

Geomorphic Processes and Environmental Degradation

R. K. Rai

*Department of Geography, North-Eastern Hill University,
Shillong*

The environmental crises of which many voices warn us is an element of many dimensions. Environmental degradation presents itself on an areal scale running from local to global and on time scale from the present to the indeterminable future point of time. The threat of crisis ranges in magnitude from deterioration of small ecosystem to the total destruction of the biosphere. Today countries all over the world and especially developing countries are affected by the impact of development and resultant environmental crisis, which are manifested in pollution of air, water and land, rapid deforestation and depletion of non-renewable resources, soil erosion, loss of top soils. Development and the environment are inter-twined issues. All developmental activities put extra demands on our natural resources and affect the environment. Land, water and air are the most important natural resources which support all living forms. Unjust economic relations (whether at international, national or local levels) lead to ecological disturbances, resource depletion and environmental degradation. These environmental crises in turn have a

disastrous affect on the development of developing societies. Environmental degradation is inevitable under the operation of natural geomorphic processes. The resultant outcome is an equilibrium state at given point of time. However, the problem becomes grave or the imbalances come into play or the equilibrium is disturbed when man interferes with the natural processes and accelerates these processes.

The chief geomorphic processes are :

1. Weathering,
2. Mass Wasting,
3. Erosional Processes, and
4. Soil Formation.

In the natural course of time, any terrain due to the impact of these processes tends to evolve landforms in a cycle, which is known as 'cycle of erosion'. But the greed of man to harness natural resources most often than not over exploits the land resources. This activity is mainly responsible for environmental degradation.

Weathering is the initial phase in the denudational history of the landscape. The surface rocks are weathered and the loose material is transported by running water. The process of erosion is very limited unless the agents of transport are carrying a load of debris.

Only a few centimetres of the soil of the land formed over millions of years due to natural denudation of rocks, is used for agriculture. But over use of land, deforestation and other mismanagement result in rapid soil erosion. It is estimated that world over in the next 20 years, an area equal to the entire cultivated area of India today (that is 140 million hectares) will be lost if soil erosion continued unabated. Nearly 5 to 7 million hectares of good agricultural land are being eroded every year all over the world. The other causes of environmental degradation of land are water-logging and salinity. As many as 175 million hectares of land constituting about 53 per cent of India's total area are subject to serious

environmental stress due to soil erosion, water logging and salinity. The total annual soil loss in India can be valued as Rs. 700 crores in terms of plant nutrient loss.

Mass wasting is an important gravity controlled movement of materials over the earth's surface. This evolves slow to sudden downward and outward movement of material, and perhaps is the most important agency that sculpture and reduce the earth's surface. Landslides are one of the major classes of mass wasting. Landslides are of profound interest to the earth's scientists, environmentalists and engineers. Landslide phenomenon is one of the most widespread and effective agent sculpturing the earth's surface. A landslide unforeseen and improperly provided for, may destroy settlements or engineering structures like road, bridges, buildings, etc. or impair their usefulness. It may also bring sudden deaths to people who have trusted these structures.

Landslides denote downward and outward movement of slope forming materials, primarily composed of natural rocks, soils, artificial fills or combination of these materials. They are more frequent where the developmental (constructional) activities have modified slope profiles, particularly making the profile segments steeper in sections. This makes the slopes unstable with a tendency to fall as and when the equilibrium is disturbed. Incidentally, all the active landslides in Meghalaya are encountered along National Highway No. 40.

Fluvial process is the most dominant geomorphic agent in sculpturing the landscape of the area. The activities of streams or running water could be either erosional or depositional. Progressive dissection and degradation of the higher lands are caused by fluvial processes. Due to erosion, different types of valleys and interfluvial ridges are formed depending on the stage of development and the lithology of the river and structure of the area.

Geomorphological Parameters

Within the contemporary concern for environmental management, many problems relate to the interaction between man, land and water. The study of natural environment frequently recognises that when man uses land, he has to accommodate its relief, materials and water resources to his purpose. The environmental management calls for understanding the geomorphology of an area before the land is used as a resource. In access, where developmental activities underestimate or ignore geomorphological characteristics, it is bound to create serious environmental imbalances. The slope characteristics, the relief of an area, the physio-chemical characteristics of soil, the hydro-geological conditions and subsurface geology are some of the important geomorphological parameters. The same parameters determine the suitability of a location for construction of dams, railways, highways, electrical powerlines, industries, townships, irrigation distribution channel net work and defence strategic installations.

