Chapter 1

Introduction

1.1. Introduction of the Study

Settlement Geography is the study of the form of cultural landscape depicting its orderly description and analytical explanation (Jordan, 1966). According to R.B.Mandal (2001), "It is a science of systematic enquiry of occupancy features distributed over space with differentiation in relation to man". While a settlement represents an area of interaction of a given group of people and includes the same used for residential, social and economic purposes (Saha, 2014).

Study of spatial distribution of rural settlements over a region gives clear idea about how the settlements are spread over the space; as well as what are the attractive and restrictive forces which are responsible behind such pattern. These attractive and restrictive forces include site, situation, topography and other physical, cultural and economic factors. Many scholars have studied how topography and other morphometric parameters guide the distributional pattern of settlements over a particular region. S. Singh and O.P. Singh in 1976, S. Pal and S. Let in 2011, and S. Saha in 2014, have conducted such studies on Palamou Upland, Dwarka River Basin and Kunur River Basin of Rarh Bengal respectively. In these studies, it has been observed that topography and various morphometric parameters strictly guide the distributional pattern of settlements.

Type of settlements imparts a clear insight about the relationship between settlements within a definitive space (Doxiadis, 1964). This also reflects the relationship of number of dwellings and number of sites (Singh, 2013, p.135). The study of Settlement Pattern marks out the geometric form and shape of the settlements which may be of different types (Singh, 2013, p.135). Morphology of settlements on the other hand gives clear idea about the layout, ground plan of the villages in relation to the surrounding environment. Study of morphology also provides clear idea about the arrangement of houses or hamlets resided by various cultural or social groups. Settlement Type, pattern and morphology have been studied by various Geographers since the early part of nineteenth century starting from Vidal De La Blasch (1926) to R.B. Singh (1979), etc.

Study of functional characteristics of settlements provides idea about how the settlement is playing its role and what services it provides to its own residents as well as to the residents of other neighbouring settlements. When all the above mentioned aspects of settlements of any particular region are studied together, then it gives a complete picture which may become helpful in planning purposes. In this thesis paper all above mentioned aspects of settlements of Rammam Basin have been studied to understand the spatial distribution as well as functional characteristics of settlements in the basin under study.

1.2. Scope of the Study

Settlement Geography, as a branch of Human Geography, studies the distribution of settlements, type, pattern, morphology, and hierarchy of settlements in a particular region. Such a study reveals the nature of man-environment interaction in that region. The physical environment determines the origin, growth, and distribution of settlements, especially the terrain characteristics of any region. Man always has a tendency to select the favourable sites to settle where he can get all necessary items for living. In a rugged terrain like Rammam Basin, it has been observed that inhabitants selected their settlement sites wisely, and all the terraces formed on the courses of river Rammam and other tributaries and other sites such as summit line or crest of danra (ridge), hill slopes have been settled by the inhabitants. Thus enumeration of settlement sites can give an idea about the settling process and the influence of terrain on it in the basin under study.

As the topography of the Rammam basin is rugged in nature, the inhabitants have been left with fewer choices for occupying the mid-altitudinal section of the slopes, including the terraces of the valleys. Thus, it can also be assumed that topography has definitely influenced the spatial distribution of settlements in the basin under study. Therefore, the study of the spatial distribution of settlements can give an idea of whether the settlement is uniformly distributed over the basin or not and, if not, then the reason behind the emergence of such distributional pattern; whether it is influenced by the terrain characteristics of the basin or not.

Examination of settlement types will help to understand the relation between the main settlement sites and the hamlets surrounding it. Settlement pattern, on the other hand, is related to the emergence of various patterns based on topography or the stage of

development of settlements on the basin, and study of this will give an idea that the settlement patterns are solely dependent on topography or the stage of development and socio-cultural-economic factors. The study of social morphology will provide scope to understand the internal relation between the inhabitants in the basin under study.

The study of service centres will provide an opportunity to understand the nature, hierarchy, and distribution of service centres in the basin, which will help in future planning for the development of the settlements in the basin.

In total, the study of spatial distribution and functional characteristics of settlements in the Rammam Basin provides a scope to study the relation between terrain characteristics and distribution of settlements as well as their type, pattern, morphology, and function.

