LAND DEGRADATION & CONSERVATION - A CHALLENGE FOR SURVIVAL

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INTRODUCTION

The background to this presentation is from information presently available from various data sources, viz. a comprehensive detailed study, called Agriculture : toward 2000 of the future of world food problems in 90 developing countries that has been done by the Food and Agriculture Organization of the United Nations (FAO) and recent World Bank estimates. The FAO points out that in 17 of these countries, in which half the population lives, more than 90 percent of potentially cultivable land is already in use. "By the end of the century", the report concludes, "shortage of land will have become a critical constraint for about two-thirds of the population of the developing countries". Between 1980 and 2000, the amount of arable land available in these countries will fall from 0.37 to 0.25 ha/head of population (this figure of natural resource availability per capita for Sri Lanka in mid - 1980s was 0.4 ha/person). Nevertheless, the report concludes that agricultural production could be doubled in these 90 countries by the end of the century. If so, malnutrition would be greatly reduced, though still not eliminated. About 14 percent of the increase would have to come from cropping land more often, 60 percent from improving yields and 25 percent from bringing 150 million ha of new arable land into production. This means increasing the area of cultivated land by 20 percent, from 750 to 900 million ha.

If this rate of expansion were continued until the middle of the next century, virtually all the potential arable land would be cultivated. Only 18 of the 90 developing countries, containing 5 percent of their total population would have any significant areas still to be brought into arable farming. Such is the pressure of increasing demand for food and fibre on land resources. Unhappily, the situation is worse than even this scenario suggests because no mention has yet been made of what is the critical factor : land degradation.

LAND DEGRADATION

Land degradation denotes all natural or anthropogenic processes that diminish or impair land productivity. Natural processes include climatic changes and accelerated intensity of winds and waves. Among the anthropogenic factors, over-use of land and water, deforestation, excessive use of agro-chemicals, and careless disposal of wastes often degrade land. In Sri Lanka, man-induced land degradation is more significant than natural forces. It is manifested through high rates of soil erosion and siltation, landslides, floods, emerging problems of salinization, coastal erosion, and loss of productivity of agricultural lands. According to FAO, the world is currently losing between 5 and 7 million ha of good land per year because of degradation. Even assuming that the current rate of land degradation does not increase, this amounts over 20 years to a loss of between 100 and 140 million ha of land - a figure which is comparable to the amount of new land which it is suggested be brought into cultivation over the same period. In other words, cultivated land is being lost at nearly the same rate as new land must be brought under cultivation. In order to mitigate the effect, soil and water conservation measures should be extended to a quarter of all farm land by the end of the century, and that flood control should be extended to 20 million ha. The alternative is famine.

CAUSES OF LAND LOSS

Land degradation is an insidious process - rarely is land in full production one year and out of production the next. Instead, crop yields begin to fall as degradation proceeds. Eventually, the use to which the land is put also changes-arable land becomes pasture, pasture becomes scrub, and finally the scrub becomes barren. The end result is indistinguishable from a simple loss of land.

Much good crop-land is currently being converted to non-agricultural use. Urban expansion and road-building are the biggest culprits but mining, industry and recreation also play a part. Unfortunately, it is the best crop-land which usually disappears.

There are four other ways in which land is degraded:

1. Build-up of salts - If topsoil becomes too saline or too alkaline, its productivity falls. One way in which this can happen is when poorly drained land is irrigated in hot climates. The sun evaporates the surface water, leaving behind the salts. At the same time, inadequate drainage causes the water table to rise, bringing salt water into contact with plant roots. In the mid-1970s, FAO estimated that 952 million ha of land were affected by salt. Salinity problems are often associated with waterlogged soils and the area of land currently being abandoned every year owing to salinization and waterlogging is roughly equal to the amount of land being reclaimed and irrigated. Worldwide, about 40 million ha out of a total of 200 million irrigated ha are either waterlogged, affected by salt, or both.

2. Physical and biological damage - Soil may be physically damaged when it is repeatedly worked with he avy equipment in wet weather, or when it is compacted around water holes in pasture land, particularly i n Africa. It is difficult to return compacted soil to full productivity and deep-rooting crops may have to be selectively planted to break up the 'pan'. Biological damage occurs when soils are deprived of their essential fertilizers and of their organic matter or humus content. The former can be replaced by artificial fertilizer, the later cannot. Crop rotation and good farming practices are the solution.

