Chapter 3: PHYSICAL RESOURCE BASE OF DHUPGURI BLOCK

3.1 Introduction

Physical resources of an area constitute the foundation on to which human labour and intellect can exploit and utilized for the development of the society. Physical resources constitute all the natural resources including land and soil, water and flora and fauna of the concern geographical area. An attempt has been made in the chapter to apprehend the status of soil and water resources of Dhupguri block. The data for such a study is mostly collected from secondary sources i.e., SWID, Govt. of West Bengal, NBSSLB, Govt. of India, NRDMS centre, Jalpaiguri etc.

3.2 Soil Resources

Soil is undoubtedly the greatest asset of a nation. If it is well managed, its fertility is not only renewable, it can also be improved. If misused, it invites irreparable damage to the nation. In fact, the soils shape the destiny of the nation, influence their culture and economy and probably exert an unalterable influence in the years to come (Sarkar, 1996). In the words of Wilcox, *the history of civilization is the history of the soil and the education of the individual begins from the soil.* Whether transported or residual in origin, the soil as the seat of plant growth is of vital ecological interest to man, for it contains minerals which he needs and the plants have transformed them to a condition in which they can be incorporated within the human body. Man's use of soil is not static, but subjected to change; farming that depletes mineral nutrients and causes soil erosion which might make the agricultural land worthless; the deposition of salts from irrigated water leave soil unproductive. Conversely, new technologies might make poor soil productive. The history of soils in West Bengal is complex. The geographical set up of the State made it a suitable place for the spread of population. Forests and shrubs had to be cleared in most places to make room for production of food and fodder for growing human and animal population. Such alteration of the natural environment had its effect on the original soil, and certainly brought about consequent changes in its nature. In many cases the soil have actually undergone more than one cycle of formation. The records of their past history have been obliterated either by the formation of new soil on the truncated top of the older soil or by the complex removal of the original soil by erosion (Sarkar, 1988).

3.2.1 Pedogenesis

Soil is the product of the action of climate and organisms upon the geological formations, which constitute the soil's parent material. The ultimate character of soil is further conditioned by factors like topography, drainage, time and human activities. All these factors are important soil controls in the study area, although, some are more important than others, which need special emphasis.

The climate of Dhupguri block has been characterised in general by hot-warm and humid tropical, with strong seasonal distribution of rainfall. Mean temperature varies from 30° C in May to 15° C in January. Rainfall varies from 4500 mm along the Himalayan margin (Chamurchi) to 3350 mm at the southern edge (Dhupguri town). Pedologically, high and concentrated rainfall reflects, in general, a bleached nature, with silica dominated surface soil. High temperature and high rainfall environment is also found to be highly conducive for large scale chemical weathering processes and thereby, produce clay rich complex soil association in many parts of the block particularly in the old terraces.

The effects of man on vegetation and on soil character are of obvious importance. Past and present land-use practices have altered the natural soil landscape so much that only a few profiles have not been deleteriously affected by human activity (Sarkar, 1988). Increasing pressure on soil resource by continuous arable cropping, coupled with massive deforestation have led to very striking unfortunate results. Profile studies show that top soil removal is so widespread that present use is often being carried out on former sub-surface horizons. The progressive breakdown of structure and tilth is one of the factors, which aids soil panning and sub-soil compaction in some places.

It has been revealed that the controls of parent materials and topography especially, slope gradient and orientation have been predominant in governing the soil variability. Physiographic characteristics show its profound influence in the pedogenic processes of their respective soil groups. The northern alluvial fan with older alluvium show profile development more frequently than that of southern part where pedogenic processes are found to be retarded many times by fluvial and/or by extreme events induced deposition. In addition strong and active surface wash and sheet erosion is also responsible for truncation of soil profiles. The alluvial plains of the southern part is characterized by the absence of horizon differentiation due to i) intensive arable farming and ii) continuous increments of soil through transportation by the major rivers. However, small accumulation of organic matter is found in many places.

3.2.2 Classification of Soils

The systematic study of soils in West Bengal was taken up as early as 1898, when four major soil groups occurring extensively, were differentiated. At the beginning of the 20th Century, 'soil fertility' became the central theme of agricultural research and soil study in West Bengal. Profile studies received attention only during 1930's and onward, when soil genesis became a significant factor in classifying soil (Sarkar, 1996).

Based on the USDA Soil Taxonomy, Murthy and Pandey (1983) prepared a soil map through NBSS and LUP, based on soil variation related to relief or physiography in different climatic zones. 101 sub-order associations was recognized in the soil map of India, of which 16 were recognized in West Bengal. Important and dominant sub-orders are: Aqualfs, Aquepts, Aquents, Ochrepts, Fluvents, Ustalfs and Orthents. National Bureau of Soil Survey and Land Use Planning (ICAR) in co-operation with the Department of Agriculture, Government of West Bengal has published Soil Map of West Bengal (Fig. 1) in four sheets in 1991. This is perhaps the most comprehensive and descriptive map of West Bengal's soil. The present discussion has mostly been based on the above-mentioned study. The following table (No.3.1) represents the major Taxonomic Order, Sub-order, Great Groups which have been identified in the Dhupguri block (NBSSL, 1991).

Two taxonomic soil Orders, **nine** Sub-orders, **seventeen** Great groups and Family have so far been identified in Dhupguri block (Table 3.1). The physical and chemical properties, geographical location of these soil groups have been discussed in the following sections:

3.2.2.1 Entisols

These soils have little or no evidence of pedologic profile development either due to short duration or receiving of new deposits of alluvial at frequent interval from the higher tracts (Sarkar, 1996). The only evidence of pedogenic alteration in these soils is a small accumulation of organic matter in the upper 30 cm. of soil profile. Entisols may have an ochric or anthropic epipedon. A few that are sands have an albic horizon. The Entisols of

Dhupguri block have a variety of soil moisture and temperature regime i.e., aquic, udic and ustic. The order Entisols comprises an area of 400.0 sq.km. or 73.53% of the total geographical area of the block (Fig.3.1). Four Sub-orders: Orthents, Fluvents and Aquents have so far been identified in the state.

Table 3.1
Major Taxonomic Orders, Sub-order and Great Groups of Soil in Dhupguri block

Order	Area(km2)	Sub-Order	Great Group	Area (km^2)	Family
Entisols	400.0	Aquents	Fluvaquents	201.0	Typic Fluvaquents
			Haplaquents	84.0	Typic Haplaquents
		Fluvents	Ustifluvents	64.0	Aquic Ustifluvents
			Udifluvents	51.0	Aquic Udifluvents
Inceptisols	144.0	Ochrepts	Dystrochrepts	103.0	Umbric Dystrochrepts
					Fluventic Dystrochrept
			Eutrochrepts	41.0	Fluventic Eutrochrepts

Based on NBSSL, 1991

3.2.2.1.1 Aquents

Aquents are the wet Entisols. They are mostly found in and around wetlands and marshes and in abundant paleo channels where the soil is continuously saturated with water, in flood plains where the soil is saturated at some time of year, or in wet, very sandy deposits. They are blueish or grey in colour and often mottled. They have thermic to hyperthermic soil temperature and aquic or per-aquic soil moisture regime. Two great group i.e., Fluvaquents and Haplaquents so far been identified in Dhupguri block.

Fluvaquents are primarily the wet soils of paleo-channels and flood plains. Most of them have either fine or coarse stratification that reflects deposition of sediments under changing currents and in shifting channels during Holocene period and have relatively high content of organic carbon at considerable depth when compared with many other wet mineral soils. These soils are previously known as Alluvial soils or Low-humic Gley soils. Fluvaquents occupy the largest area of Dhupguri block i.e., 201.0 sq. km. on 36.94% of the total geographical area. These are very deep, imperfectly drained and are grey to dark grey in colour, slightly alkaline in reaction and silty clay loamy texture. The soils are gleyed below 100 cm. Cation exchange capacity has been estimated in between 10 to 21.6 m.e. /100gm.