Being exquisite in terms of beauty, this area possesses a huge wealth of natural resources such as forests, minerals, building materials, wild lives, medicinal plants, etc. Due to unscientific and over exploitation of these natural resources and the developmental activities, the environment is deteriorating and hence causing imbalances in ecosystem. Thus, this area is experiencing danger from the acceleration of unplanned developmental processes and exploitations.

This area, as a whole, is extremely susceptible to large scale soil erosion. Shifting cultivation on steep slopes are proving disastrous and resultant soil erosion, many areas have turned into barren hills and have become unfit for any economic agricultural use. With the increase in population and declining productive potential of land, more and more areas have been brought under cultivation and period of fallow has decreased gradually. Cutting the trees for timber,

fuel and fodder, road construction, hydro-electric power projects and other developmental projects have resulted into reduced forest area. Most of the environmental ills in the country are directly or indirectly related to deforestation. Conservation of forest wealth is, therefore, most vital for our survival. It has resulted quicker surface run-off in rainy season with ensuing soil erosion, gully development and landslide.

To highlight the effects of damage due to deforestation, an example around Barapani has been cited here. In an area of 1935 sq. kms. shows the changes in landuse pattern (Table - 11.1).

Table- 11.1 : Landuse Changes in the Barapani Area of Meghalaya (between 1910-11 & 1966-67).

Landuse	1910-11		1966-67	
	Area (Sq. Km.)		Area (Sq. Km.)	
	Total	%	Total	%
1. Forest	38.5	26.9	35.5	24.8
2. Agriculture	11.3	7.9	-	-
3. Shillong Township	4.3	3.0	9.9	6.9
4. Deforested	77.9	54.5	87.6	61.3
5. Completely Deforested	11.0	7.7	-	-
6. Lake	-	-	10.0	7.0

It is worth mentioning that in this area, the primary forest has almost disappeared. The present forest cover represents secondary pine forests only. This secondary pine forest are also under indiscriminate exploitation. As a result, large patches of deforested land is visible on the slopes and forests older than 25-30 years are not seen.

Another important factor which has endangered for the environment is the construction of roads. Though, these constructions are very essential for the development, but necessary measures and precautions are seldom taken and hence they are also treated as threat for environmental degradation. Many of these roads are unscientifically planned thus causing hillside slope and producing a huge amount of debris. The debris is allowed to slide down the slopes into the valleys and, in turn, carried away by streams, leading to rapid siltation. Moreover, the sliding of the debris destroys plants completely. Indiscriminate construction of roads, bridges, heavy building and other developmental works like canal, dam etc. must be discouraged. Such activities should be recommended only after a thorough geological analysis.

The landslides although can not be prevented or can be avoided if suitable measures are taken before a developmental scheme is implemented. They are as given below :

1. Proper guard maintenance of slope.
2. The slope cut faces should be rounded rather than making them sharp.
3. Breast and retaining walls to be made.
4. Benching and terracing of slopes.
5. Proper drainage galleries and drains to be provided.
6. Wire mesh to be provided in rock fall areas.
7. Slope profiles to be suitably modified in slide prone areas.
8. Vegetation cover along the highway areas not to be disturbed.
9. Total ban on agriculture, grazing and additional residential construction activities along both sides of highways.

Considering serious nature of the consequences in the fragile ecosystem of the area, there is need of identifying the geo-dynamically vulnerable area on the basis of geological structures, lithology, nature of topography and vegetal cover for the better environmental management.

There is a need to re-establish the harmonious relationship between man and nature. The main objective of forest management should be soil and water conservation along with other natural resources like timber, vegetal cover, wild life etc. Deforestation should be stopped and afforestation must be resumed.

Environmental awareness should be a part of education to achieve wider participation of local people so that a continuous flow of technically skilled personnel would be available at village level for extension activities. Jhumming should be stopped and alternatives should be sought out. In reviewing the overall situation, a very systematic appraisal of soil, minerals, forests and water is warranted. The environment must be preserved. Deforestation should be stopped and afforestation should be encouraged. The national environmental awareness campaign should be taken up in this area on a large scale which would help in increasing environmental consciousness among the people of this area.

The non formal methods of environmental education can play a crucial role in developing an awareness and consciousness among the masses.
