

**PART – TWO**

**PROBLEMS AND PROSPECTS OF  
PHYSICAL ENVIRONMENT OF  
AGRICULTURAL RELEVANCE**

## **CHAPTER – EIGHT**

### **Geology Including Rocks Composition, Soil and Agriculture (Existing)**

#### **8.0 Geology**

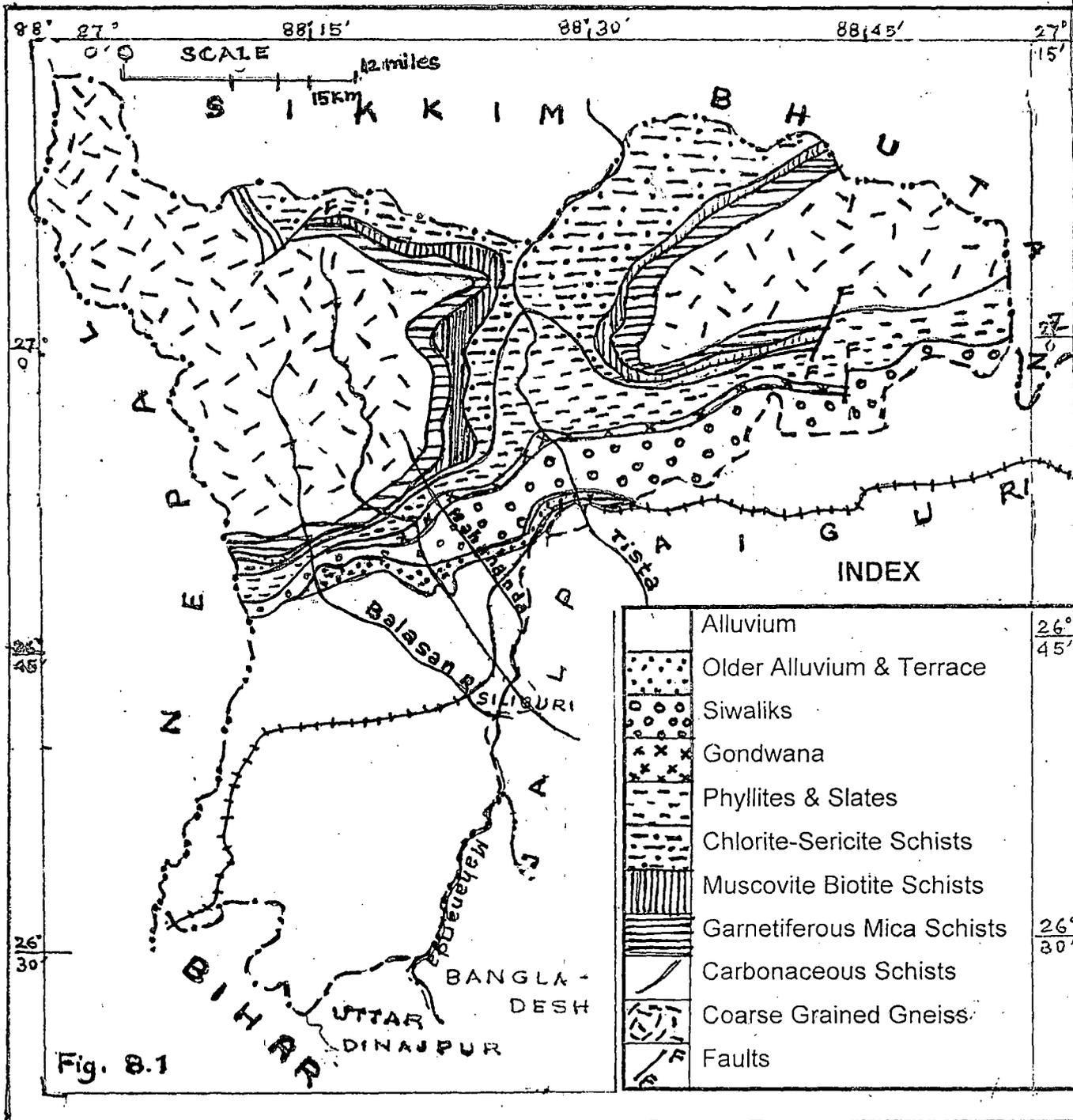
##### **8.01 Geology, Soil and Agriculture**