The soils are only suited for paddy cultivation. The Fluvaquents of Dhupguri block has been identified as Typic Family.

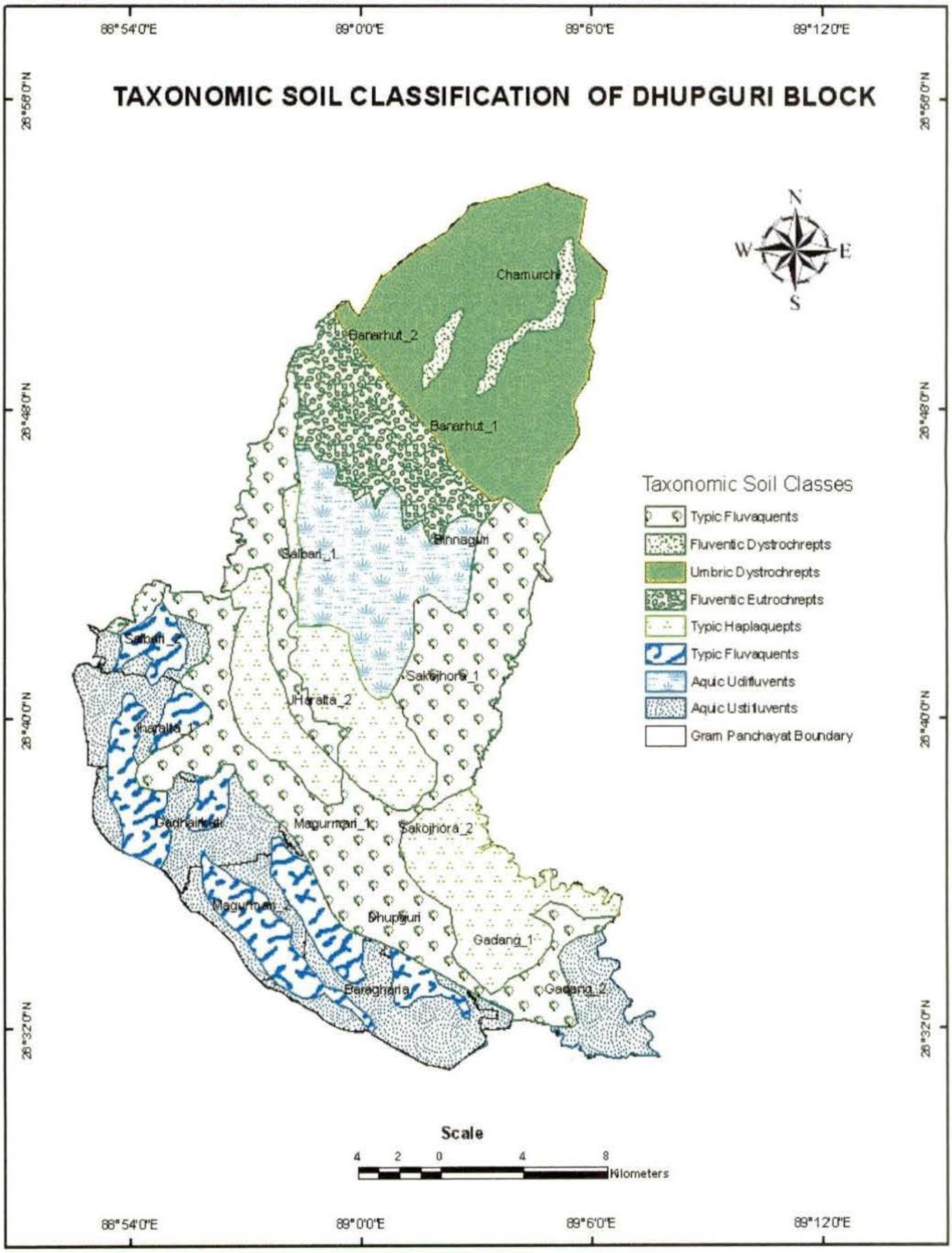

Figure No. 3.1 Taxonomic soil types in Dhupguri block

Haplaquents are wet Aquents mostly found in older alluvium. They have the colour of a cambic horizon at a shallow depth but do not have a cambic horizon because they either have rock structure at a shallow depth or have a thick sandy surface horizon. They do not have the organic carbon that is characteristic of the Fluvaquents, because they are of Pleistocene rather than Holocene age. Haplaquents occupy 84.0 sq. km. or 15.44% of total geographical area of Dhupguri block. These are deep, imperfectly to poorly drained, acidic, grey in colour, sandy loam to sandy clayey soil, with cation exchange capacity varying from 6 to 12 m.e./100 gm. The Haplaquents of Dhupguri block has been identified as Typic family.

3.2.2.1.2 Fluvents

These are mostly brownish to reddish soils that are formed in recent water-deposited sediments mainly on flood plains, fans and deltas of rivers and small streams. The Fluvents are flooded frequently unless dams or levees protect them. Stratification of the materials is normal. Most alluvial sediments came from eroding soils or stream-banks and contain an appreciable amount of organic carbon that is mainly in clay fraction. Strata of clayey or loamy materials commonly have more organic carbon than overlying more sandy strata. Thus, the percentage of organic carbon decreases irregularly with depth if the materials are stratified. The Fluvents of Dhupguri block have been identified to be Udifluvents and Ustifluvents great groups.

Udifluvents are the Fluvents that have udic soil moisture and hyperthermic soil temperature regime. Udifluvents cover only 51.0 sq. km. or 9.37% of the total geographical area of Dhupguri block and is mostly found around Salbari I and Binnaguri gram pancheyet. The dominant land-use patterns have been identified to be arable use. The Udifluvents of Dhupguri block has been identified as Aquic Udifluvents Family.

Ustifluvents are the Fluvents that have an ustic soil moisture and isomesic to isothermic soil temperature regime. These soils are found on flood plains and are found flooded regularly during monsoon. The soils are previously known as Alluvial soils and occupy 64.0 sq. km. or 11.76% of the total geographical area of Dhupguri block. The Ustifluvents are best represented in the in Gadang II gram pancheyet, which have developed in recent alluvial materials of the Jaldhaka flood plain. They are very deep, well drained, dark yellowish brown colour, moderately fine textured and neutral in reaction. A horizon often is underlain by layer of sandy deposit i.e. C horizon. Abundant mica particles are present throughout the soil profile. The Ustifluvents of Dhupguri block has been identified as Aquic Ustifluvents Family.

3.2.2.2 Inceptisols

These soils have altered horizons that have lost bases or iron and aluminum but retain some minerals, they do not have an illuvial horizon enriched either with silicate clay that contains aluminum or with an amorphous mixture of aluminum and organic carbon. The common diagnostic horizons that they may have are an umbic or ochric epipedon and a cambic horizon. Inceptisols develop mainly in the fine textured parent materials. These are the most common soils in northern part of Dhupguri block covering 26.47% of total geographical area of the block (144.0 sq. km.) and are found in Chamurchi. Banerhat I and II gram pancheyets. One Sub-orders have so far been identified (Fig. 3.1) i.e., Ochrepts.

3.2.2.2.1 Ochrepts

Ochrepts are light coloured, brownish, more or less freely drained Inceptisols. They have been formed on old alluviums of late Pleistocene or Holocene age. Most of them had or now have forest vegetation. A few have been formed from Mollisols by truncation of the mollic epipedon and are mostly under cultivation. Ochrepts have an ochric epipedon and cambic horizon. Great groups have so far been identified: Dystrochrepts and Eutrochrepts.

Dystrochrepts are the brownish, acid Ochrepts of humid and perhumid region. The parent materials generally are acid, weakly consolidated sedimentary deposits. The common horizons are ochric epipedon on a cambic horizon. Dystrochrepts occupy only 103.0 sq. km. (18.93%) of Dhupguri block and are identified in Chamurchi, Banarhat I and II GPs. These soils are deep, moderately well drained, brown in colour, strongly acidic in reaction, and are very good for cultivation and have fairly good air-water relationship.

