



An Appraisal of Soil Erosion in Dehradun Valley

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Abstract: In the recent past, there has been a very rapid increase in the developmental activities in the Himalayas in general and Dehradun Valley in particular. These comprise large-scale construction, roads, mining activity, overgrazing, deforestation etc. leading to the land degradation. A near exponential population growth has placed a further heavy demand on already limited natural resources. High rainfall coupled with fragile rocks and good relief provides a dense network of stream system. The debris from landslides and mine waste cause inequilibrium in flow regime causing meandering in both mountain and valley streams. These problems pose serious threat to environmental and ecological balance in an already fragile eco-system. Landslide, river sedimentation, disruption to communication lines and depletion of water sources are some of the direct consequences of mass erosion problem. The effect of majority of casualties and other natural hazards due to mass erosion often disrupts economic and social fabric over a much wider area than the hazard site and prompt action is required in order to minimize these losses. There are several mass erosion problems but landslides, mine spoil stabilization and stream bank erosion problems are dominant and therefore selected for the present study.

Index Terms: Deforestation, Erosion, Landslide, Overgrazing, Quarrying, Remedial Measures, Run Off, Soil.

I. INTRODUCTION

The Denudation of the soil cover and subsequent washing down is described as soil erosion. There are two causes for soil erosion are human activities and natural factors. The Dehradun Valley in the foothills of the Himalaya is bounded by Lesser Himalayan Rocks in the north and Siwaliks in the south and transversely bordered by the Ganga in the South - East and Yamuna in the North - West forms an intermountain valley eco-system extending from 29° 55' - 30° 30' N Latitude and 75° 35' - 78° 20' E Latitude with an area of about 2700 sq ranging from

330 m to 2710 m altitude above m.s.l. The steeply sloping Himalayan ranges in the north of the Dehradun Valley are internally unstable and are susceptible to landslides. About 20% of the area are classified as having severe erosion due to landslide hazards. 4-10 landslides and 8-20 slumps per sq. km., engulfing an area of about 5-20 ha have been reported by Saxena et al., (1995). The limestone found in the Dehradun Valley area is of very high grade with 92-95% purity, and has a ready off-take by industries. There has been extensive mining for limestone in the area for the past three decades from the 60 odd open cast mines spreading over a length of 40 km covering an area of about 1400 ha with an annual turnover of around 1.1 million tones. The heavy debris and silt from the mined spoil sites have destroyed the irrigation system and pasture land resulting in drastic changes in the life style of people in these valley catchments. Mining in Dehradun Valley reduced food production by 28%, water resources by 50% and livestock production by 35% (Anonymous, 1988) apart from environmental degradation problems.

II. MAJOR FACTORS LEADING TO LOSS OF SOIL COVER

A. Landslides

Landslide is a downward movement of a mass of rock or soil because of slope failure. The main reason for landslide occurrence is gravity force involving failure of the earth material under shear stress i.e. when the shear stress exceeds the shear resistance of the soil mass. The landslide adversely affect utility services like roads, power generation units, dams, reservoirs, human settlements, agriculture, forests pastures orchards, trade, tourism and all other developmental, cultural and economic activities.

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B. Stream Bank Erosion

In Dehradun Valley, foothills of the Himalaya and Siwaliks hills torrents cause extensive damage to life and property as a result of frequent changes in their course and associated flash flows with heavy debris loads. However when the streams reach the relatively flat valleys, their debris carrying capacity diminishes due to drastic reduction in flow velocities and the debris is deposited in the water courses in form of gravel bars and islands. As a result, the flow tend to braid and migrate laterally over topping and undermining the low erodible banks and affecting the adjoining lands utility services such as roads and bridges etc.

In Dehradun Valley proper and Siwalik ranges, torrents damages are extensive and are showing a menacingly uprising trend. The torrents are in facts downstream manifestation of the upstream causes of land mismanagement. Many of the perennial water have turned in sediment – laden torrents because of unscientific land use and over exploitation of the resources.