3. Wind erosion - Large areas of the world are affected by wind erosion, one of the key causes of desertification. Wind erosion occurs when soil is left bare of vegetation and is particularly severe in arid and semi-arid areas following over-stocking and over-grazing.

   Not only can the wind strip top soil from good land but it causes extra damage by burying land, buil dings machinery and fences with unwanted soil. Under the worst conditions, as much as 150 tonnes of soil can be blown-off one hectare of land in an hour.

4. Water erosion - The commonest form of erosion, it is causing massive damage in nearly all developing countries. It is found where steep land is being unwisely farmed and where gently sloping land is left exposed to the effects of heavy rain for any length of time.

   Worldwide, about 25,000 million tonnes of soil are being washed away each year, ending up in the riv ers and finally the oceans.

HOW EROSION HAPPENS

Soil is a country's most precious natural resource, aptly described as "the bridge between the inani mate and the living". It consists whethered and decomposed bedrock, water, air, organic material formed from plant and ani mal decay, and thousands of different life forms, mainly micro-organisms and insects. All play their part in maintaining the complex ecology of a healthy soil.

In the humid tropics, starting from a sandy base, a soil can be formed in as little as 200 years. But the process normally takes far longer. Under most conditions, soil is formed at a rate of 1 cm every 100-400 years, and it takes 3000 to 12000 years to build enough soil to form productive land.

This means that soil is, in effect, a non-renewable resource. Once it is destroyed, it is gone for ever. Although soil erosion does occur naturally, the process is slow. Man has increased the rate of natural erosion by at least 2.5 times and, over the centuries, has destroyed an estimated 2000 million ha of land.

Soil erosion occurs primarily when land is exposed to the action of wind and rain. Unprotected by a cover of vegetation, and the binding action of roots, each raindrop hits the naked soil with the impact of a bullet. Soil particles are loosened, washed down the slope of the land, and either end up in the valley below or are washed out to sea by streams and rivers.

With reference to Fig.1, the most insidious form of erosion is called sheet erosion and occurs when the whole surface of a field is gradually eroded in a more or less uniform way. The process is insidious because it is not immediately obvious that soil is being lost. The only evidence of sheet erosion may be that the roots of trees or crops, or the bottoms of fence posts, become increasingly exposed. Yet by the time a farmer notices such things, he may have lost tens of tonnes of soil per hectare. On an average field, a farmer who loses just 1.5 cm of topsoil - barely enough to notice - will have lost about 190 tonnes of soil per hectare.

Rill erosion can occur on steep land or on land which slopes more gently. Because there are always irregularities in a field, water finds depression in which to settle and low-lying channels through which to run. As the soil from these channels is washed away, rills or miniature gullies are formed in the field. Their presence is not always obvious because they are small enough to be ploughed or harrowed back into the land. Rills can develop into gullies but even as rills they represents a serious loss of soil.

On steep land, there is often danger of the formation of gullies. Water running downhill cuts a channel deep into the soil; a gully head, where there is a sudden fall, forms at the low end but gradually works its way b ack uphill. As it does so, it deepens and widens the scar which the gulley makes in the hillside. Eventually, what started as a trickle of water, often down a path used by men or animals, can turn into a chasm tens of metres deep and hundreds of metres wide. Gully erosion is related to stream-bank erosion, in which fast-flowing rivers and steams progressively cut down their own banks.

Wind erosion occurs when the land surface is left bare in regions which are arid enough to allow the soil to dry out and flat enough to allow winds to work their way over several consecutive days. Once wind erosion starts, the moving soil particles accelerate the process, acting like a sand-blaster on what might otherwise have been a sta ble soils surface.

Water erosion causes two sets of problems: an 'on-site' loss of agricultural productivity; and a dow nstream movement of sediment, causing flooding, a loss of river navigability and the silting up of reservoirs.

PREVENTION AND REPAIR

Soil conservation is not a negative activity, involving huge expenses and small returns. Soil conservation is positive: even in the short-term it results in substantial increases in agricultural production and, in the lo ng-term, it ensures the continued productivity of the most important natural resources.

Without human intervention, soil erosion is usually extremely slow. Rapid erosion, of the kind prevalent in many developing countries, is caused by land-use patterns and farming techniques which are unsuited to th e land in question. Perhaps the land is being worked beyond its capabilities; perhaps the wrong crops are being grown; or perhaps the farming techniques are inappropriate for the soil type.