1.3. Literature Review

Many articles and books related to Settlement Geography have been published since the second half of the nineteenth century, and after a close inspection of the literatures related to the above topic; it can be categorized into literatures based on the study of the Regions of the western world and the literatures published in the Eastern half of the world including India. According to R.B.Mandal (2001), "Rural settlement studies on a systematic basis originated with Karl Ritter's work in the early nineteenth century and the subject has been mostly fully developed in West European countries, especially in Germany and France". During this period, most studies were related to the rural house types, settlement patterns, and colonization. At the end of the nineteenth century, August Meitzen (1895) published four volumes in which he classified rural settlements into two classes, i.e., agglomerated and isolated, and also studied the morphology of settlements. During the early twentieth century, P.Vidal De La Blache (1926), in his pioneer book 'Principles of Human Geography,' discussed the building materials and different sites of settlements all over the world in detail, as well as different types of settlements according to their shape and arrangement of buildings. He defined the terms 'clustered', 'scattered,' 'isolated,' etc., as a type of settlements with fair instances and their social systems. He also discussed the settlement patterns found in India. During the same year, M.A.Lefevre (1926), in his paper ''L'Habitat Rural En Belgique', studied the patterns of rural settlements in Belgium. J.A.Barns and A.H.Robinson added another literature entitled 'A New Method for the Representation of Dispersed

Settlements' in 1940. C.D.Despande studied the settlement types of Bombay Karnataka in 1942. S.M.Ali (1942) discussed the rural settlement types, patterns, locations, sites, and house types of Ghaggar plain in relation to population distribution. Glen.T.Tewartha (Dec. 1943), in his paper 'The Unincorporated Hamlet: One Element of American Settlement Fabric', studied twelve counties of South-western Wisconsin and tried to describe methods and techniques of hamlet investigation in the United States. In Germany, R.E.Dickinson (Dec.1949) published his article entitled 'Rural Settlements in German Lands' in the Annals of Association of American Geographers, where he discussed the distribution of a generalized classification of rural settlements and the distributional aspects. He also studied the distribution and functions of smaller urban settlements and the market areas of East Anglia. R.Lahiri (1950) studied the 'Settlement Types in the Ajay-Barakar Basin', Enayat Ahmad (1952) studied the rural settlement types of United Province of Agra and Oudh, Uttar Pradesh and mentioned that "the distribution of these various types is markedly related to features of the physical setting of the State." M.Anas (1954) studied the Pattern of Rural Settlements in the Sub-Himalayan Region (East). K.H. Buschmann published two articles on 'Settlement and Habitation in India-I & II' in two consecutive volumes in 1954.

R.L.Singh (1955) studied the evolution of settlements in the Middle Ganga Valley. A.N.Bhattacharyya (1956) studied the Rural Habitations in Upper Ganga Plain Son Valley. P.Bandyopadhyay (1957) studied the settlement patterns of Eastern Kolhan. S.D.Kaushic (1959) studied the 'Types of Human Settlement in Jounsar Himalaya.' S.N.P.Jaiswal (1962) published an article entitled 'Sachendi: A Study on a Rural Service Centre.' Michael Chisholm published a book on 'Rural Settlement and land Use' in 1962. Settlement patterns of Puri Chilka coastal tract were studied by Mira Das (1964). K.N.Singh (1966) studied the spatial pattern of central places in the Middle Ganga valley. Rural service centres of Hoogly District were studied by Bandana Guha (1967). R.K.Mukherjee published his book entitled 'Man and His Habitation' in 1968. Doxiadis took the initiative to develop an independent science to study human settlements known as Ekistics. He published his book in the same name 'Ekistics: An Introduction to the Science of Human Settlement' in 1968. R.B.Singh (1969) also studied the Rural Settlement Types and Their Distribution in Varanasi District. An attempt has been made to develop the theoretical aspects of rural settlement geography, and J.C.Hudson took the leading role in this regard by publishing the article entitled 'A Location Theory for Rural settlement' in 1969. E Ahmed (1962) studied 'Indian