Since my particular study area of this thesis is Darjeeling district so from this chapter onwards I will only focus my study in Darjeeling district. Any agricultural operation is intimately related to soil, which has its historical and natural background in its formation. It is formed as a result of a complex combination of the interaction of rocks, macro and micro organisms of zoological and phytological worlds, climate, relief and production activities of man. Soils are formed by the weathered igneous sedimentary and metamorphic rocks. When this weathered fine materials begin to support plant life, the chemical and physical changes in it are accelerated and brings revolution in the agricultural world. It is quite relevant to mention that the agricultural activity particularly its production is fully dependant on geology from which specific productive soils are derived.

Keeping in mind the above-mentioned point, we will discuss about the rock characteristics and related soils of Darjeeling district, which ultimately play a vital role in flourishing its agricultural activities. Most silt loam soil and mature soil are more productive than sandy soil and mature soil are more productive than soil that is either geologically young or very old. It should be remembered that productivity of the particular soil is partly determined by the way it has been managed in cultivation. So productivity of Darjeeling district has been analysed in terms of its relation to management and treatment as an investment, as good management and some soil treatment system increases the efficiency of the soil in fulfilling crop requirements and protect the soil from drainage and erosion. This is depicted on the map prepared

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## Geology



on the basis of superimposition of these parameters, e.g. rock, climate and soil and analysed its relationship with the crop productivity potentiality. Figure 8.1 depicts geology of Darjeeling district.

Geographically Darjeeling belongs to the plains of India but geologically Darjeeling hills can be divided into three zones viz. – an outer belt of Siwalik frontal range, a medium narrow belt of Gondwanas and an inner range of metamorphites.

The low hills of the Siwaliks formations lying below 937 m. are composed of pebble stone in the upper levels and sand stone in the lower levels. Clay stones, shale and stills tone alterations are minor but these gain abundance in the lower part of the area. Soils derived from these groups of rocks are sandy loam with little humus.

The narrow belt of Gondwana formation gives rise to a low range rarely exceeding 750 m. lying in between higher hills of the Siwaliks and there of the metamorphites. This formation is composed of coal, seams clay sandstones and shales.

The hill ranges of the inner belt are 1000 to 2500 meters. The outer zone of the inner belt is occupied by the Dalings, which gradually give place to the Darjeeling genisses in the upper levels. This series of consists of slates schists, phyllites and quartzites, similar groups of rock occur from the Niora river to Jaldakha river in the Kalimpong division known as Buxa series. This group consists of dolomites, slate, phyllite, schists and orthoquartzites (Lahiri, 1957)<sup>1</sup>.

The physical configuration of Darjeeling varies from a wide range of alluvial plain, terai Duars to the mountainous areas of the Darjeeling Himalaya or the lower Himalayan range. In terms of geological era, this region is the product of very recent times.

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<sup>1</sup> Lahiri, S., 1957: Influence of Physiograph on the location and landuse of the tea gardens of Darjeeling.

The greatest difference in relief has brought about difference in climate, natural vegetation, drainage and soil character. All these factors together influence the agricultural practices in the Darjeeling district.

Soil conditions of Darjeeling hill is acidic. The brown forest soil of the area contains medium to high level of organic matter – nitrogen (N), phosphorous (P) and potassium (K).

In Siliguri sub-division of Darjeeling district, soil is leached, light acidic with low organic carbon. Good drainage offers scope for cultivation.

The agricultural pattern in Darjeeling hill area is somewhat different from that of the plain areas of the district. This is mainly because of the physical constraints in the hill area.

The hilly areas of the Darjeeling consists of a landscape with rugged terrain full of ridges. The mountainous are made of folded rocks piled one over another by a series of north-south horizontal compressions. The pre-Cambrians or the crystalline basement of the Himalayas belong entirely to what was originally the northern borders of India built up the metamorphosed rocks of Aravallies. In Darjeeling they are called the Darjeeling gneiss and Debeng series.

The Darjeeling district may be divided into four tracts viz. the hard rocks area, the Bhabar belt, the Terai belt and the alluvial plains. The southern portion of the hard rocks area is covered with sedimentary rocks and the northern part is composed of metamorphic rock. The Bhabar belt comprises big-boulders, rock fragments and fine grained clastics derived from hard rock area and is characterized by boulder surfaces, forest of tall trees and steep slopes. The terai belt is composed mostly of coarse granular materials alternating with fine clastics. This belt is the zone of rejected recharge and as such has developed swampy condition. The alluvium consists of succession of layers of sand silt clay with occasional gravel beds and lenses of peaty organic matter.

