HOW TO DECREASE EROSION BY NATURAL TERRAIN SCULPTURING

David J. Barr and John D. Rockaway, professors of Geological Engineering, School of Mines and Metallurgy, University of Missouri, Rolla.

There is a natural tendency for all of us to think of "ideal" landscaping as a flat, smooth, or uniform terrain surface. A close look at any natural terrain surface, however, will not support such a perfect concept of the land.

It is assumed such smooth uniform surfaces are in harmony with nature. Subdivisions, parks and other constructed landscapes are often made as free of irregularities as possible.

We suggest that attempts to construct landscapes that are smooth, uniform and perhaps visually pleasing actually contribute greatly to increased erosion and subsequent sedimentation.

Rather than trying to hold the soil in place, it may be more realistic and cost effective to sculpture the terrain into a form and shape that would approximate a natural surface at equilibrium. Application of such a sculpturing technique might range from large scale surface mine reclamation or subdivision design to small half acre units feeding into an existing watershed.

Take a look at any natural terrain surface and the drainage system which evolved to carry away runoff water. It will include rills and gullies near the tops of slopes integrating downslope into permanent channels and trunk systems. Side slopes will be concave in shape with steep gradients near ridge crests and flatter slopes in the tributary bottoms. Although relief within a watershed may vary from a few feet to hundreds of feet, natural landscapes are seldom smooth and uniform or without irregularities.

Slope geometry

Numerous studies involving field and theoretical laboratory work indicate that natural terrain slopes most often can be classified as concave, convex, uniform or complex in shape.

It is accepted by observation and theory that the concave shape is most stable and in near equilibrium with precipitation runoff that would tend to produce sheet erosion. In fact, a convex slope shape will ultimately erode to a concave shape and the complex and uniform shapes probably represent traditional profiles. As figure 1 shows, a great volume of material has the potential to erode.

Attempts to construct landscapes that are smooth and uniform actually contribute to increased erosion.

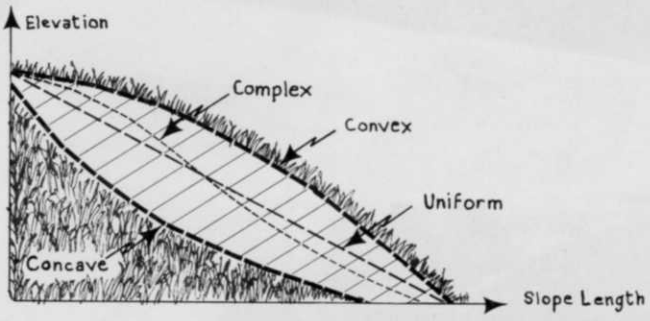

Figure 1 illustrates (top) quantities of erodable material with various slope shapes.
Severe initial erosion on a smooth graded slope prepared for a development.

Studies indicate that the concave shape yields the least amount of sediment through erosion to a stream. The steepness of the toe of the slope (that portion at the lowest elevation) is most significant in affecting the rate of erosion and sediment yield. Most man-made landscapes are created with convex or complex slope shapes thus creating a natural tendency for sedimentation and erosion.

Drainage design

Any land surface which has been altered by man will, with time, develop a drainage network sufficient to carry the discharge from the area. The network will be characterized by its drainage density, which is the cumulative length of channel segments in a unit of area, usually per square mile. These channels are distributed in a random veinlike pattern unless manmade controls are exerted upon the system.

An inspection of an area prior to disturbance will give some indication of tendency to erode. For large areas this may be most practical by aerial observation. The higher the density of channels the more likely the surface will erode. Factors which

Aerial view of site developed for building shows erosion beginning on smooth slopes. Note rills forming.

may play a part in erosion are the shear strength of the soil, the slope of the hillside, the rate of flow of runoff, and shape.

Naturally occuring drainage densities vary across the United States. The Coastal Plain of Virginia has a drainage density of 6 mi./sq.mi., while the Badlands of New Jersey (Perth Amboy) have a drainage density of 650 mi./sq.mi. Other examples are the Appalachian Plateau of Kentucky with a drainage density of 56 mi./sq.mi. and the Coastal Range of California with a drainage density of 35 mi./sq.mi. The glaciated areas of north Wisconsin have a drainage density of just 1.5 mi./sq. mi.

Concave slopes yield the least amount of sediment through erosion to a stream.

These densities were taken from areas where the forces giving rise to channel development are in dynamic equilibrium with those forces resisting initial channel development. It is generally accepted that the drainage density remains relatively constant throughout a watershed.

Some basic characteristics of drainage densities are:

— as soil shear strength decreases, drainage density increases.

— as average slope increases, drainage density increases.

— as runoff rate increases, drainage density increases.

Applications

Although none of the concepts presented have been evaluated for economic practicality, there is strong evidence that reclamation and landscaping could be improved by making reclaimed surfaces more nearly the shapes of natural surfaces. Initial grading for creation of concave slope profiles and well-defined, randomly oriented channels could reduce the potential for natural erosion to carve these shapes.