Two Families of Dystrochrepts have so far been identified in Dhupguri block namely, Umbric Dystrochrepts and Fluventic Dystrochrepts. The Umbric Dystrochrepts have been identified in Chamurchi, Banarhat I and Banarhat II GP and mostly found under natural shades of either by forest or tea bushes. The Fluventic Dystrochrepts have been identified along two narrow tracts of elevated old deposits in Chamurchi and Banarhat I GP.

Eutrochrepts are the brownish, base rich Ochrepts developed mostly in Holocene or late Pleiostocene deposits. These are deep, freely drained loamy soils that have small quantity of free carbonate. Eutrochrepts occupy only 41.0 sq. km. (7.54% of the total geographical area) of Dhupguri block and mostly identified in Banarhat I, Banarhat II and Salbari I gram pancheyets. They are deep, moderately well drained and have brownish grey colour, moderately alkaline, loamy silt A horizon. The soils are calcareous throughout the profiles with cation exchange capacity varying between 9 to 29 m.e. /100 gram. The soils also have good air-water relationship and respond favourably to the various management practices. The Eutrochrepts of Dhupguri block has been identified as Fluventic Eutrochrepts.

3.2.3 Characteristics of Surface Soil

3.2.3.1 Textural composition of soil

Textural composition of surface soil is important as it control the fertility via-a-vis productivity of soil. Texturally the soils of Dhupguri block have been identified as sandy loam to loamy sand. These are light colour course texture soil with low water holding capacity. Data related to textural composition of soil has mostly been obtained from the NRDMS centre, Jalpaiguri and described in the following section.

3.2.3.1.1 Sand composition

The surface soil of Dhupguri block is dominated by sand by and large which vary from above 75% to below 25%. The spatial distribution of sand content has been shown in figure 3.2. Sandy soil with more than 75% of sand content in surface soil has been identified along the south western and the extreme northern parts of Dhupguri block covering Baragharia and Magurmari II and Chamurchi gram pancheyets respectively. Sand content varies from 50% to 75% has been identified in most part of western part including gram pancheyets namely Gadhairkuthi, Jhar altagram I, Jhar Altagram II, Salbari I, Salbari II, Banarhat II and Magurmai I. Surface soil along the eastern part of Dhupguri block contain 25 to 50% of sand. These includes the area belongs to Banarhal, Binnaguri, Sakojhora I, Gadang I and Gadang II gram pancheyets. The lowest percent of sand content of below 25% has been identified in a small pocket in Banarhat II gram pancheyet (Fig. 3.2).

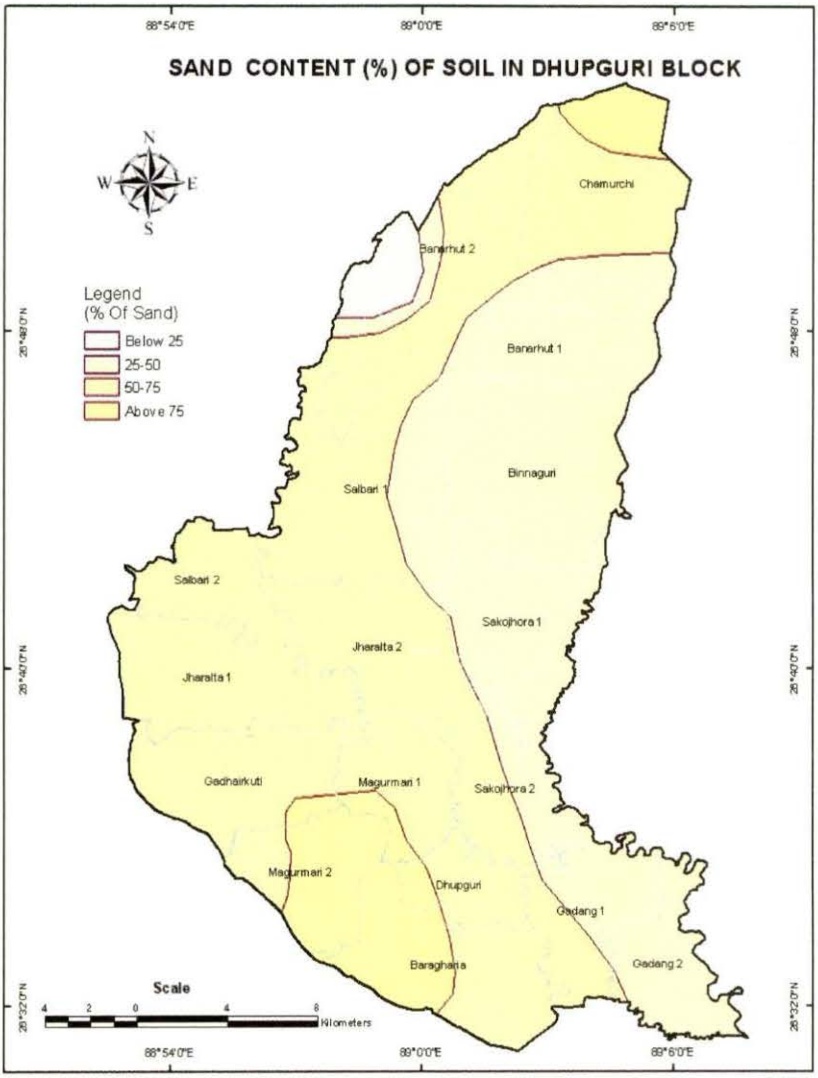

Figure 3.2 Coarse Sand composition of surface soil

3.2.3.1.2 Silt composition

Silt content in surface soil has been found generally high to moderate in Dhupguri block that varies from > 50% to < 10%. The spatial distribution of silt content in surface soil of Dhupguri block has been shown in figure 3.3. The soils of north central part of Dhupguri block contain more silt fraction of above 40 to above 50%. While, that of extreme northern and south eastern parts of the block is much less (< 10%). The highest concentration (> 50%) of silt fraction in surface soil has been identified in Banarhat II gram pancheyet. The surface soil of entire northern and north eastern part of Dhupguri block contains moderate amount of silt which vary from 20 to 40%.

