BY THE NUMBERS

• Soil erosion rates in Asia, Africa and South America are estimated to be about twice as high as in the USA. FAO estimates that 140 million hectares of high quality soil, mostly in Africa and Asia, will be degraded by 2010, unless better methods of land management are adopted.

• The average daily cost to operate a river dredge is $29,000. Los Angeles will spend $150 million over the next six years to battle dust storms emanating from Central California's dry Owens Lake bed.

• In the USA, soil has recently been eroded at about 17 times the rate at which it forms: about 90% of U.S. cropland is currently losing soil above the sustainable rate.

• According to Hebert Research's report summarizing the gross sales volume for seven categories of erosion control products, total sales volume was $225 million, although the Economic Research Committee believes that will be much higher when regional manufacturers are included in future surveys.

• It is estimated that human activities have degraded some 15% (2000 million hectares) of the earth's land surface between latitudes 72 degrees north and 57 degrees south. Slightly over half of this is a result of human-induced water erosion and about a third is due to wind erosion (both leading to loss of topsoil), with most of the balance being the result of chemical and physical deterioration.

• The current annual sediment load of the Huanghe River in China is estimated at 1.1 x 10 (9) tons, an order of magnitude greater than some 2000 years ago when human influences in the drainage basin were far less.

• Soil degradation is one of the largest threats to environmental sustainability: over the past half century the productivity of more than 1.2 billion hectares of land (an area larger than China and India together) has been significantly lowered. It is

Focus Feature

What About the Soil?

by Julian Durant
Soil Dynamics, Inc.

There are many aids for erosion control – all to protect and strengthen soil. But what about the soil? Could soil by itself, ever not require these aids? It is important to examine the soil as its own "protection", its own "erosion control"; soil that will not erode and not cause sedimentation; soil that will stand up to heavy rains without any aid, or blanket. Such a soil would be a breakthrough in soil technology and open many possibilities for Landscape Architects and Geo-technical Engineers.

Hendrikus Schraven, owner of Hendrikus Schraven Landscape Construction & Design, Hendrikus Schraven Organics, and Soil Dynamics, has developed patent pending soil blends that he calls EssentialSoil™. The product is an organic based soil that mimics the texture and micro-biology of native topsoil overnight at depths of 12" to 36" and remains stable on 1:1 slopes or steeper. It does not erode, rill, or slump during record rains. It also promotes healthy rapid plant and root growth, more than twice as fast as conventional soil. Tested in both laboratory & field, the soil is now becoming known for a long list of benefits and characteristics that apply not just to erosion control, but other environmental, biological and ecological concerns as well. Hendrikus won both the "Contractor of the Year Award" and the "Excellence in Technology Award" from the International Erosion Control Association for his work in organic soils application. To understand the role that this product will have in the future, the broad range of these benefits should be understood.

EssentialSoil™ in fact, has seven primary environmental and ecological characteristics. Each has its own benefit:

• Erosion/Sedimentation - Near zero

• Runoff Reduction - In runoff on a 1:1 test slope by 31%. (Caltrans Soil Erosion Research Lab, June 2000)
• Stability - Will not erode, rill or slump without root growth, during rain conditions on 1:1 or greater slope. (Caltrans Soil Erosion Research Lab June 2000)
• Permeability - Resembles course sand (Shannon & Wilson 2000)
• Retention - 45% water retention even on steep slopes. (Caltrans Soil Erosion Research Lab, June 2000)
• Plant / Root Growth - EssentialSoil™ is typically installed at a minimum of 12" deep. Plant and root establishment is accelerated, forming deep root structures and disease resistant plants.
• Water Purification - Binds heavy metals. Beneficial microorganisms assist in degradation of pollutants. (Soil and Plant Lab. Inc., 2000)

Hydraulically-applied soil binders, bonded fiber matrices, and rolled erosion control products all have an important role in erosion control. The role of this new product however, seems to be both as a stand alone product and as an adjunct to these conventional products. What results could be achieved by

How It Works

Soil Dynamics coined the term, "bio-stable", which refers to soils that are strong and stable because of the combination of certain key organic and mineral products with the biological processes created by the many microbes, bacterial, fungi present within the soil. These microorganisms act as an army of tiny engineers, structuring the soil, shredding, building, damming, opening, feeding plants, and protecting roots. Like yeast is to water and flour, microbes are to minerals or organic matter, in the right ratio. EssentialSoil™ functions because of the synergistic relationship between all the above components. The process of installing the soil includes inoculation with microbial compost tea, regardless whether the soil is pneumatically installed or installed by wheel barrow and shovel.