The soil of Darjeeling is characterized by brown podzolic variety. It may be mentioned here that mountains cover about sixty six (66%) percent of Darjeeling district. The nature of the soil changes with altitude. For example, it is black and alluvial in the Siliguri but higher up it is rather reddish or white in colours. (Fig. 8.2).

Geology and composition of soils have influenced the agricultural practices of Darjeeling. The soil in the plain is dark and more fertile. For a better understanding about the types of soil of cultivable areas in different blocks of Darjeeling district, (Table 8.01) is given below.

**Table 8.01**  
**Classification of Types of Soil in Each Block of Darjeeling)**  
(Types of soil in percentage temp.)

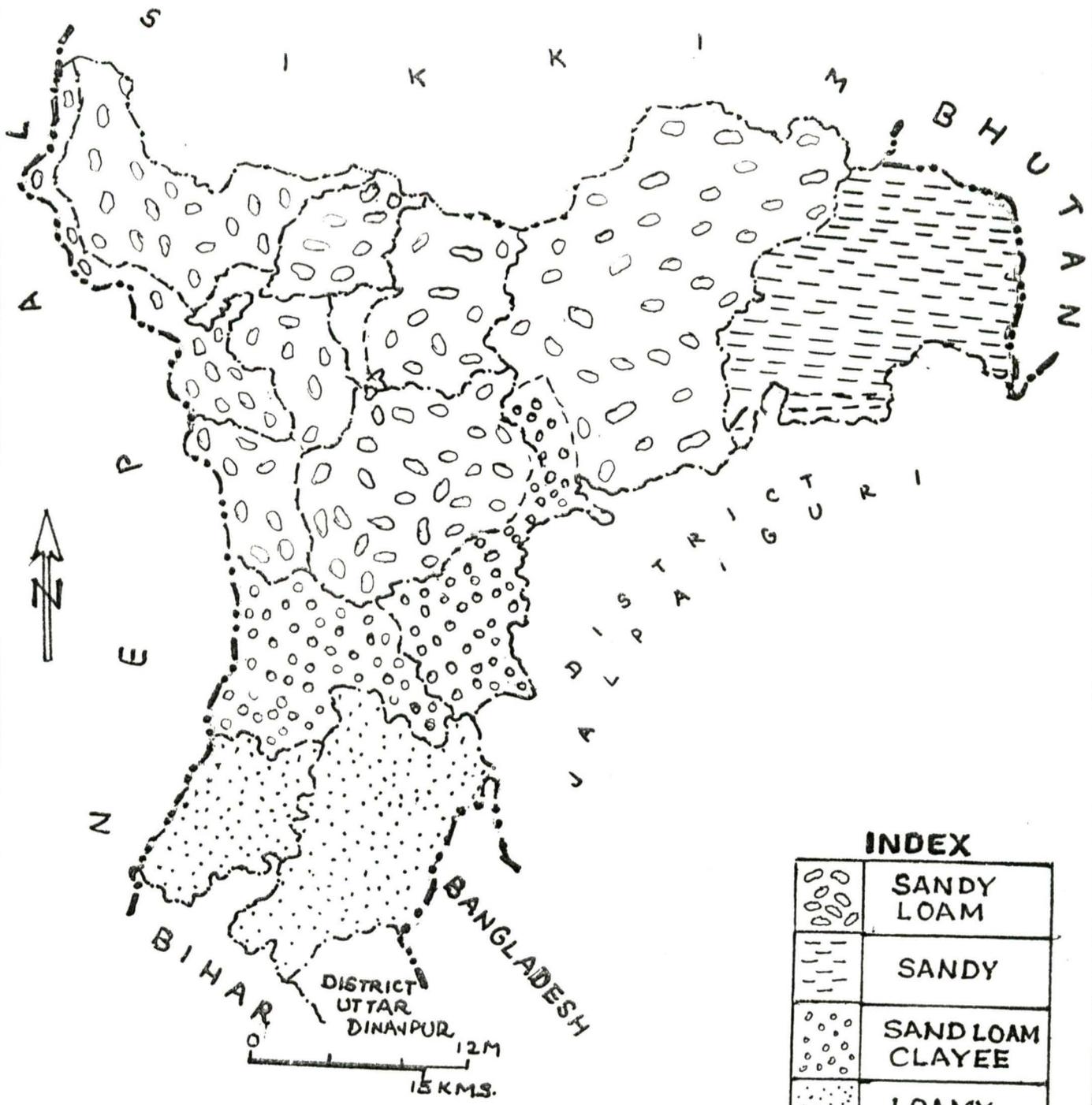
Name of the Block	Cultivable Area in Hec.	Sandy Loam	Sandy Loam	Clayee Loam	Clayee Loam	Boulder etc.
Darjeeling	9783.00		95			
Pulbazar						
Jorebunglow	2037.00		95			
Sukhiapokhri						
Rangli-	2958.00		95			
Rangliot						
Kurseong	2023.00		60			40
Mirik	1130.00		60			40
Kalimpong-I	7206.00	28	60			12
Kalimpong-II	7120.00	28	60			12
Gorubathan	4844.00	28	60			12
Siliguri						
Naxalbari	11316.00	28	60			
Khoribari						
Phansidewa	18454.00		60	30	10	