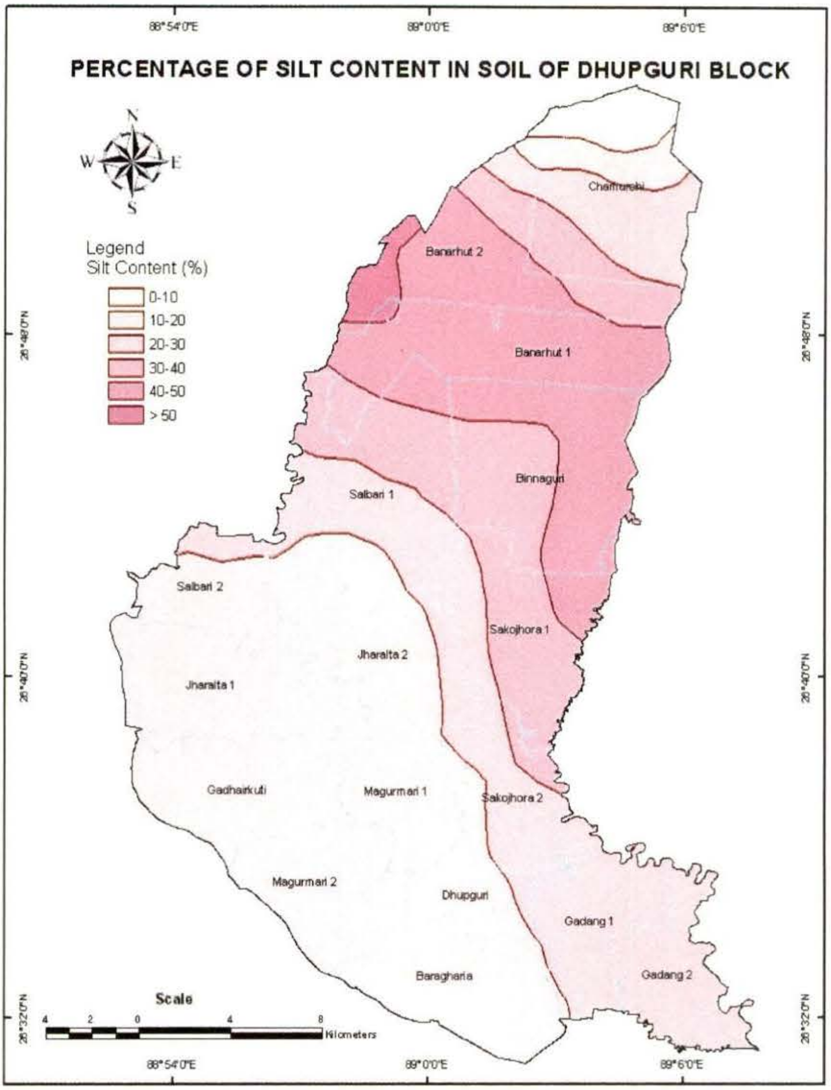

Figure 3.3 Silt composition of surface soil

3.2.3.1.3 Clay composition

Clay content in surface soil has been found generally low to moderate in Dhupguri block that varies from > 15% to < 10%. The spatial distribution of clay content in surface soil of Dhupguri block has been shown in figure 3.4. The soils of eastern and north central parts of Dhupguri block contain more clay fraction of above 15%. While, that of extreme northern and south eastern parts of the block is much less (< 10%). The clay content in surface soil in south central and northern parts vary between 10 to 15%.

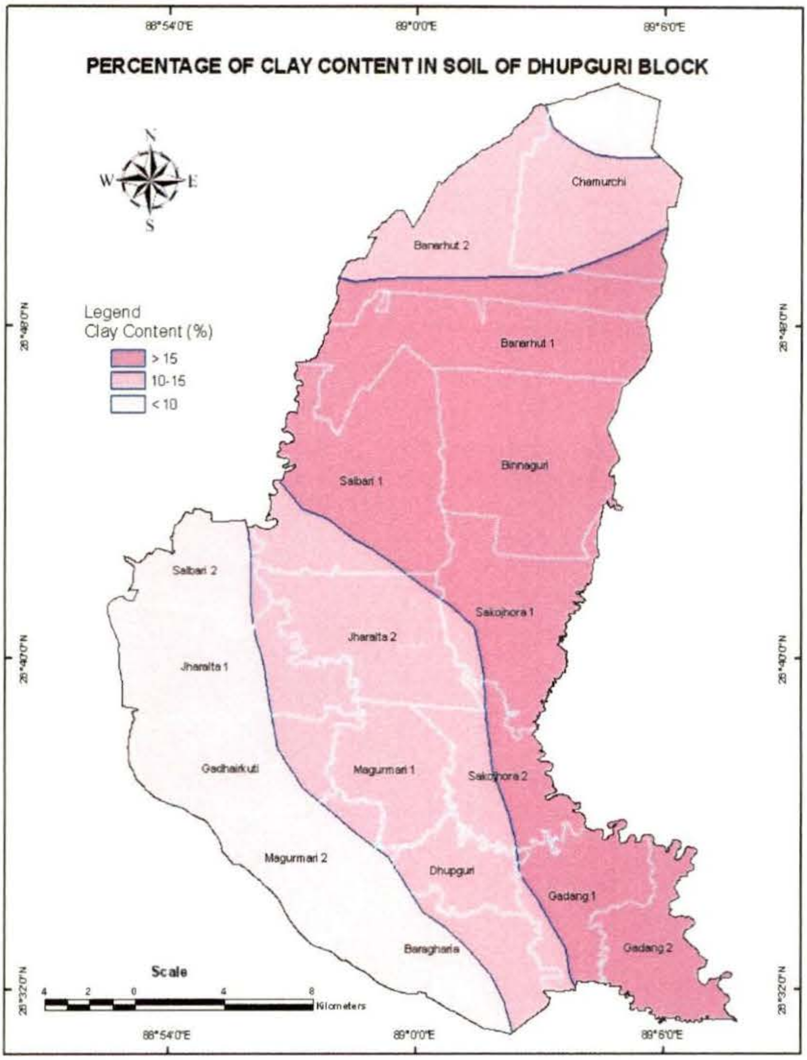

Figure 3.4 Clay content of surface soil

3.2.3.2 Soil Reaction

Generally speaking the soil of Dhupguri block is acidic in reaction. The spatial distribution of pH value of surface soil in Dhupguri block has been shown in figure 3.5. pH of surface soil varies from above 7.0% to below 6.0% in Dhupguri block. Strong acidic soil with pH value of below 6.0 has been found in eastern and east central parts including the area belongs to Banarhat I, Binnaguri, Salbari I, Sakojhora II, Gadang I and II gram pancheyets. Slightly acidic soil with pH value ranges between 6.0 to 7.0 has been noticed in Chamurchi, Banarhat II, Gadhairkuthi, Jhar Altagram I and Sakojhora I gram pancheyets along the north western and south central parts of the block. Neutral to slightly alkaline soil has been noticed along the active flood plains of Jaldhaka in Magurmari II and Barogharia gram pancheyets where the pH value has been recorded as above 7.0.

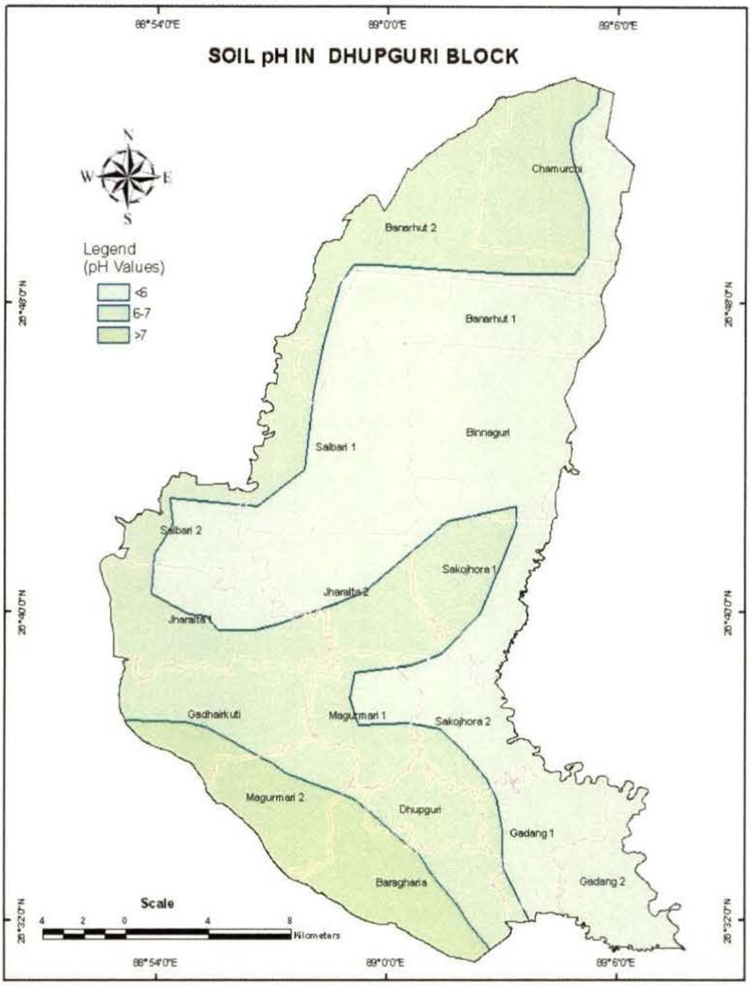

Figure 3.5 Spatial distribution of pH value of surface soil

3.2.3.3 Organic Carbon content

Organic carbon is often known as store house of plant's nutrients. It is often treated as the determinants of soil's nutritional status. The spatial distribution of organic carbon in surface soil of Dhupguri block has been demonstrated in figure 3.6. Carbon content varies from above 1.5% to below 0.5% in Dhupguri block. The soil of south central part of Dhupguri block in Magurmari I, Sakojhora II, Gadang I, Jhar Altagram I and Jhar Altagram II gram pancheyets contain moderately high organic carbon (> 1.5%). The northern alluvial fan area under Chamurchi, Banarhat I & II, Binnaguri and Salbari I gram pancheyets display low to negligible amount of organic carbon content (< 0.5%) in surface soil. The active flood plain of Jaldhaka also has very low organic carbon content in surface soil (< 0.50%).