Also, the drainage on previously reclaimed mine areas or landscapes could be modified to induce more randomness in drainage as well as concave slopes and thus reduce natural erosion. Further study might lead to tested values for desired terrain characteristics, but at present a sculptured terrain could be designed using a combination of theoretical and artistic interpretation and inference.

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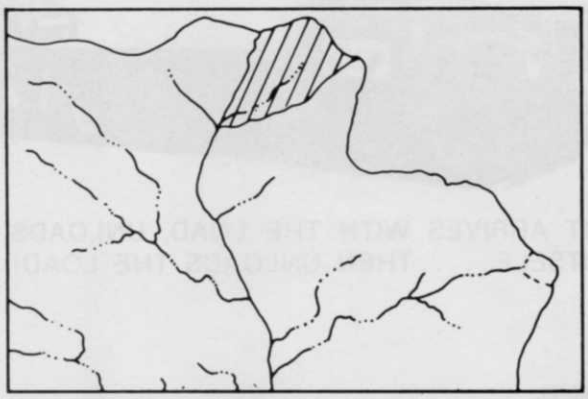
Erosion *from page 32*

The following steps, if undertaken, would tend to cause land to be more natural in shape and consequently less prone to severe initial erosion:

Runoff area design — The smallest area which supports the creation of a channel high in the drainage network can be estimated. This area should be approximately the same before disruption and afterward in a manmade drainage network.

Drainage density — Design of drainage density should include the appropriate drainage density for the site. The drainage layout could best be sketched in a naturally appearing random (veinlike) branching pattern. A first approximation to the required drainage density could be measured from pre-disturbance maps and photos and then increased slightly for effects of disruption.

Drainage channels should be constructed to resemble natural channels. All channels should grade from shallow (0.5 ft.) at the head end to several feet deep for trunk collector channels. Top bank widths should range from perhaps 12 ft. wide for small tributaries to broader channels in the trunk stream. The gradient of the channels should be steepest at the head end with flattening toward the mouth of the primary trunk stream.



Random drainage pattern common to undisturbed land.

Slope profiles — In the process of creating drainage channels some effort should be taken to sculpture the land into concave shapes where possible. Similar shapes within watershed areas would tend to reduce severe initial erosion. Exacting mathematical formulas using the above criteria are available for those interested from the authors, 125 Mining Building, Rolla, MO 65401. **WTT**

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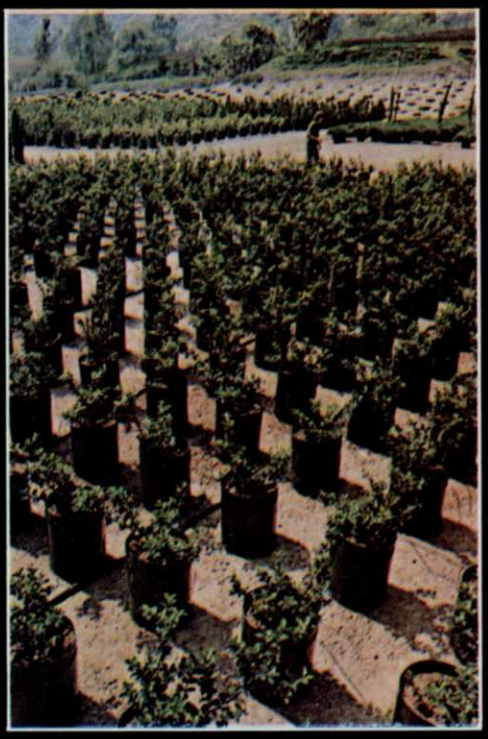

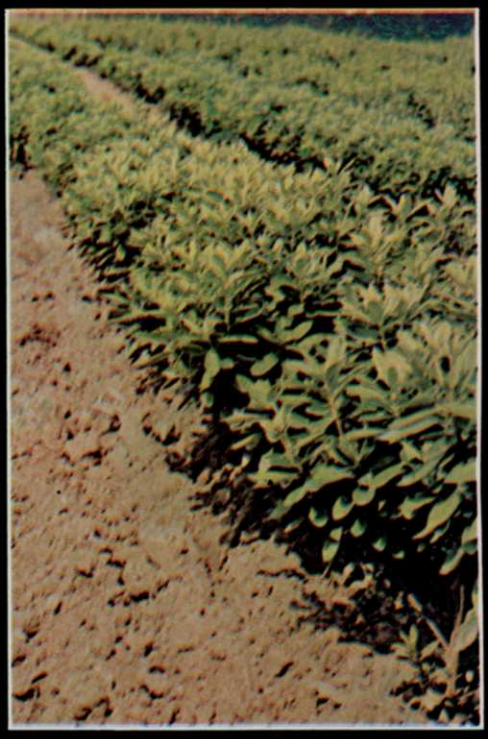

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1979 MARKET DATA INDICATES FEBRUARY IS BIG BUYING MONTH

February is a big buying month for landscape contractors according to "Pulse Reports" tabulated by the research arm of the Business Publications Division of Harvest Publishing Company, of which Weeds Trees & Turf is a part.