In Dehradun Valley the area affected by soil erosion is about 20000 to 240000 hectares (50000 to 60000 acres). The main causes of soil erosion (Khan, 1951) are discussed in the following paragraph:

1) Soil Depletion

The increasing pressure on the land disturbs the natural balance between soil formation and soil conservation on the one hand and soils erosion on the other hand. It is function of soil and water conservation measures to restore and maintain the balance. The Dehradun Valley in constantly subjected to severe soil erosion due to deforestation, quarrying, flood water logging, runoff, land sliding leaching and soil creeping and these lead to the depletion of soil, water, forest, mineral and climate resources.

2) Soil Depletion and Run off

The Dehradun Valley is under well-defined drainage and has the maximum runoff during rainy season causing severe erosion. Evaluation of any conservational practice necessitates measurements of soil loss and runoff. The details related to

Soil depletion and over following and over-ploughing under different crop combination with various systems as follows:

Minimum soil erosion (1.3 tones/hectare) occurs when giant fodder grass is grown on bare land, but on cultivated land, the contour cultivation system with maize and wheat crop combination result in minimum loss (Sexena, 1979). It may, therefore, be conclude that the land need not be left bare fallow.

3) Soil Erosion Due to Deforestation

The practice of deforestation (Planning Commission, 1963 – committee on natural resources, study on wastelands including saline alkaline and water logged land and their reclamation measures) prevails in the forest villages of the valley.

Towards Lesser Himalayan and Siwalik slopes deforestation also occurs on account of flow rainwater which washes the decomposed layers of silts, pebbles and weakens the roots due to which trees fall down. The people for either fuel or along the Ganga and Dehradun – Haridwar railway line deforestation is due to increase of settlement areas. The land under soil erosion due to deforestation is recorded to be 20% (Sexena, 1975)

4) Soil Erosion Due to Overgrazing

It is one of the constant factors responsible for the causation of soil erosion in the valley. The movements of animals generally decompose the cultivated land adjacent to the forest roads and this decomposed layers of soil is washed out during rains. The total land under soil erosion by grazing is about 7 sq.km. (2723 acres)in the valley (Anantharaman, 1981).

5) Soil Depletion Due to Quarrying

Quarrying is one of the most prominent geo factors of soil erosion. The valley has 7% of the total lime deposits of the country. The Krol formation consists of limestones, Gypsum, Marble, Dolomite and Calcite (Saxena and Anantharaman, 1978). The Krol formation extends from the Gun Hill of Mussoorie to the LaxmanJhula in Rishikesh. There are 41 quarries in this range at various places. The quarrying decomposes the soil strata, which are consequently washed out during rains. Of the total area under soil erosion 29% is depleted by quarrying in the valley and is generally found in the higher altitude.

Table I. Soil loss and run-off in the Dehradun valley

Treatment	Between June - October			Between November – March		
	Rainfall in mm	Water loss as % of rainfall	SoilLoss due to soil erosion tons/hr.	Rainfall in mm	Water loss as % of rainfall	Soil Loss due to soil erosion tons/hr.
Fodder grass	1250	27.1	1.10	173	11.4	1.10
Bare fallow	1250	71.1	42.4	173	58.7	3.55
Bare ploughed	1250	59.6	55.95	173	45.6	5.77
Natural grass	1250	21.2	1.00	173	4.1	0.03

dissected portion of the valley are given in Table 1.

Source: Soil and Water Conservation, Dehradun

III. REMEDIAL MEASURES

1. Less use of heavy machinery, to avoid unnecessary traffic routes in sensitive areas.
2. To initiate severe restriction on further deforestation in primary forest.
3. Improvement of drainage conditions to avoid physical damage from landslides.
4. To stop the soil erosion in sloppy and hilly areas area, construction of check dams is required.
5. Promote terrace farming and contour ploughing in hilly areas.

IV. CONCLUSION

Improving the vegetation cover on hill slopes, use of land according to its capability and systematic treatment of critical areas by soil and water conservation measures should be given high priority.

The mined areas, barren hill sides, stream banks, the blank community lands and under stocked forest areas require early rehabilitation through a phased afforestation program to augment the availability of fuel wood and fodder and also to restore the ecological balance, in Dehradun Valley.

Agriculture should be practiced only on land with less than 30% slope. The land having 30 to 50% may be used for horticulture / fodder development, in case the forest does not cover it. All land more than 50% slope should be brought under permanent tree cover. Urbanisation (e.g. housing colonies, rehabilitation, construction of road etc.) should be confined to relatively unproductive patches of land only.

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