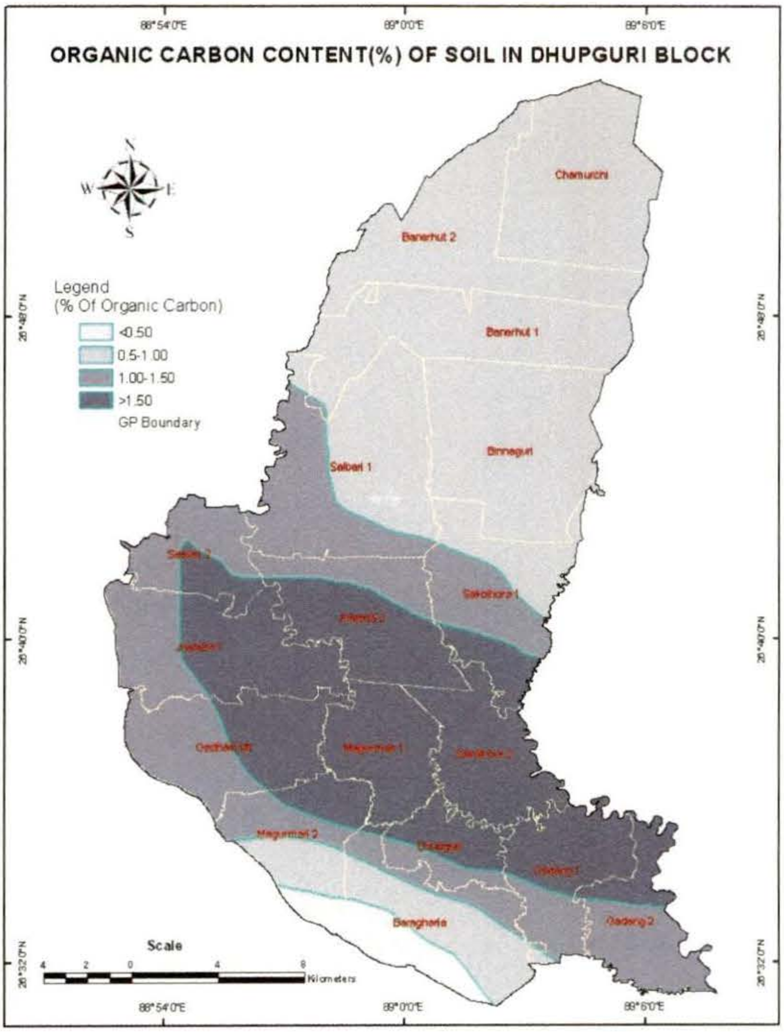

Figure 3.6 Organic Carbon content of surface soil

3.2.3.4 Nitrogen

Nitrogen content of the surface soil in surface soil of Dhupguri block has been demonstrated in figure 3.7. Nitrogen content varies from above 0.12% to below 0.04% in Dhupguri block. Generally, the soil of south eastern and north western parts of Dhupguri block recorded more nitrogen of above 0.80%. The highest nitrogen content of above 0.12% in surface soil has been recorded in Gadang II gram pancheyet. This is followed by in Magurmari I, Sakojhora II, Gadang I, Salbari I and Salbari II pancheyets contain moderately high organic carbon (> 0.08 to 0.12%. The active flood plain of Jaldhaka in Magurmari II and

Barogharia gram pancheyet recorded has very low organic carbon content in surface soil (< 0.04%). The north eastern, south western and central parts of Dhupguri block recorded moderately low nitrogen content (0.04 to 0.08%) in surface soil. The land belongs to Chamurchi, Banarhat I & II, Binnaguri, Jhar Altagram I & II, Gadhairkuthi and Sakojhora I gram pancheyets fall under this category.

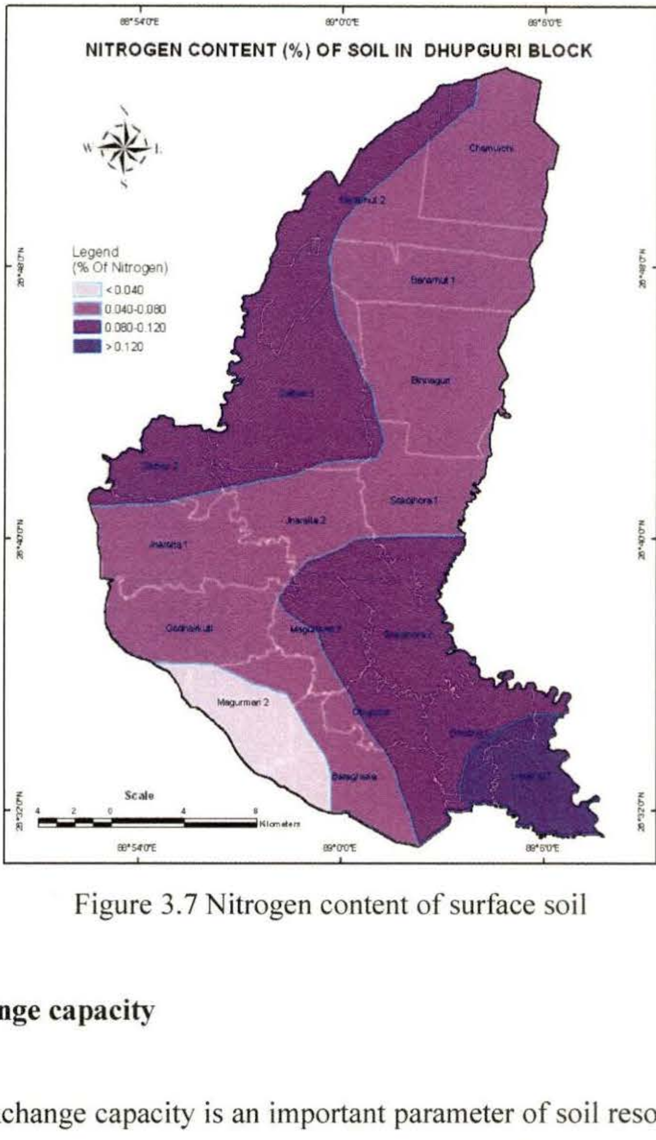

Figure 3.7 Nitrogen content of surface soil

3.2.3.5 Base exchange capacity

Base exchange capacity is an important parameter of soil resource as it determine the capacity of soil's nutrients availability status. The spatial distribution of base saturation of surface soil in Dhupguri block has been shown in figure 3.8. Base exchange capacity of soil varies from above 50 m.e./100g to below 10 m.e./100g in Dhupguri block. Very high base exchange capacity of soil of above 50m.e./100g has been found in extreme south eastern corner of Dhupguri block in Barogharia gram pancheyet. The entire northern, north eastern, central and south eastern parts of Dhupguri block demonstrates low base exchange status of less than 10 m.e./100g soil. Low to moderate base exchange capacity (10 to 20 m.e./100g) has been identified in Binnaguri gram pancheyet.

