

Reducing Man-Caused Gully Erosion

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Gullies are not uncommon features on western rangeland. Their presence should concern everyone responsible for range management, or dependent on continuing range productivity. Gully erosion directly causes loss of productive soil, reduces ground water availability, and may even be a barrier to stock movement. The indirect effects of accelerated sediment supplied to natural and man-made waterworks is equally undesirable.

Erosion is at its peak in semiarid areas like our Southwestern region. This reflects a combination of storm runoff capable of causing erosion and available moisture able to support only limited vegetation. It does not take a major decrease in plant cover to greatly increase storm-related erosion. The acceleration of gully erosion in the West after the 1880's is often linked to circumstances which reduced vegetation. Land abuses clearly can reduce plant cover and disturb soil to the extent that gully networks forms. There is little doubt that man-related activities, in the not-to-distant past, created or enhanced local gully development on the Fishlake National Forest in central Utah. Watershed condition inventories identify gullies caused by roads, overgrazing, water transmission ditches, and other man-related activities. (See photos.)

Many people mistakenly think we understand the gully erosion process. It is certainly true that we can describe and measure the erosion and expansion of a gully. Likewise, we know how gully formation is linked to some specific factors such as slope steepness and soil particle sizes. But this is only part of the process. We do not yet understand the interaction of factors that leads to gully erosion in one area, but not in a similar neighboring area. Nor can we predict threshold values, points at which gullies first begin to form. As a geologist, I find it frustrating to be unable to show which areas are prone to gully erosion and which ones are not.

If we cannot yet show which areas are prone, or not prone to gully erosion, how can we effectively reduce man-caused gullies? One way is to view man-related activities in light of their gully-causing potential. A similar effort has been applied to reduce man-caused landslides. Man-caused landslides result from (1) changing slope shape, or (2) increasing moisture in surface layers. We can view man-caused gullies as forming where activities: (1) increase the amount and/or velocity of runoff, or (2) increase soil detachability and/or transportability. By increasing or eliminating plant cover, changing natural drainage patterns, steepening slopes, or compacting the ground, we increase the amount and/or velocity of runoff. Overgrazing and fire, improper road design, and paving areas are activities that influence runoff. Surface disturbance, such as logging, and chaining of pinyon-juniper, and excavation, such as construction and



This gully retreated about 40 feet from 1972 to 1979. Water collected and channelled by an old road initiated it. Note the gate where the fence crosses the gully. Expansion of the gully was largely unaffected by changing the road to the present alignment and restoring the old roadbed. Rapid expansion is enhanced by the fine-grained alluvium present at this site.

surface mining, increase soil detachability and/or transportability.

We can apply this view of man-caused gullies to help in two ways. First, we can recognize which activities have gully-causing potential. Second, we can identify what information is needed to establish if that potential will be realized.



Stockwater is limited on Thousand Lake Mountain plateau. Cattle follow the same paths between grazing areas and the only water source. Compacted trails collect runoff in sufficient quantities to cause gully development.



Miles of water transmission ditches dug by hand and horse-drawn equipment collected water on the upper slopes of Thousand Lake Mountain. Most were constructed to supply water to homesteads in the 1800's and early 1900's. Lack of continued maintenance in recent years has led to breaches. Diversion of collected water onto adjacent slopes initiated numerous gullies. One breach and resulting gully is visible in the middle of the photo.

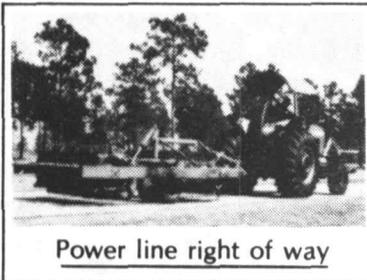
Much of what we do on rangelands is a combination of activities rather than a single action. This is especially true of land management programs. It would be inefficient to routinely evaluate every activity in a program for gully erosion potential. In many cases the potential would be nonexistent. By recognizing which activities either increase the amount and/or velocity of runoff, or increase soil detachability

and/or transportability, we consider only those with gully-causing potential. The other activities need no further consideration for this problem. For example, a range improvement project may include constructing stock driveways and building several miles of fence. The fencing work affects neither runoff or soils. It requires no further consideration in terms of gully erosion. The stock driveways might be bulldozer cuts improving movement across rough terrain separating grazing areas. This activity has gully-causing potential because it can increase soil detachability and transportability.

Once we recognize which activities have gully-causing potential, we must decide if that potential will be realized. In our example, evaluating potential for the stock driveways requires soils information. This information might include soil particle-size distribution, rockiness or stoniness, and slope steepness. A gently sloping driveway across a stony, sandy-textured soil is less likely to cause gullies than a moderately sloping driveway across a stone-free, silty-textured soil. By knowing what information is needed to assess potential, two additional benefits result. First, the required information indicates which specialist is needed when an interdisciplinary team effort is involved. Second, it helps identify which mitigating measures may be most effective in assuring that gullies do not develop.

Research and resulting management practices in recent years have focused on rehabilitating existing gullies. Researchers are continuing to add to our understanding of the entire gully erosion process. Their work will eventually enable us to map areas in terms of relative gully erosion potential. Until that is possible, our preventative efforts should concentrate on assessing man-related activities for their gully-causing potential.

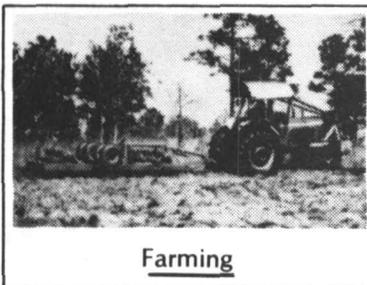
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