Whatever the case, inappropriate land use has two results. One is that agricultural yields is inevitably below the maximum that could be obtained. The second is that erosion soon follows and accentuates the problem. In other words, these three factors - erosion, yield and land-use - interact in a vicious circle. When the wrong crop is selected, or the wrong farming techniques chosen, yield inevitably, drops. Erosion follows, and reduces yield still further. Finally, the land is degraded and goes out of production.

It follows that as soon as the causes of erosion are corrected, two results ensure: erosion stops an d yields increase. There can be no more encouraging conclusion, for both planners and farmers. In conservation, getting things right pays double dividends.

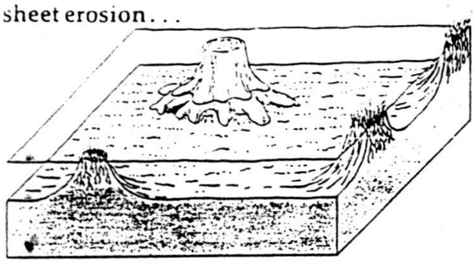
Fortunately, getting things right is not as difficult as it is in other areas of development. The causes of soil erosion are well known. So are the techniques with which to combat it. Soil conservation has been regarded as an important science since the devastating effects of wind erosion became apparent in the United States in the 19 30s. Over the decades, the battery of techniques which is available to control erosion has been steadily developed and expanded. These techniques fall into two categories.

The first known as the biological techniques of erosion control. They have little to do with engineering. Instead, they involve a fundamental assessment of the suitability of the crops being grown and of the techniques b eing used to farm them. Very often, getting both these things right will bring erosion under control by itself. Even if not, it will certainly reduce the amount of expensive physical work which has to be done.

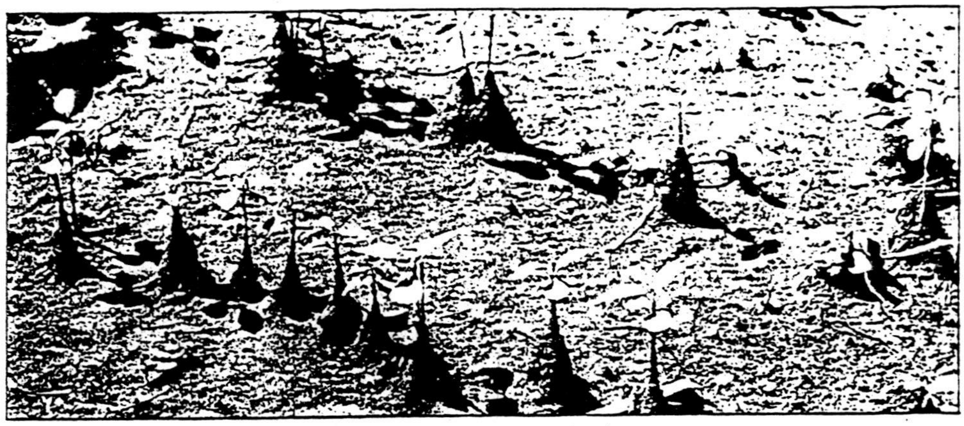
The second category is the physical techniques, such as the many different forms of terracing which now exist, methods of gully control, dams for controlling flood water and siltation, and overall watershed management. The physical techniques are not cheap, either in terms of manpower or its mechanical equivalent. However, as the illustrations on these two pages show, (Fig. II & III), their effects extend far beyond the immediate terrace or gully dam which is being constructed.

The successful control of erosion affects everyone. Ultimately, national development plans can succeed or fail according to the success achieved in controlling erosion. A nation without soil is effectively bankrupt. A nation with appropriate land-use patterns and farming techniques, where erosion has been controlled and containe d, is poised on the springboard of development.

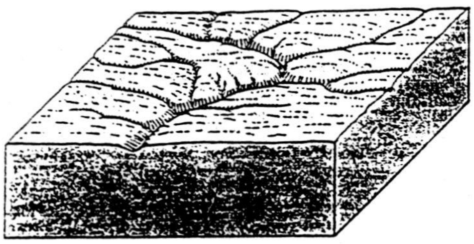
sheet erosion . . .