Village Patterns' and asserted that "An unmistakable connection between the configuration of the site, surface water (river, canal, tank or pond or well), the nature of the soil, cultivation, groves and the shapes of the fields on the one hand and the pattern of settlements on the other" can be seen. He identified 25 types of village patterns in India. A.B.Mukerji (1970) in his article 'Spacing of Rural Settlements in Rajasthan: A Spatial Analysis', identified the regional pattern of spacing between the rural settlements in Rajasthan, explained the pattern through the co-variance of characteristic determinants or associated areal attributes, evaluated the manner in and the extent to which the spatial pattern of spacing contributes to the character of areas. S.C.Kharkewal (1970) studied the impact of morphometric elements on the distribution of settlements in Nainital and its Environs. Sevati Mitra (1971) studied the evolution of typical rural settlements of the Midnapore Coast, the growth of the settlement Jhilimili in Bankura, and the rehabilitated state village Massanjore. Bimalendu Bhattacharyya (1971) published an article on 'A Genetic Classification of Settlements and their Hierarchical Order in the District of Darjeeling.' R.C.Sharma published his doctoral work entitled 'Settlement Geography of Indian Desert' in 1972. The Proceedings of I.G.U.Symposia, Varanasi and Tokyo, was published by the National Geographical Society of India as 'Rural Settlements in Monsoon Asia' in 1972. A. Prasad published his post-doctoral work entitled 'Chotanagpur: Geography of Rural Settlements' in 1973. L.R.Bhattacharyya (1973) studied the Rural Settlement Pattern in Rajasthan Desert. R. Bhattacharyya (1975) studied the Settlement pattern in Deltaic Bengal. A.B. Mukerji (1976) studied the evolution of settlements in the Siwalik Hills and depicted the form of the settlements resulting from the adaptation of the peoples originated from the Punjab Plains to the environmental settings of the Siwalik Hills. S.Singh & O.P. Singh (1976) studied morphometric control on the rural settlement on Palamau Upland. N.Sharma (1977) studied the Rural Centres of Service in Simdega. Gobind Singh Bisht (1978) studied the settlement morphogenesis and functional organization of the village Chatripur. The hierarchy of settlements in the Silabati Basin was studied by K. Bagchi (1978). S.K. Biswas (1980) identified the service centres of the Purulia District. S.K. Munsi published an article on 'An Enquiry into the Nature of Frontier Settlements: Case Study of Hill Darjeeling' in Geographical Review of India in 1981. R.P.Misra (1987) studied the development of rural settlements and growth centres. Several unpublished theses on Settlement Geography, such as M. Ghosh, completed her Ph.D. Thesis on the topic 'Functional Classification and Hierarchy of Settlements in North Bengal' in 1984 from the University of North Bengal. I. R. Naqvi completed his Ph.D.

in ‘Farukhabad District: A Study in Rural Settlement Geography’ in 1987 from Allahabad University; A. Sarkar completed his Ph.D. Thesis on ‘Evolution of Size and Spacing of the Urban Settlements in West Bengal 1901 to 1981’ from Calcutta University in 1991.

Some recent works on Rural Settlement Geography published in various journals and e-journals are -‘Analysis of Human Settlement Pattern using RS and GIS in the Plains of West Bengal’ published by A. Sarkar in 2010. R. Chaturvedy (2013) studied the Hierarchy of Service Centres of Allahabad District. S.Pal and S.Let (2011) studied the morphometric control on settlement distribution in Dwarka River Basin in Rahr Bengal. S.Saha (2014) studied the impact of morphometric parameters on Kunur River Basin settlement distribution in Rahr Bengal.

1.4. Location of Study Area

The Rammam basin is one of the most distinguished basin areas in the Himalayan region, which is world famous for its several viewpoints, such as Singalila, Phalut, Sabarkum, Sandakphu, and Tonglu, along with some picturesque settlements like Gorkhey, Samanden, Gurdum, Rimbick, Ribdi, Okhery, etc. The whole tract is divided into two unequal parts: the North Rammam Basin and the South Rammam Basin. The North Rammam Basin is comprised of the south-western part of the West District of Sikkim, and the South Rammam basin occupies the north-western part of the Darjiling district in West Bengal. The main river Rammam marks the boundary between the two said parts and exits the terrain near Nayabazar for plunging into its trunk river - the Great Rangit. The total length of the river Rammam is 42km. The altitudes of the entire basin vary widely – from 3685m on the Singalila peak to 320m at the confluence point of the river Rammam and Bari (Great) Rangit, below Nayabazar. The total basin area is 403.16 sq. km. The northern part covers an area of 153.1565 sq. km. and the southern part 250.0035 sq.km. The latitudinal extension of the study area is from 27° 02′ N - 27°15′N, while the longitudinal extension is from 87°59´E - 88°17´E.

