soil that hasn't been eroded away—and compares it to the composition of material that has eroded away.

Notice that there is a greater percentage of organic matter and nutrients in the eroded material than in the remaining soil. These figures, which show how erosion steals the most valuable part of the soil, come from a study on six watersheds in Indiana. The watersheds averaged a soil loss of 8.8 tons per acre per year.

Rill Erosion

When the thin layer of water moves downhill, it tends to concentrate in tiny channels called "rills." These rills look like miniature rivers, bending and cutting through the soil.

At this point, raindrops continue to break apart the soil, but runoff also has built up enough momentum to break loose particles. In addition, rills have an excellent ability to transport soil particles.

The amount of destruction done by moving water depends on the length and steepness of slope. The longer and steeper the slope, the more momentum water builds. And as water builds momentum, it gains greater power to erode.

Gully Erosion

Eventually, the rills in a field will merge to form larger channels. These may form even larger channels and can become deep enough to be labelled, "gullies."

Channels are defined as gullies when they cannot be obliterated with normal tillage operations. They are large, noticeable scars on the land. In many areas of the Midwest, gully erosion has even divided fields into small parcels that are inefficient to farm.

Deep gullies with vertical side walls are a phenomenon found in the deep loess soils along the bluffs of the Illinois and Mississippi Rivers. Some can even reach depths of 30 feet or more.

But gully erosion can be deceiving. Although it is the most obvious form of erosion, it doesn't remove nearly as much soil in Illinois as the other, more invisible forms of erosion.

Splash, sheet, and rill erosion are the forces behind the loss of an estimated 160 million tons of soil each year on Illinois agricultural land. In comparison, gully erosion accounts for the loss of only about 11 million tons of soil each year on all land in the state.