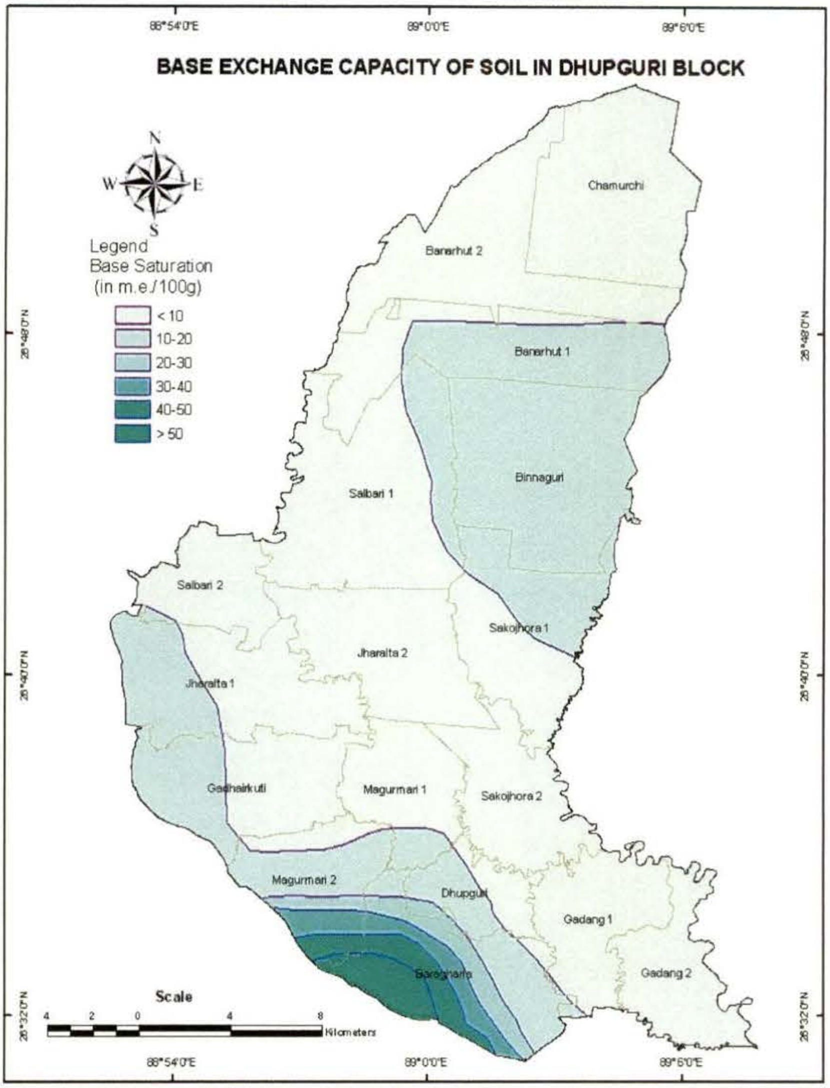

Figure 3.8 Base Exchange capacity of surface soil

3.3 Water Resources

The northern part of Dhupguri block has mostly been deforested and been used for the extension of tea gardens. As a result, most of the precipitated water goes down the sloping surface as run-off giving rise soil erosion. Out of the total surface water of over 3 meter, nothing has been commercially utilised. The distribution of rainfall is highly uneven, the five monsoon months account for 90% of the total amount. It is thus imperative to find out suitable means to conserve un-utilised monsoon water and make it available for the benefit of the local people especially during lean months. An attempt has been made to assess the surface water resource of Dhupguri block and its seasonal distribution. The present study includes (a) the study of rainfall and run-off, (b) the study of evaporation loss and (c) the estimation of surface water resources.

3.3.1 Assessment of Surface Water Resources

3.3.1.1 Study of Rainfall and run-off

Run-off is the function of rainfall after the deduction of common losses. The common loss due to evaporation and transpiration generally known as evapotranspiration is the function of the temperature of the area concern (Sarkar, 1998). According to Khosla (1950), R α P/T where, R is run-off, P is precipitation and T is temperature. Thus Khosla's model reads as follows:

$Rm = Pm\text{-}Lm$ and $Lm = Tm^{0}C/0.2074$ when m is month and L is the total loss.

Mean monthly evapotranspiration loss and run-off have been determined based on the mean monthly rainfall and temperature data obtained from 8 recording station located in Dhupguri block (table 3.2). The mean annual precipitation in Dhupguri block varies from 3984 mm along the Himalayan foothill near Bhutan to 3318.6 mm in Dhupguri town located Km south of the Himalayan margin. Thus the precipitation has been found generally decreasing from north to south. The mean annual temperature has been found more or less uniform over the block with highest recorded value of 23.9^{0}C in Dhupguri town and the lowest value of 23.4^{0}C recorded in Chamurchi tea garden. The estimated mean annual evapotranspiration rate based on Khosla's model ranges between 1382.8 mm in Dhupguri town to 1332 mm in Diana tea garden.

Mean annual run-off as estimated based on Khosla's model reflects spatial variability with the highest value of 2613 mm in Gayerkata tea garden and 1935.8 mm in Dhupguri town. It is observed that the northern part of Dhupguri block recorded more run-off than the southern part of the block. It is interesting to note that only 58.33% of the total annual rainfall is available for run-off in Dhupguri town while, 67.02% of mean annual rainfall moves as run-off in case of Binnaguri tea garden.

Table 3.2 Rainfall, temperature, evaporation loss and Runoff in Dhupguri Block*

Stations	MaP** (mm)	MaT ** (^0C)	MaE** (mm)	MaR** (mm)	MmP** (mm)	MmE** (mm)	MmR** (mm)
Dhupguri	3318.6	23.9	1382.8	1935.8	2677.2	537.5	2139.7
Chamurchi	3769	23.4	1333	2486	3503	644	2871
Gayerkata	3984	23.7	1372	2613	3487	657	2830
Diana TG	3658	23.5	1332	2105	3137	595	2329
Mogalkata TG	3558.5	23.7	1342	2115.8	3127.2	580.5	2319.7
Lakshmipara TG	3358.5	23.5	1362	2135.8	3177.2	530.5	2339.7
Ambari TG	3869	23.6	1363	2506	3553	654	2881
Binnaguri TG	3884	23.6	1362	2603	3477	647	2840

** Source: NRDMS Centre, Jalpaiguri & Tea Gardens.*
***MaP is mean annual precipitation; MaT is mean annual temperature; MaE is mean annual evapotranspiration loss; MaR is total run-off; MmP is monsoon precipitation; MmE is mean monsoon evapotranspiration loss; MmR is mean monsoon run-off*

The highest mean monsoon run-off of 2881 mm has been estimated in Ambari tea garden located in the extreme north of the study area while the lowest value of 2139.7 mm has estimated in Dhupguri town. Generally, the monsoon run-off decreases from north to south. 81.96% of the total monsoon precipitation has been found to be available as run-off in Chamurchi tea garden while that of 73.64% in Lakshmipara tea garden.

3.3.1.2 Estimation of Water Resource

The empirical estimation of run-off for the study area has been done for both the monsoon months and for the whole year. These two estimates provides us with the basic information about the long term mean available water resources.
Water resource in Monsoon

Mean Monsoon Water Resources

The total available water resource during rainy months (June-October) has been estimated based on the respective map (Fig. 3.9) with the help of data obtained from the NRDMS centre, Jalpaiguri. Three major run-off classes have been identified and their respective area coverage along with the estimated run-off has been represented in figure 3.9.

The run-off class 2000 to 2500 mm contributes to about 76% of geographical area and 73.1% of total surface water. The run off class of above 2500 mm contributes to 20.9% of the total water resource against 18% of areal coverage. The total surface run-off during the monsoon months in Dhupguri block has been estimated to be 1250.1 million cubic meter.