1.5. Administrative Set Up

The basin under study comprises of 33 village units, one Notified Bazar Area and four Forest Blocks among which 19 village units, one Notified Bazar Area and four Forest Blocks are located in the North Rammam Basin and 14 village units in the South Rammam Basin. As said earlier that the 19 village units in the North Rammam Basin

are located under the jurisdiction of Soreng sub-division of West District of Sikkim and 14 village units in the South Rammam Basin are located under Darjiling Sadar Subdivision of Darjiling district; the details of which has been given in table 1.1.

1.6. Objectives

The main objectives of the present study are the followings:

i) To analyse the spatial distribution and spacing of settlements in the Rammam Basin

ii) To enumerate the site, situation and functional characteristics of settlements in the Rammam Basin.

iii) To study the type, pattern and morphology of settlements in the Rammam Basin.

iv) To study the role of the service centres in the growth of settlements in the Rammam Basin.

v) To find out the problems and future prospects of settlements in the Rammam Basin.

1.7. Hypotheses

In order to fulfill the above mentioned objectives, the following hypotheses have been taken into consideration:

1. The spatial distribution and spacing of settlements in the study area is closely linked with the terrain characteristics of the basin under study.
2. The types of settlements depend on the functional characteristics of settlements in the study area.
3. The settlements are mostly grown in the middle and lower part of the basin with their distinctive service centres.

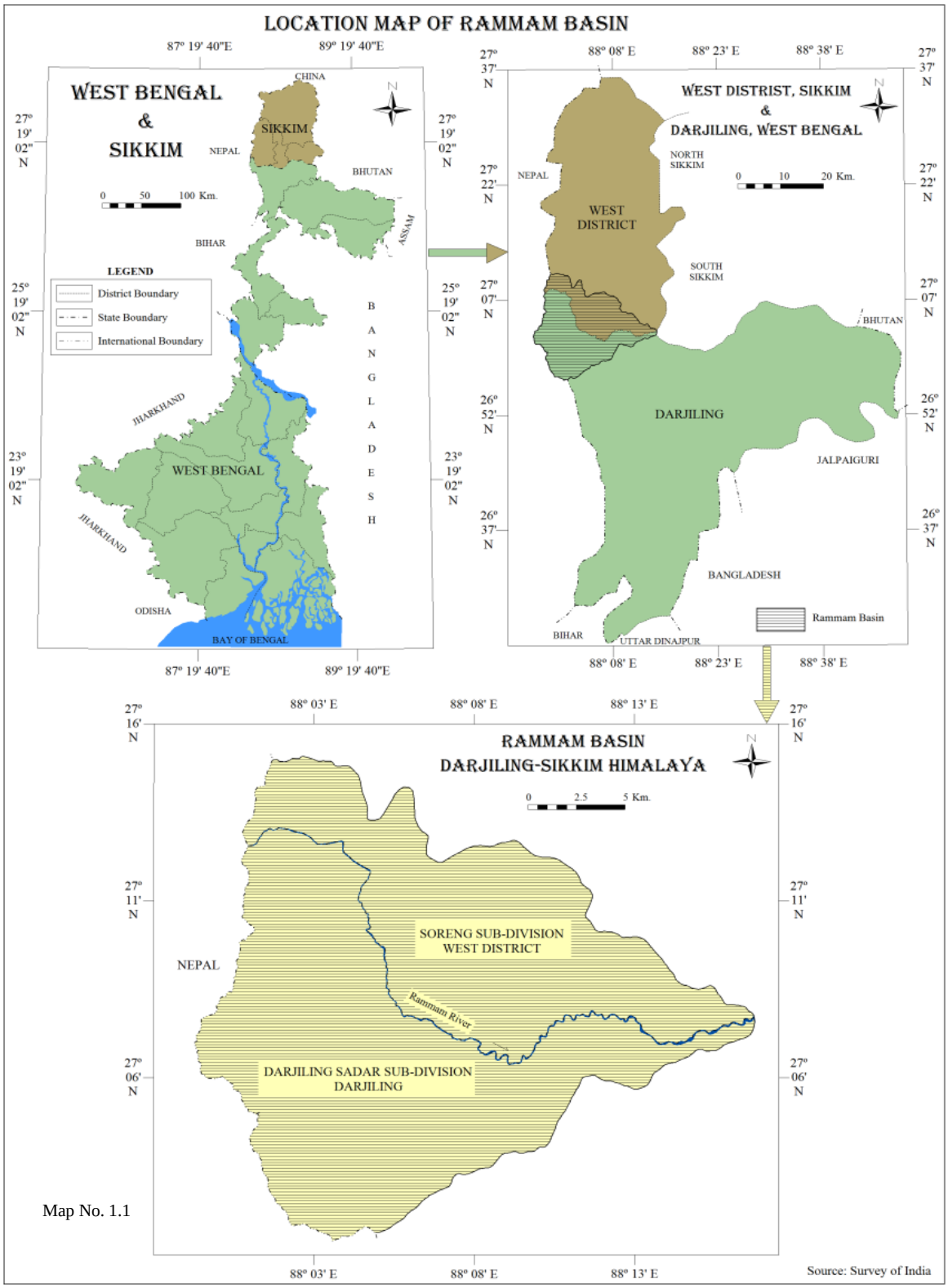
Table 1.1: Administrative Set up of Rammam Basin