Monthly or quarterly questionnaires were sent during 1979 to obtain indications of market surges or unrest. We were very interested in indications of cutbacks caused by anticipated recession. Third quarter 1979 figures did not reflect any such withdrawal from the marketplace.

As recession is a loose term which can cause major waves in the economy, we will continue to survey Green Industry markets in 1980. The definition of recession is two consecutive months of drop in Gross National Product. Such an occurence is likely in mid-1980. The real key to a recession is the size of the drop in GNP, not merely the fact that it dropped at all. If consumers react as they should to counter inflation, there will be recession. They are reacting now against automobile prices, energy prices, and the cost of borrowing. These factors will create conditions which can be interpreted as recession, but may not represent all factions of business. Few recognize this and therefore will respond with very conservative spending for all items. As a result, it is up to each healthy market to sell its positive growth individually, customer by customer. The Green Industry is a positive growth market which needs to get its message of growth to consumers right away.

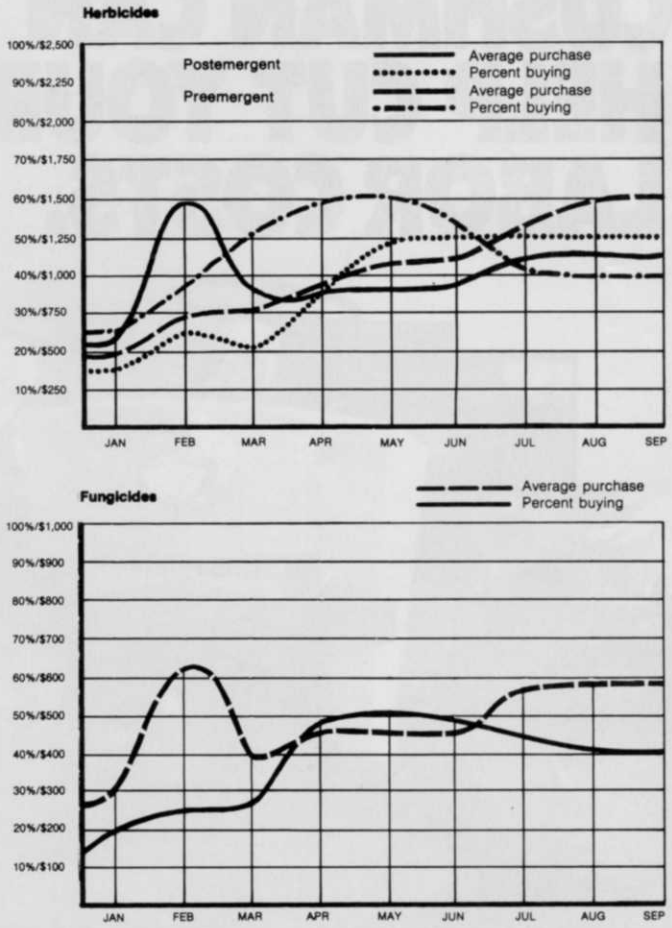
The February results to our surveys may show us a great deal about 1980. Landscape contractors must at least cover what they have on the books for the coming season. If they anticipate cancellations it will be evident in the February figures. Unfortunately, we won't be able to research, tabulate, and publish the returns until April. We will let you know as soon as possible in any case.

Basically, good accounts will stay and iffy accounts will hedge and possibly drop temporarily. It is important to categorize these different types of accounts early. At the same time you should maintain constant communication with your supplier as to his purchasing plans. Let him know what you need as early as possible.

At the same time, more people will be staying home and making carefully thought out additions or improvements to their property. You will have to have answers if you want their business. You will need examples to show them and data to support the return on investment of landscaping. Offer, if possible, things like 90 days same as cash through local finance companies, installation as soon as possible after a decision, and multi-year improvement plans to spread the cost of major improvements over two or three years.

To sell more effectively, you must have good sales aids such as color before and after photographs and sales figures of real estate following landscape improvement, and both within the practical reach of the customer to which the sales effort is directed.

In fact, since residential real estate is moving so slow, a good relationship with realtors may return be a good idea to move homes needing landscape alterations.



Graphs show jump in percentage buying and average purchase in February.

Other observations

At the time of writing we did not have fourth quarter figures back yet. For the first three quarters of 1979, the months of February and April showed the biggest jump in purchasing for landscape contractors. The February purchase involved a lower percentage of buyers, but the average size of purchase was high.

One suprising result was that fungicide and insecticide buyers were lower in percentage but higher in average purchase in the third quarter. Perhaps the did not anticipate the amount of disease and insect control business as they received in the summer of 1979. The data could have been influenced by higher than normal disease and insect problems in a particular area in 1979.

The most popular mower in 1979 was the self-propelled rotary, by nearly five to one over reel.

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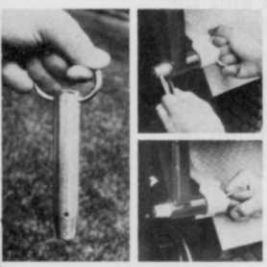

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