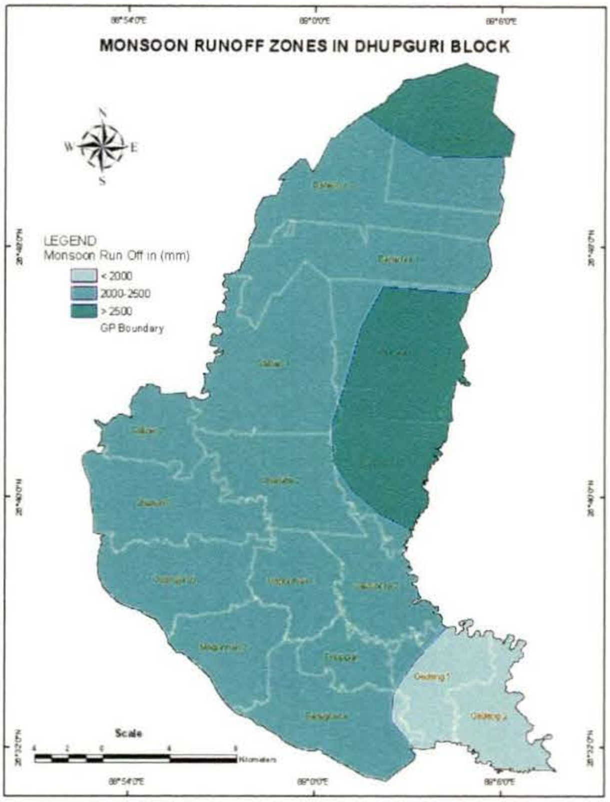

Figure 3.9 Monsoon Run-off Zones

Mean Annual Water Resource

The mean annual surface water resource of Dhupguri block has been estimated based on the respective run-off map (Fig. 3.10) which has been drawn based on the table . Out of the total 1186.6 million cubic meter of surface water, the run-off class 2000 to 2250 mm contributes to the bulk share in both water resource and geographical area (38%) and 36.9% of total water resource.. It is interesting to note that the mean annual water resource of the study area has been estimated to be about 63.5 million cubic meter less than that of the monsoon. Because, the Khosla's model yielded negative influence on the respective run-off class in dry period.

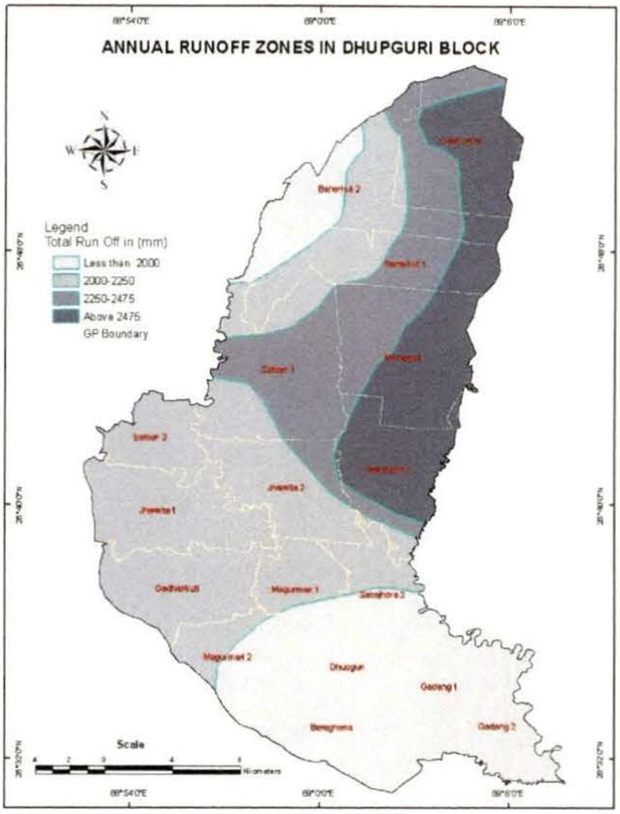

Figure 3.10 Annual Run-off Zones

3.3.2 Ground Water Resources

Dhupguri block being situated in the Himalayan foreland (Duars) has been identified as moderately rich in ground water storage. Ground water has been mostly utilised for drinking purposes in the area. Of late, large scale exploitation of ground water has been initiated since the past two decades for agri-irrigation purposes. An attempt has been made in the present study to assess the water table fluctuations during monsoon and dry period along with ground water quality has been assessed to understand the status of ground water resources in Dhupguri block.

3.3.2.1 Water table in Rainy months

Spatial variations in ground water table during monsoon (rainy) months (June – October) of Dhupguri block has been demonstrated in figure 3.11. Water table data has been accessed from SWID, Govt. of West Bengal and from the NRDMS centre Jalpaiguri. The variation of water table varies from less than 1.5 to 6.0 meter. Generally speaking, the southern part of Dhupguri block has shallow water table of below 3.0 meter during the rainy months (June – October). The extreme northern part along the Himalayan margin also demonstrates shallow water table of less than 3.0 meter during rainy months. While, the entire north-central part of Dhupguri block recorded water table of above 3.0 meter during the rainy months. The tea garden belt of Banarhat II gram pancheyet has water table of above 6.0 meter even during monsoon months. Perhaps these are the driest part of Dhupguri block.

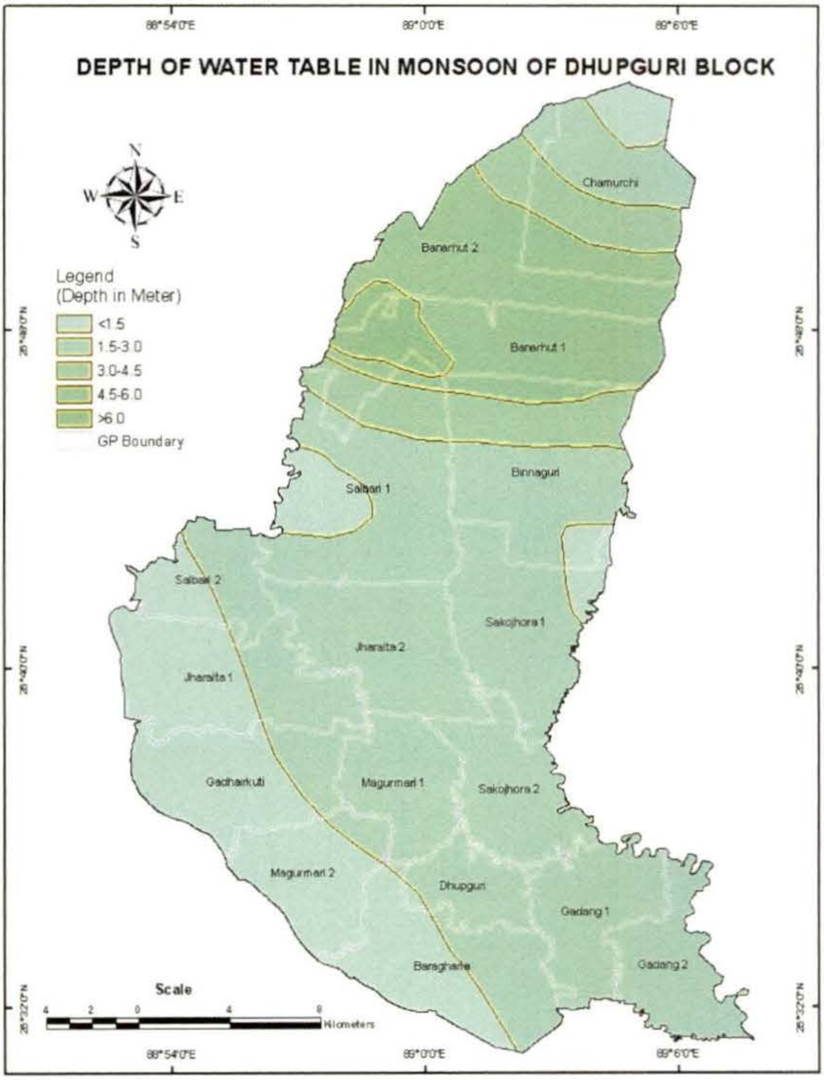

Figure 3.11 Depth of water table in non-monsoon (dry) months

3.3.2.2 Water table in dry months

Spatial variations in ground water table in non-monsoon dry months (November-May) of Dhupguri block has been demonstrated in figure 3.12. Water table data has been accessed from SWID, Govt. of West Bengal and from the NRDMS centre Jalpaiguri. The variation of water table varies from less than 6.0 to 30.0 meter. Generally speaking, the southern part of Dhupguri block has shallow water table of below 6.0 meter during the non-monsoon months (November – May). While, the entire northern part of Dhupguri block recorded water table of above 6.0 meter during the dry months. The tea garden belt of Banarhat I & II, Chamurchi and Binnaguri gram pancheyet has water table of above 6.0 meter during non-monsoon months. The deepest water table of above 30.0 meter in dry months has been recorded in the extreme northern part of the block along the international boundary with Bhutan in Chamurchi gram pancheyet (Fig. 3.12).