Sl.No.		District	Sub-division	Block	Gram Panchayet	Village	Hamlet
1	NORTH RAMMAM	West	Soreng	Daramden	Ribdi-Bhareng	Bhareng	Upper Bhareng and Lower Bhareng
2		West	Soreng	Daramden	Ribdi-Bhareng	Ribdi	Khope Ramatey, Upper Ribdi, Lower Ribdi and Ribdi Meggi
3		West	Soreng	Daramden	Okhery	Okhery	Upper Okhery, Middle Okhery, Lower Okhery, Pureytar, Chyangbagaon and Lattaytar
4		West	Soreng	Daramden	Siktam Tikpur	Siktam	Upper Siktam and Lower Siktam
5		West	Soreng	Daramden	Siktam Tikpur	Tikpur	Lower Tikpur, Orange Village, Middle Tikpur, Upper Supreynagi and Lower Supreynagi
6		West	Soreng	Daramden	Longchok Salyangdang	Longchok	Upper Longchok, Middle Longchok and Nalbogaon,
7		West	Soreng	Daramden	Longchok Salyangdang	Salyangdang	Upper Salyangdang, Lower Salyangdang and Lungyam
8		West	Soreng	Daramden	Lower Fambong	Dhalam	Upper Daramden, Middle Daramden and Lower Dhalam,
9		West	Soreng	Daramden	Lower Fambong	Lower Fambong	Lower Fambong, Ambotey and Ringyang
10		West	Soreng	Daramden	Upper Fambong	Upper Fambong	Fambong Mathilo Tar, Sombaria, Choktey Gaon, Anden Park, Hattavan and Ronglyang
11		West	Soreng	Daramden	Rumbuk	Rumbuk	Upper Rumbuk, Middle Rumbuk and Lower Rumbuk
12		West	Soreng	Soreng	Rumbuk	Burikhop Rumbuk	Buriakhop-Tarebhir, Buriakhop Nasa and Buriakhop Monewgaon
13		West	Soreng	Soreng	Buriakhop	Buriakhop	Upper Buriakhop, Buriakhop Bichgaon, Lower Buriakhop, Buriakhop-Rengeng, Buriakhop-Ghattey,
					Dodok	Dodok	Gairi Gaon, Middle Dodok, Sipai Gaon, Ahley and Thongling
14		West	Soreng	Soreng	Karthok Bojek	Karthok	Upper Yangthang, Lower Yangthang, Karthok, Upper Bojek and Lower Bojek
15		West	Soreng	Soreng	Tharpu	Tharpu	Raigaon, Tharpu School, Ratimatay, Kolbotey and Gairigaon
16		West	Soreng	Soreng	Timburbong	Timburbong	Bahungaon, Gairigaon, Daragaon Teendhurey, Arubootey, Tarbari, Chisopani and Ridang
17		West	Soreng	Soreng	Soreng	Soreng	Nesorgaon, Soreng Lungthung, Soreng Daragaon A, Soreng Daragaon B, Khopi Kharka-Pekgagaon, Mangarjung and Mangsari