. . . is the more or less uniform erosion of the whole surface of a field. The roots of plants, tree roots and fence posts are increasingly exposed

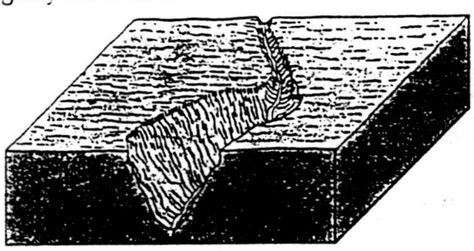


rill erosion . . .

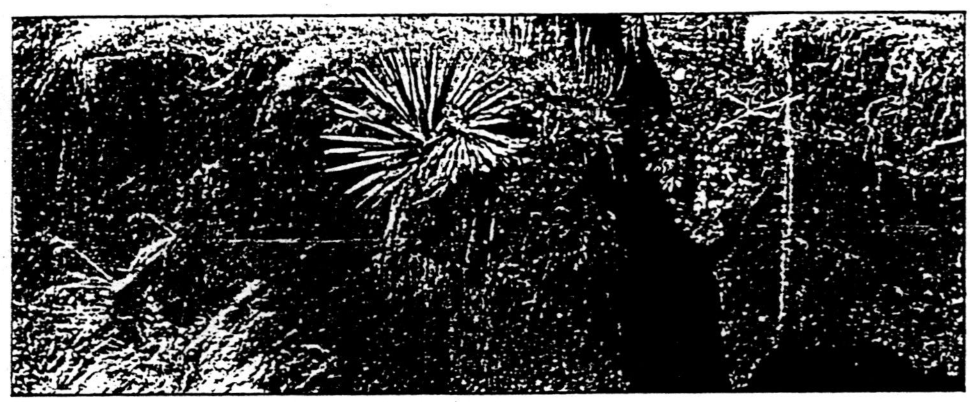


. . . is the accentuation of natural depressions caused by surface run-off. While normal cultivation often hides the damage, much fertile soil is still lost

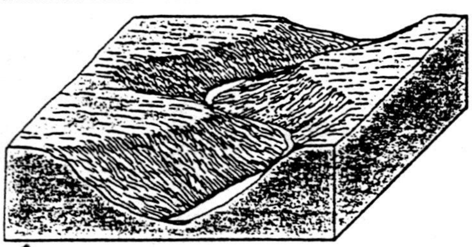
gully erosion . . .



. . . causes deep fissures in otherwise cultivable land. If left unchecked, gullies eat their way progressively back into the hill



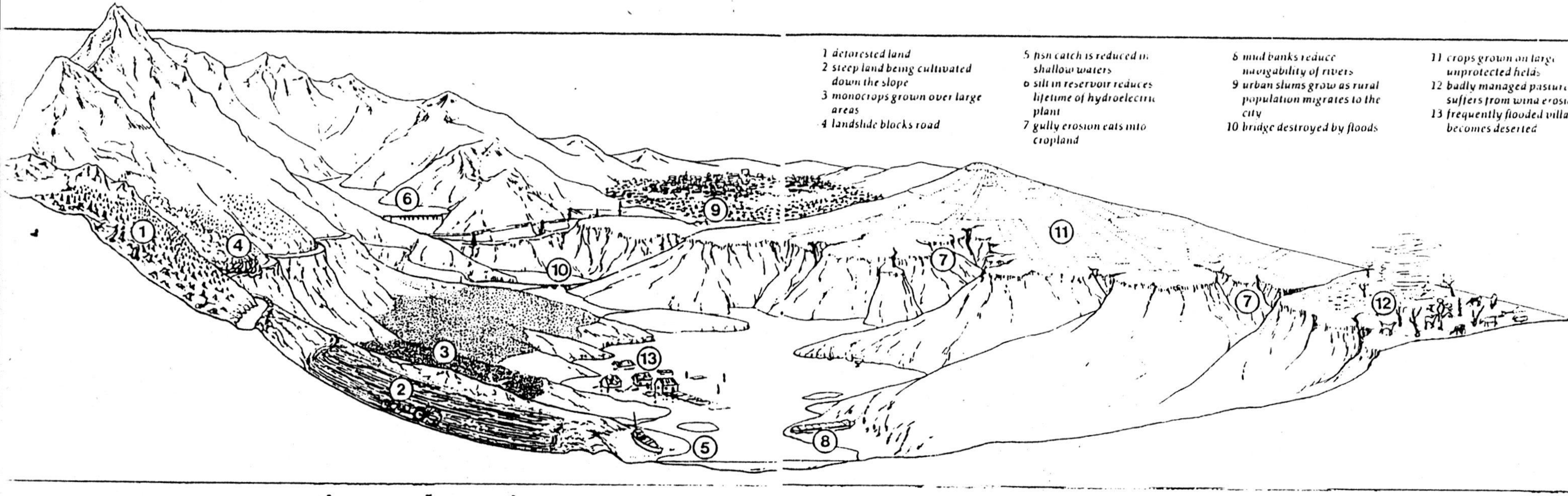
streambank erosion . . .



