Introduction

1. INTRODUCTION

1.1. GENERAL

"Soil degradation in its broadest sense is one of the major problems facing the world at this moment... The soil is, and will for the foreseeable future be, the basis for food production... Obviously there is going to be much greater pressure on the land." This excerpt from a FAO-publication (1983) shows the seriousness of the problem of soil degradation, of which erosion is a major part.

Erosion includes all processes that result in the physical wearing down of the surface of the earth. Erosion processes are complex, consisting of "natural" (geological) erosion and "accelerated" (man induced) erosion (CARSON 1985).

The problem of erosion is especially acute in Nepal for the following reasons:

- Natural erosion rates are very high because of the constant tectonic uplifting of the major mountain ranges and consequent downcutting of the river systems. The net result of these unrelenting forces are unstable slopes that cannot maintain their river-canyon form. Natural erosion is characterized by different forms, particularly rock failures, landslides, slumps, riverbank cutting and gullying.
- Pressure on limited land resources by the steadily growing population results in increased land degradation due to forest clearing, overgrazing, poor maintaining of marginal arable land, and fire. The resulting accelerated erosion is mainly characterized by the loss of topsoil by sheet and rill erosion and gully building (SHARMA 1974, LABAN 1978, NELSON 1980, IVES and MESSERLI 1981, KIENHOLZ 1981, KIENHOLZ et al. 1983).
- Increasing activity in construction work, such as dam and road building, is also an important cause of land degradation. This will grow in importance with the advancing development of the country (NELSON 1980).

1.2. FACTORS CONTROLLING EROSION

Loss of topsoil by surface erosion is the direct result of heavy rains pounding unprotected soils. This erosion consists of two stages: first the separation of the soil particles, and secondly their transport or removal by runoff. The cumulative effect is the impoverishment of the soil base. It is necessary to develop a method whereby surface erosion can be quantified. The major physical factors controlling the rate of erosion by water are (FAO 1983):

- Rainfall: The power of rainfall to produce erosion (i.e. its erosivity) is related to its amount, intensity and distribution, and is therefore a factor of climate.
- Vegetation and soil cover: Where there is a growth of vegetation, the parts above ground intercept and absorb the force of the rainfall, and the amount of energy thus intercepted and neutralised is directly proportional to the amount of land surface covered by the vegetation. In addition, fallen leaves, etc. and plant roots protect the soil and improve its structure, infiltration rate, and moisture storage capacity, and retard runoff. Vegetative cover also influences the effect of sun and wind on the soil surface and this in turn affects its erodibility.
- Soil: Soils vary in their resistance to erosion (their erodibility). Part of this is inherent in the soil, and is related to texture (mainly clay content) and amount of organic matter, and part depends on soil condition and depth. A soil with a well developed and stable crumb structure will resist particle separation longer, and will also absorb rainfall faster, thus reducing the amount of destructive runoff. Runoff will also tend to be reduced in proportion to the depth of a soil. It is also evident that the more fertile and less degraded the soil, the greater its ability to produce and support an effective vegetative cover.
- Topography: The degree of land slope has a very strong influence on the amount of erosion. Soil losses from steep slopes are much greater than from gentle slopes. Length of field and slope is also important. Surface roughness will retard runoff and decrease its quantity.
- Aspect: In some climates, and particularly when land slopes are greater than 3%, there is a relationship between the amount of erosion and the aspect of a field or the geographical direction it faces.

Scientists have developed a number of regional assessments characterizing soil erosion in Nepal (see Ref. in CARSON 1985, LAUTERBURG 1985). Such exercises are difficult to carry out because of the extreme variability found throughout the country. Rainfall erosivity, wind velocity, aspect, slope, bedrock type and characteristics, land use, forest type and condition must all be considered in the prediction of surface erosion.

Surface and topsoil erosion caused by rainfall can be estimated by the use of the Universal Soil Loss Equation (U.S.L.E.) (WISCHMEIER and SMITH 1978).

Briefly the U.S.L.E. is A = RKLSCP,

where A = the amount of soil loss in tons per ha

R = Rainfall erosivity

K = Soil erodibility

LS = Slope length and steepness

C = Cropping management

P = Erosion control measures

The Universal Soil Loss Equation was developed for gently sloping agricultural land in America and direct applicability to the mountainous regions of Nepal cannot be assured (FLEMING 1978, IWM 1980).

The aim of the investigations in hand is to observe the natural successional regeneration of vegetation in landslides and slopes. The connection between plant cover and amount of runoff and soil loss on steep slopes is examined. In conclusion the possibilities of decreasing erosion and stabilizing slopes by plant cover are discussed.