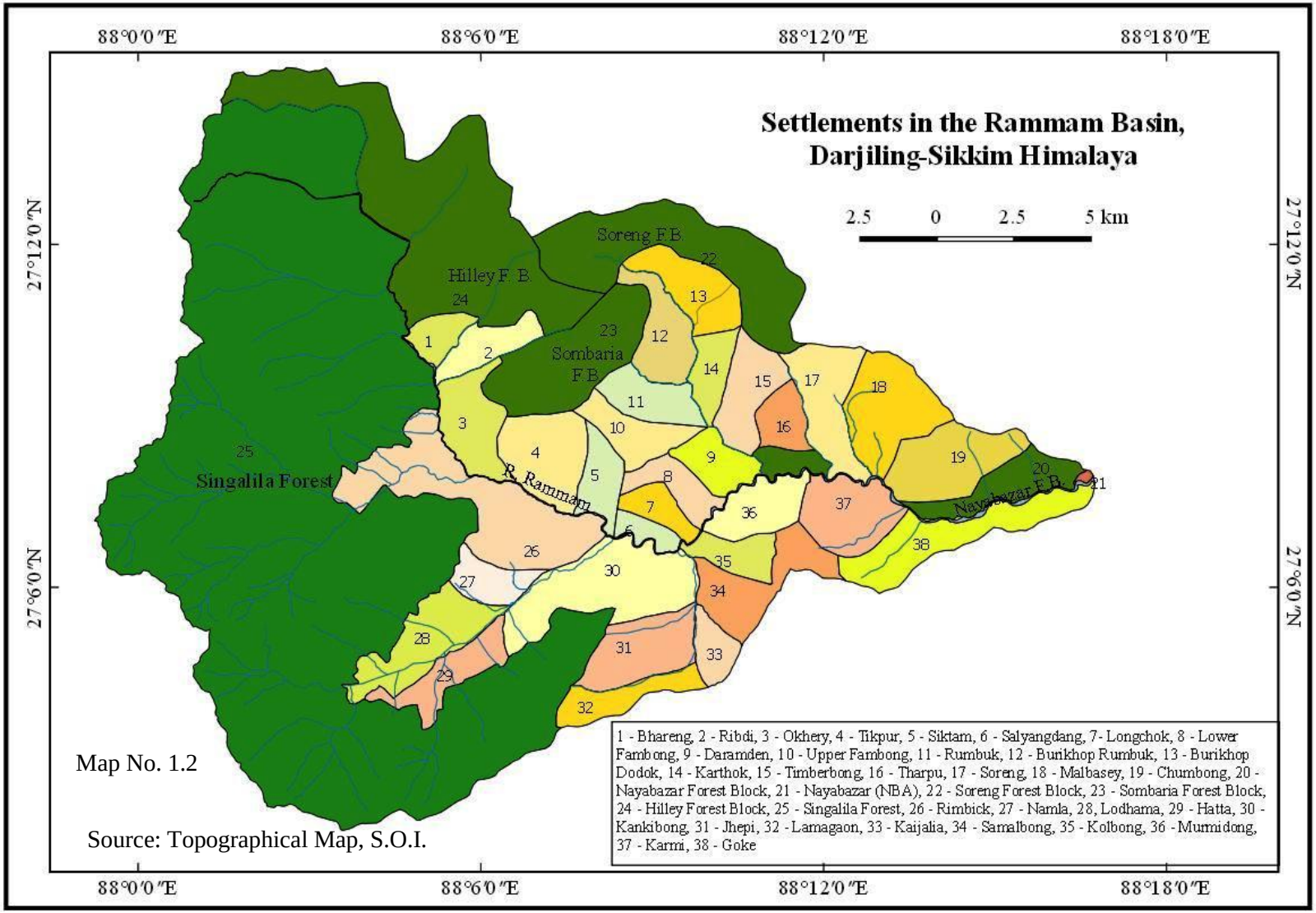
Sl.No.		District	Sub-division	Block	Gram Panchayet	Village	Hamlet
18		West	Soreng	Soreng	Malbasey	Malbasey	Samthang, Lower Samthang, Malbasey, Thulogaon and Upper Pakkigaon
19		West	Soreng	Chumbong	Chumbong	Chumbong	Singrep, Torkigaon, Chumbong, Sigret-Sadhugaon, Budang, Asyong Sajbotey, Sipsu and Malthek,
20		West	Soreng	Nayabazar NBA	Nayabazar Notified Bazar Area	Nayabazar Notified Bazar Area	Nayabazar Notified Bazar Area
21		West	Soreng	Nayabazar Forest Block	Zoom	Nayabazar Forest Block	Nayabazar Forest Block
22		West	Soreng	Soreng Forest Block	Soreng	Soreng Forest Block	Soreng Forest Block
23		West	Soreng	Sombaria Forest Block	Upper Fambong	Sombaria Forest Block	Sombaria Forest Block
24		West	Soreng	Hilley Forest Block	Ribdi-Bhareng	Hilley Forest Block	Hilley Forest Block
1. A	SOUTH RAMMAM	Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Sirikhola-Daragaon	Singalila Forest	Gorkhay F.V., Rammam F.V., Samamden F.V., Daragaon F.V.(Kalyan FV), Sirikhola F.V., Beechgaon F.V. and Gurdum F.V.
2.A		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Sirikhola-Daragaon	Rimbick	Baisakay –Lekkharga, Daragaon –Musepakha, Daragaon-Bhanjyng, Beech Gaon, Sirikhola, Timburay, Lower Sirikhola, Rajavir and Sepi
2.B		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Rimbick	Rimbick	Maneydara, Upper Jawlaygaon, Lower Jawleygaon, Upper Rimbick, Middle Rimbick, Lower Rimbick-1, Lower Rimbick-2, Dipali, Lampati, Tubun, Toksar, Gumbadara and Yakraybong
1.B		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Lodhoma-I	Singalila Forest	Namla F.V. and Lingsaybong F.V.
3		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Lodhoma-I	Namla	Namla Busty and Fatingtar
4		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Lodhoma-I	Lodhama	Lodhoma Bazar, Lower Lingsaybong, Upper Lingsaybong, Upper Bansbotay and Lower Bansbotay
1.C		Darjiling	Darjiling	Darjiling-	Lodhoma-II	Singalila Forest	Ritu Foktay F.V. and Dhotray F.V.