Source: Annual Action Plan, 1989.

From Table 8.01, it is revealed that sandy loam is the predominant type of soil in all the blocks of Darjeeling district. Soils in the district are mostly acidic.

Due to physiographical and soil conditions rice and wheat are not grown over most of the areas. Important crops that are grown in the hill areas of Darjeeling are maize,

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	SANDY LOAM
	SANDY
	SAND LOAM CLAYEE
	LOAMY CLAYEE

Fig. 8.2

millet, potatoes and vegetables. While undertaking the field work it was observed that dry land under cultivation are usually unirrigated and are used for growing maize and millets. In Kalimpong sub-division highest percentage of land is under cultivation. In Darjeeling sadar sub-division and Kurseong a few patches of non-contiguous cultivated land are found in the northern part of rivers Great and Little Rangeet. Few agricultural lands are also present to the south of water parting.

On the eastern side of the Great and Little Rangeet Cinchona plantations are located in Mungpoo and Latpanchor.

In Kalimpong subdivision comparatively large areas are under cultivation in the upper basins of the western and southern river valleys. Some areas are also cultivate in the north of the main range in the upper basin of the river Rishi Khola.

On the whole agricultural practices and cropping pattern shows considerable variations due to influence of geology and soil formation. The present cropping pattern in the hill areas owes its origin to the old system of agriculture with a heavy bias on cultivation of food crops. (Fig. 8.3)

There is no flattened land or valley at the relatively high altitude. This is one of the many reasons of limitations in the area available for cultivation. The crops grown in different elevations are grouped as follows (Table 8.02).

**Table 8.02**  
**Rotation of Crops at Different Altitudes**

Levels of Altitudes	
1718 m - 2185 m	Maize, potato, radish, carrot. Peas, beans, turnip, cabbage. Aman paddy, maize, potato, squash, cauliflower. Cabbage, peas, beans, radish, wheat, ginger cardamom pineapple and orange.
1250 m - 1718 m	Maize, paddy, wheat, potato, beans, ladies finger, tomato, beans tomato, cauliflower, cabbage, orange, plum, peach.
625m – 1250m	Paddy, wheat, jute, potato, maize, vegetables.
80m – 625m	

