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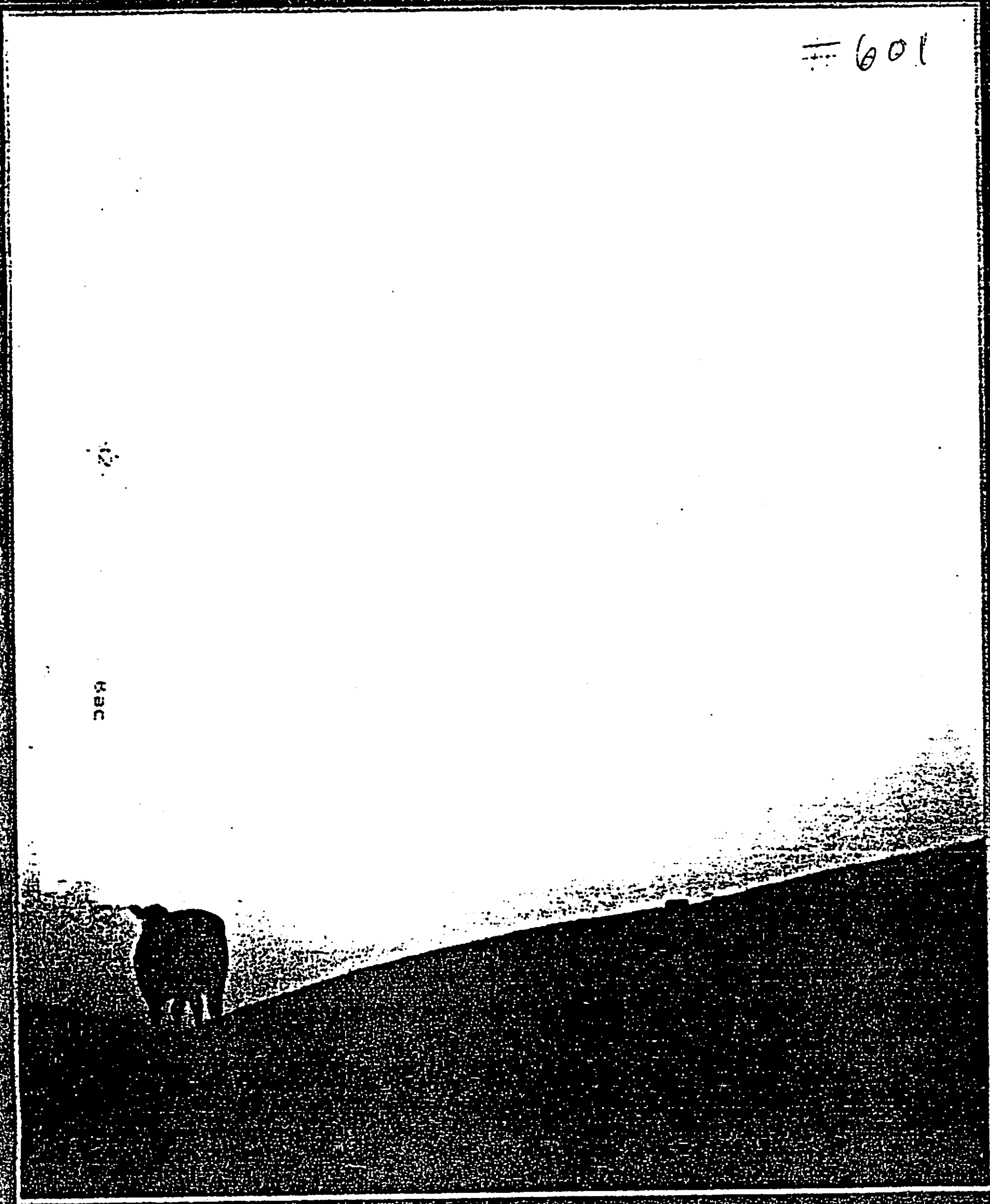


PEN POINTS

A comment on gravel use

Added quantification was welcomed of what has long been accepted as an engineering practice: use of a gravel base to reduce erosion/sediment yield from minimum-standard roads [*JSWC*, January-February 1987, pp. 46-50]. Some comments regarding the work seem warranted:

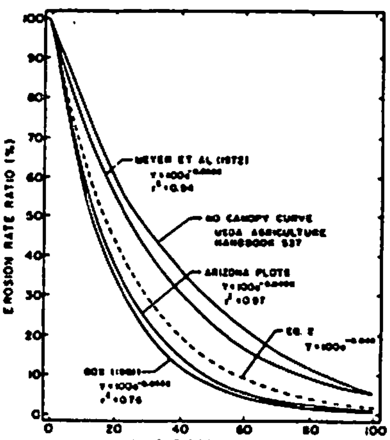
1. Results would have been more useful had they not been confused by the effect of the bank sloughing. Only at the Fernow Loop Road site did the drainage area remain constant during the 1980-84 experimental period. At the Stonelick Road site the drainage area changed in one instance by 32%. Because these changes might well have occurred during only one or two of the more unusual storms, the sediment yield data in table 2 are questionable unless the researchers can identify for sure when the changes occurred and adjust the records appropriately.