. . . converts deep, fast-flowing streams into wide and sluggish meandering watercourses with extensive mud banks. It can cause serious loss of cultivable land

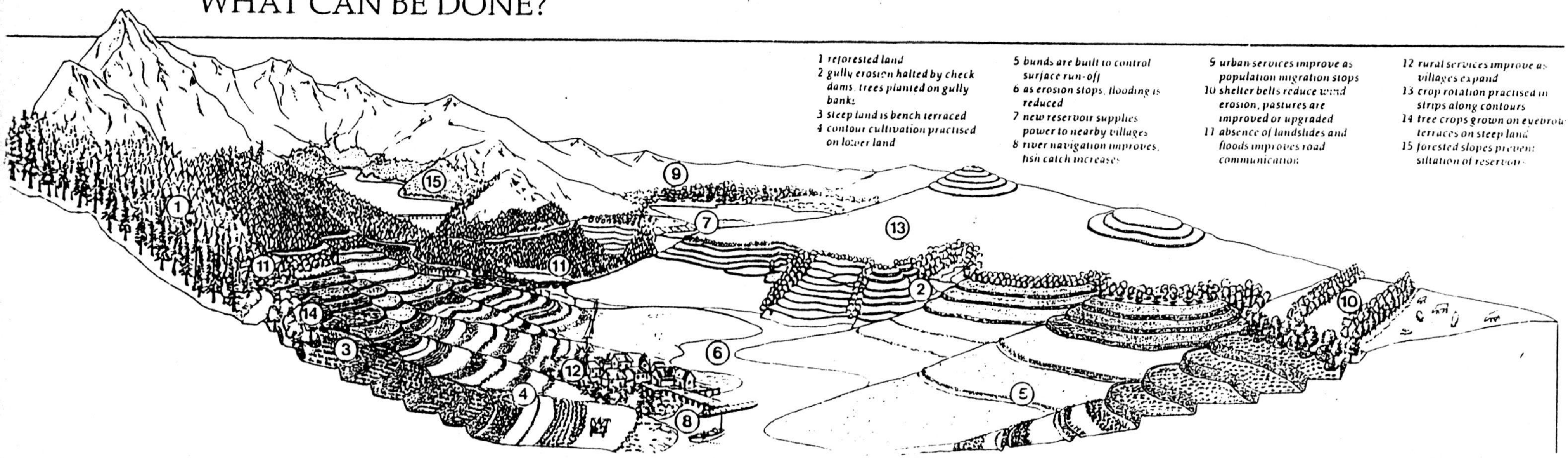
Fig. 1 FORMS OF SOIL EROSION

Fig.II THE CONSEQUENCES OF EROSION



1 deforested land
2 steep land being cultivated down the slope
3 monocrops grown over large areas
4 landslide blocks road
5 fish catch is reduced in shallow waters
6 silt in reservoir reduces lifetime of hydroelectric plant
7 gully erosion eats into cropland
8 mud banks reduce navigability of rivers
9 urban slums grow as rural population migrates to the city
10 bridge destroyed by floods
11 crops grown on large unprotected fields
12 badly managed pasture suffers from wind erosion
13 frequently flooded village becomes deserted

Fig.III prevention and repair WHAT CAN BE DONE?



1 reforested land
2 gully erosion halted by check dams, trees planted on gully banks
3 steep land is bench terraced
4 contour cultivation practised on lower land
5 bunds are built to control surface run-off
6 as erosion stops, flooding is reduced
7 new reservoir supplies power to nearby villages
8 river navigation improves, fish catch increases
9 urban services improve as population migration stops
10 shelter belts reduce wind erosion, pastures are improved or upgraded
11 absence of landslides and floods improves road communication
12 rural services improve as villages expand
13 crop rotation practised in strips along contours
14 tree crops grown on eyebrow terraces on steep land
15 forested slopes prevent siltation of reservoirs