*Source: District Agriculture Office, Darjeeling, West Bengal, 2002.*

# DISTRICT DARJEELING

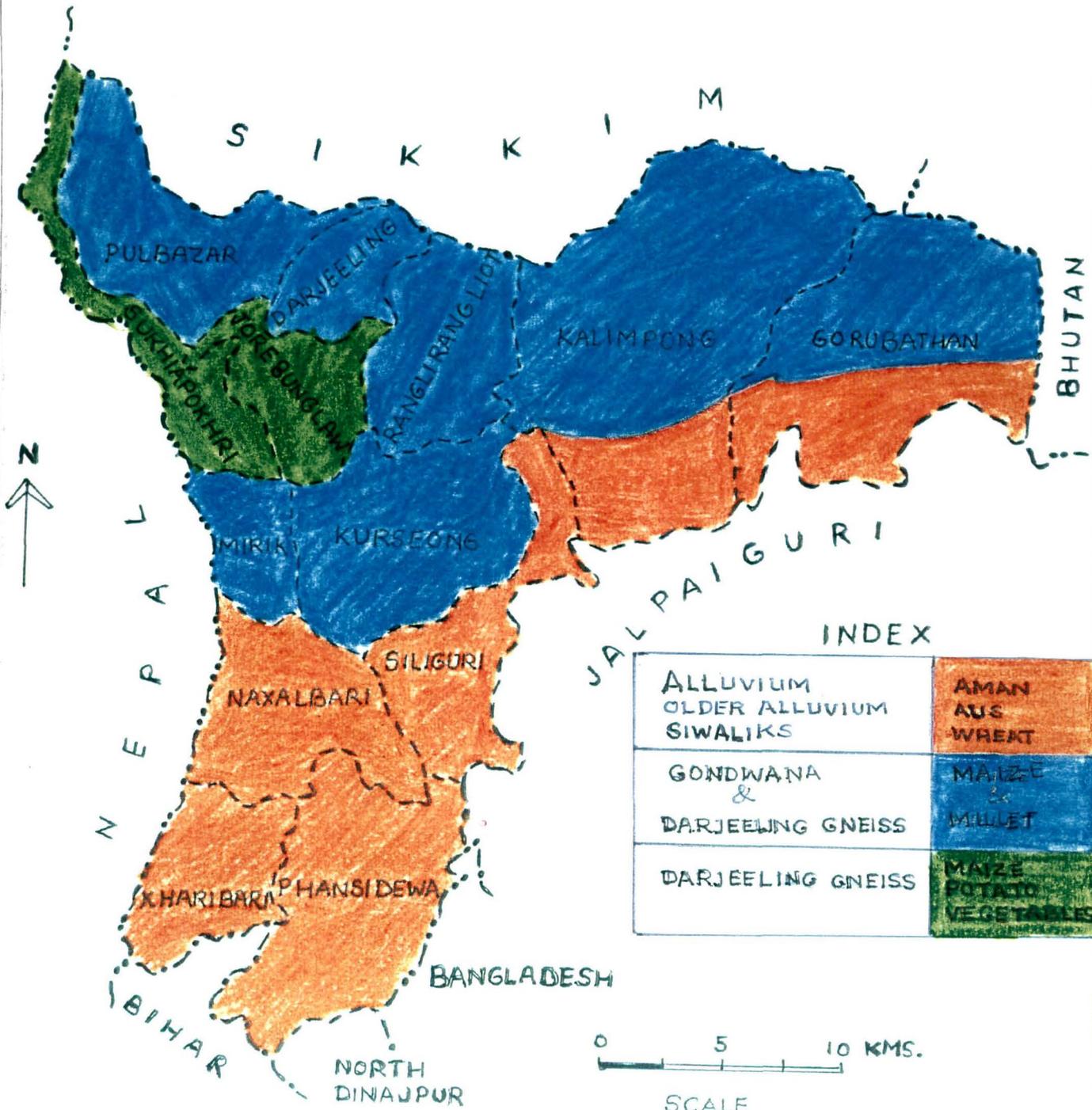


Fig.8.3 Showing relationship between geology & crops.

In high altitudes the productivity per unit area is very low, since crops are subject to various physical and other constraints. Besides some food crop like maize, potato and different kinds of vegetables, Darjeeling hill areas have necessary environment for growing sub-tropical and temperate fruits. Rich black soil of Darjeeling is suitable for orange cultivation and it grows well between 600 to 1250 m.

The soil in the plain areas of Siliguri sub-division is dark in colour and fertile. Paddy is grown in different blocks of Siliguri sub-division because of favourable climatic and soil conditions of the region. Jute is another important cash crop is widely grown in this region. Wheat, vegetables, pineapple, potato, maize, millets are also grown in plain areas of Siliguri sub-division.

Tea is an important cash crop of Darjeeling district. Tea gardens are located between an average elevations varying from 625 meter to 1250 meters with comparatively less steep gradients. Areas with altitudes varying between 312 meters to 625 meters lie mainly near the valleys of the main river. But slopes near the main valleys are usually very steep and tea and cinchona plantations are found here.