Chapter 11
Soil Quality Assessment at Nganglam, Bhutan

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ABSTRACT

The study area considered for environment impact assessment (EIA) studies is an area covering 5 kms radial distance from proposed plant site in the foothills of Himalaya at Nganglam, Pemagatshel, Bhutan. Analyzing the soil samples collected from six locations in the study area has assessed the soil characteristics in the study area, especially the extent of pollution undergone by the soils due to various sources and reasons. Sampling locations were chosen to represent the soil quality of the study area. A preliminary reconnaissance survey was made to get a general picture of the area’s land use. The activities around the sampling sites were also taken into consideration to learn the sources of pollution if any or factors governing the physico-chemical properties of the soil. To analyze the soil quality of the area and to assess the impact of industrial or urban activities on land environment with respect to any specific contamination, soil quality studies were carried out under EIA study.
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BACKGROUND

Bhutan has 72 per cent forest coverage, and that 20 per cent of its land is designated as protected areas, while the cultivated area accounts for only 8%. Pastures account for nearly 4% of the total land. Usable land is severely limited due to rugged and mountainous terrain and vast areas of snow and rocks (SIIR, 2009). As in other parts of the world, Bhutan is also experiencing land use changes due to a number of activities - both man-made as well as natural. Land degradation in the country is mostly manifested in the displacement of soil material through water erosion and internal biophysical and chemical deterioration. The rising population has aggravated the situation and will further worsen it if timely counter measures are not taken. Soil quality is simply defined as “the capacity of a specific kind of soil to function”, i.e. mainly to provide nutrition to plants and absorb the drain water (Bharti, 2007). The different properties of soil are - texture, moisture, fertility (level of nitrogen, phosphorus, potassium) and pH level. The pH is the measure of a soil’s acidity or alkalinity. Each of these properties depends on different factors. For example, soil moisture depends on climate, topography and other soil characteristics. The temperatures of soils vary depending on their water holding capacity. Soils with low water holding capacity are warm (Bharti & Chauhan, 2013; Bharti & Singh, 2013; Chauhan & Bharti, 2015; Ezeaku & Bharti, 2015). The most significant environmental problems in Bhutan were soil erosion and water pollution. The erosion of the soil occurs because 50% of the land in Bhutan is situated on mountainous slopes, which are subject to landslides during the monsoon season. Soil represents the loose and unconsolidated materials derived through the breaking down of rocks. The soil is a natural body of animal, mineral and organic constituents differentiated into horizons of variable depth, which differ from the material below in morphology, physical make up, chemical properties and composition and biological characteristics (Bharti & Chauhan, 2017; Bharti, 2013a; Bharti, 2013b; Bharti, 2013c). The comprehensive study of soil system in terms of its contamination with a toxic chemical is of vital significance because it is an integral part of the bio-geographic system. Land environment study is an important study for prediction of various impacts due to industrialisation and urbanisation. The impact of pollutants on soil quality may be a rather slow process but it can sometimes cause concern in the long run (Bharti et al., 2013a; Bharti et al., 2013b). The fall out of heavy metals and other pollutants present in the smoke and dust emitted from industries, traffic and other sources may get accumulated in the soil and ultimately affect the trace metal concentration. Such accumulation could also prove to be beneficial to plant growth but beyond a certain limit, the pollutant concentration may be deleterious to the vegetation. Studies were carried out in the study area, for estimation of physico – chemical characteristics of the existing soil.
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