2. Sediment yield data in table 2 result from two apparent sources, bank erosion and erosion from the roadway. Figures 1, 2, and 4 illustrate some of the exposed banks, which presumably, are contributing much of the sediment yield. These exposed banks appear to be appreciable, as the cut bank height figures in table 1 indicate. Do these bank areas constitute a large portion of the drainage area in the study section? The mean sediment yield of 5.7 tons/acre from the Stonelick Road section with the 3-inch clean gravel could represent bank erosion entirely. Furthermore, the gravel may have actually filtered some of the bank erosion, especially adjacent to the bank, before the water-sediment mixture reached the measuring site, figure 3.

3. The authors mention that "the percentage of annual runoff from the instrumented road sections ranged from 41.5 to 139%." The seeps causing this additional runoff may also confuse the sediment yield, although one would expect that runoff from these seeps would be relatively free of sediment. Sediment yield from the periods where appreciable seep flow occurred should be identified separately from that occurring during other periods. Sediment yield from the storm events should only be considered in the evaluation of the road material. Thus, from a statistical sense, either all test sections should have seeps or no sections should. The results of the replications for the data presented cannot be submitted to statistical testing because they represent different results with the seeps or at least that becomes another variable and, in that sense, there were no replications (the data in the paper are incomplete for such an evaluation). Were the four years of measured precipitation normal, above, or below normal? Presumably the variability between years for any treatment (Table 2) reflects differences in the input storm characteristics.

4. The treatment headings between tables 1 and 2 are inconsistent. At the Stonelick Road site, one table says that 3-inch crusher-run gravel was used; the other says 1-inch crusher-gravel was used. This inconsistency also confuses any attempt to draw a conclusion about using clean gravel versus crusher-run gravel, especially when the conclusion says the authors previously recommended 3-inch crusher-run gravel.

At the Soil Science Society of America meeting in 1982, a session was held on "Erosion and Productivity of Soils Containing Rock Fragments." These papers (SSSA Special Publication Number 13) are noteworthy because they contain data that supplement this current work. The figure below illustrates some of the data. Don Meyer and coworkers in Indiana used rock mulches to control erosion on roadside cuts, then measured soil loss using a rainfall simulator. Jim Box made similar measurements in Georgia where the surface rock mulch was composed of a slaty material. In arid and semiarid areas of the Southwest, where soils contain a large percentage of rock fragments, erosion leaves residual rock surfaces when wind and/or water erodes the finer materials from the soil surface. Roger Simanton and associates verified the results of Box's and Meyer's work with a rainfall simulator for different rock fragment intensities on the surface and expressed the results in the figure as an exponential decay. In each of these experiments the rate of decay differs from one set of experiments to another. The data were normalized to a common base using slope length-steepness concepts, such as those used in the universal soil loss equation, and the soil erodibility term, K, was removed. Also shown is the "no-canopy curve" from Agriculture Handbook 537. When Simanton and colleagues added additional years of data to the results of this original publication and included results from the Nevada test site, the exponential decay changed from the original -0.049 to -0.044. These data indicate that when a 100% rock cover is maintained one would not expect significant erosion from the road area. Erosion on the bare roadside banks would then need to be added to that estimated from the roadway.



Rock fragment cover and erosion rate ratios from simulator plots.

How can this new information be used? In the revision of the USLE now nearing completion, a subfactor approach is being used to calculate the C-factor for rangeland. The subfactor was first proposed by Walt Wischmeier and later detailed by Cal Mutchler and associates and John Laflen and co-workers for cropland. I looked at application of the approach to rangeland. The factor C is expressed as: $C = LU \cdot CC \cdot SC \cdot SR$, where LU is a land use subfactor, CC is a canopy subfactor, SC is a surface cover subfactor, and SR is a surface roughness subfactor. The surface cover subfactor is then obtained as: $SC = \exp(-4.0 \cdot M)$, where M is the surface fraction covered by nonerodible material, such as living and dead plant material and rock and large gravel (the equation is also shown in the figure).

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