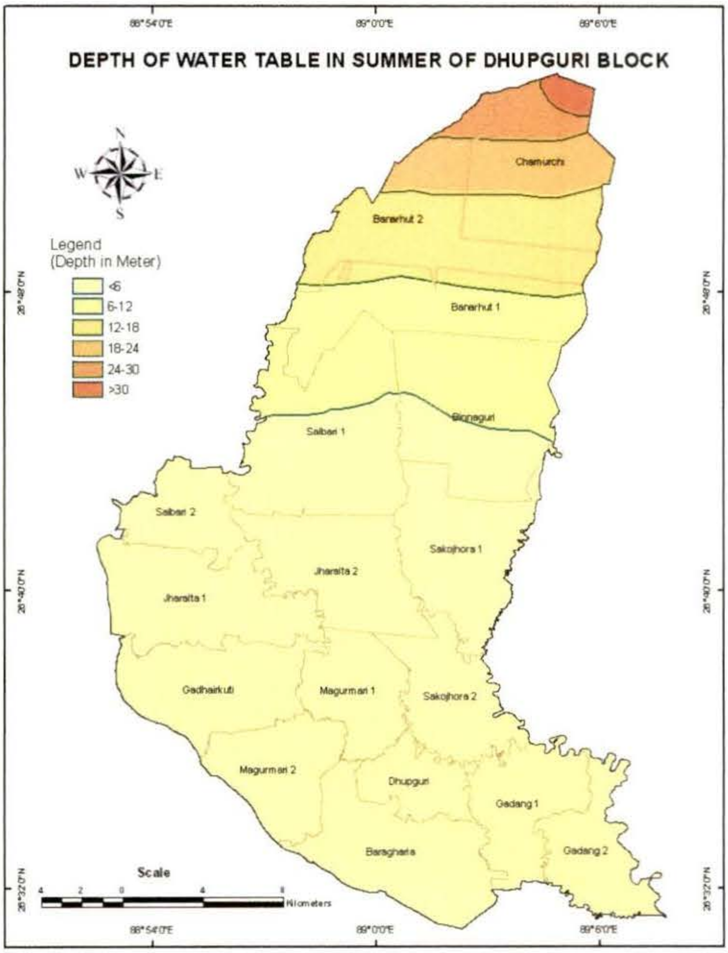

Figure 3.12 Depth of water table in Monsoon (Summer) months

The fluctuation of water table is of great interest that gives an idea of mean annual recharge. It is observed that such fluctuation in the southern half of Dhupguri block ranges between 3.0 to 4.5 meter. In the northern half of the block such fluctuation has been found much bigger ranges between 4.5 to 24.0 m. In fact, the highest fluctuation has been recorded along the Indo-Bhutan border in Chamurchi gram pancheyet where 28.5 meter annual fluctuation in water table has been recorded.

3.3.2.3 Ground water Quality Analysis

Ground water in Dhupguri block is generally being used for drinking purpose and as such the quality of ground water is of paramount importance in the overall health scenario of the people. Quality of ground water of Dhupguri block has been assessed based on the data available from SWID, Govt. of West Bengal and CGWB, Govt. of India and it observed that except marginal iron contamination the ground water is of good quality. Ferrous concentration in ground water of Dhupguri block has been spatially demonstrated in figure 3.13. It is observed that ferrous content vary between above 0.8 to below 0.2 ppm. Low iron content (below 0.2 ppm) in ground water has been identified in south central and northern part of the block. These include Dhupguri, Barogharia, Magurmari I and II gram pancheyets. Moderate to high chlorine content in ground water has been identified in Gadang I and II gram pancheyet.

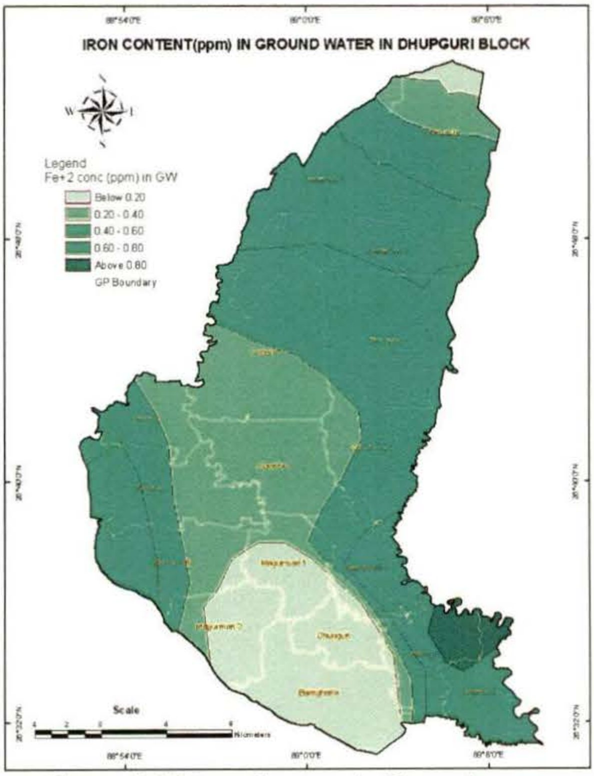

Figure 3.13 Iron Content in Ground water

The permissible limit for iron content in ground water is 0.3ppm and the maximum allowable limit as per Central Ground Water Board, Govt. of India is 1.0ppm. It is observed that except the south central part of Dhupguri block including Dhupguri municipality, Barogharia, Magurmari I, II and Jhar Altagram gram pancheyet all other area of the block have iron contamination in ground water in varying degree (Fig. 3.13).

3.4 Conclusion

Soil is a priceless resource from which we obtain food and other necessities. It is the mysterious source of all life on earth, the beginning and the end of every life cycle, that is, the vital link between the organic and inorganic world. Our society is most deeply rooted in the soil. The age-old tribal society displays a unique example of land-social harmony. Many ecological relations exist between man and the soil of his region. These are apparent in some of the major phases in man's life, in his great engineering work, and in certain direct occupational adjustments. Pottery, the hundreds of types of clay articles demonstrating every aspect of human culture, possibly the oldest of man's industrial skill depended on the soil. The soil has been termed as the ultimate resource of a nation and displays a unique property of inexhaustibility.

Taxonomically, the soils of Dhupguri block have been classified into two orders, three sub-orders, six great groups and seven families. Out of these, Typic Fluvaquents occupy 36.95% of the total geographical area of Dhupguri block. This is followed by the soil family Typic Haplaquents that occupy 15.44% of total geographical area of the block. The taxonomic soil classification of Dhupguri block as presented may be treated as a provisional one, and further field study, specially along the less accessible tracts are required to improve upon the quality and acceptability of the given classification.

The high intensity rainfall on generally deforested sloping ground causes high run-off and consequently less water becomes available to saturate soil and recharge aquifers. Out of the total surface water yield of 1186.6 million cubic meter, nothing has yet been used commercially. It is thus, imperative to find out suitable ways and means to conserve such huge unutilised water resource. The construction of mini dams across the rivers at suitable sites to conserve the monsoon supply for re-distribution during non-monsoon months would serve the immediate purposes.

Hydrogeologically, the block is located in porous alluvial formations with reasonably good yield rate. The Central Ground Water Board estimated a yield rate of 150m^3/hr, the highest in the state in areas under Dhupguri block. Ground water quality of Dhupguri block has been found satisfactory. The concentration of Arsenic, Fluoride, Nitrite and Chloride is found much less than the permissible limit (Central Ground Water Board, Govt. of India). However, some parts of Dhupguri block have been identified as threshold area in terms iron contamination in ground water (CGWB; *http://cgwb.gov.in/gw_profiles*).

3.5 References

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