Once installed, (usually a minimum depth of 12") the organic components bond, forming a matrix within the soil. This matrix allows water to flow into and through the soil rather than across the surface. According to the Soil Research Laboratory in San Diego, EssentialSoil™ has "reduced runoff volumes (31%). A high reduction in erosion (98%) appears to indicate that the product can retain water within its matrix without creating instability." Even after a "50 year storm event was applied after three successive 10 year storm events (7 inches precipitation over 41 hours on 12 inches of bare soil) there was NO erosion, and water was retained in the soil at a high rate" (45%). Conjointly, moisture is retained through innumerable micro-aggregates composed of fine organic matter and micro "dam" building microbes. The soil becomes its own 3-dimensional biological and geotechnical net. Dr. Elaine Ingram of Soil Foodweb wrote in April 2000, that the stand alone product "will result in nutrients remaining in the soil, instead of leaching into surface and ground water...and EssentialSoil™ will lead to improvement in water-quality in urban and suburban areas." Further she wrote; the soil..."will enhance disease-suppression, nutrient-retention, nutrient-cycling and soil structure building organisms." Hendrikus Schraven Landscape Construction & Design has been able to reduce watering schedules as much as 70% on lawns in the North West Region.

Global Applications

Combined with EssentialSoil™, grading plans can incorporate steeper slopes and some engineered retaining walls may be shortened in height. Planting designs can be expanded because the soil, even on steeper slopes will permit and support larger and more diversified plants. Mines and barren land reclamation can be reforested without waiting for nature to rebuild its own soil. Durable and high infiltration ball fields, golf courses and turf applications can be designed and maintained without herbicides, pesticides and chemical fertilizers that pollute groundwater. Highway road cuts can be built to be free from freeze-thaw damage using a permanent cover of bio-stable soils. Logging and clear cut areas can accelerate their reforestation process. Sedimentation can be reduced into our shorelines and water bodies.

The product represents a method of organic soil replacement for erosion control: a form of "bio-terra" technology whose goal is to generate thick organic living soils that would take nature 100 to 1,000 of years to create....in only one day. Aware of all the opportunities and potentially global significance for EssentialSoil™ Hendrikus Schraven invites responses and collaboration from many different professions, Landscape Architects, designers, engineers, biologists, politicians and policy makers from every region.

The time for expanded thinking and new technology in the area of erosion control is at hand. The rate of "soil erosion in the USA is approximately 17 times the rate of which it forms; and approximately 90% of US cropland is currently loosing soil above the sustainable rate" (US Global Change Research Information Office). It is time to work together, to combine technologies and invent new ones, to solve some of the critical problems we are now facing. 700400

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soils between latitudes 72 degrees North and 57 degrees South have been degraded by human activities - 7% through loss of soil nutrients and/or organic matter (mainly in Africa and South America), 4% because of soil salinization (mainly in Asia), about 3% by physical deterioration (compaction, sealing and crusting), and 1% by soil pollution, the latter two mainly in Europe.

• In 1987, it was estimated that about 3.9 billion metric tons of soil are lost each year through the processes of wind and water erosion. About 70% of the total is eroded from agricultural land.

• Desert winds carry more fine sediment than any other geological agent: the Sahara probably moves 60-200 million tons/yr of dust.

• Dust storms remove large quantities of surface sediments and topsoil with nutrients and seeds: in the 1930s, drought and dust storms create the 'Dust Bowl', greatly reducing agricultural production on the North American prairies.

• Wind-borne dust, especially where the grain size is less than 10 microns, and salts are known hazards to human health.

• Wind and water erosion in the U.S. causes $17 billion annually in on-site damage, such as lost soil nutrients. When off-site damages like siltation, drainage disruption, flooding, and undermining of foundations, pavements, and roads are added in, the figure rises to $44 billion per year. It is estimated that controlling erosion on U.S. cropland would cost only $8.4 billion per year - a better than 5-to-1 cost-benefit ratio.

• Wind speeds of more than 5-10 m/sec are required for entrainment. Thresholds are strongly affected by the character of the ground surface and the vegetation cover.

• The soils of boreal regions are estimated to hold the equivalent of some 60% of the current atmospheric carbon: long-term warming is expected to increase decomposition and drying, thus potentially releasing huge volumes of methane and CO2.

Statistics provided by The U.S. Global Research Information Office. Visit www.gcrio.org for more data.