Sl.No.		District	Sub-division	Block	Gram Panchayet	Village	Hamlet
			Sadar	Pulbazar			
5		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Lodhoma-II	Hatta	Chottahatta, Barahatta, Palmazua-Fedikhola, Syangbogaon- Piplidara, Gairigaon and Dilpa Busty,
1.D		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Jhepi	Singalila Forest	Salaybong F.V.
6		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Jhepi	Kankibong	Batasay, Tumfuwa, Kankaybong-I, Kankaybong-II, Rai Gaon, Sanman Gaon, Upper Sumbuk, Middle Sumbuk, Lower Sumbuk and Bahungaon
7		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Jhepi	Jhepi	Gurdum, Ramitay, Jhepi, Rawligaon and Bhujelgaon
8		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Relling	Lamagaon	Upper Lamagaon , Middle Lamagaon I andMiddle Lamagaon II
9		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Kaijalia	Kaijalia	Kaijalia, Bhanjyang, Sirisay, Upper Barraray, Lower Barraray, Upper Lingten and Lower Lingten
10		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Nayanore	Samalbong	Upper Samalbong and Middle Samalbong
11		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Goke-II	Kolbong	Upper Kolbong and Lower Kolbong
12		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Goke-II	Murmidong	Padeng, Malatang , Sanjbotay, Kohm Busty and Murmidong
13		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Goke-II	Karmi	Karmi Estate/Upper Nezi, Karmi Estate /Lower Nezi
14		Darjiling	Darjiling Sadar	Darjiling-Pulbazar	Goke-I	Goke	Upper Rangdu, Lower Rangdu, Lower Takbia, Upper Goke, Lower Goke, Kamjer Busty, Garbetar, Upper Karmatar, Lower Karmatar and Kerabari

Source: District Census Handbook of Darjiling and Sikkim, 2011, Gram Panchayat Offices & Field Survey


LOCATION MAP OF RAMMAM BASIN
WEST BENGAL & SIKKIM
CHINA
NEPAL
SIKKIM
BHUTAN
BIHAR
ASSAM
JHARKHAND
WEST BENGAL
ODISHA
BAY OF BENGAL
BANGLADESH
LEGEND
District Boundary
State Boundary
International Boundary
0 50 100 Km.
87° 19' 40"E
89° 19' 40"E
27° 19' 02" N
25° 19' 02" N
23° 19' 02" N
WEST DISTRIST, SIKKIM & DARJILING, WEST BENGAL
NORTH SIKKIM
WEST DISTRICT
SOUTH SIKKIM
DARJILING
JALPAIGURI
BANGLADESH
BIHAR
UTTAR DINAJPUR
Rammam Basin
0 10 20 Km.
88° 08' E
88° 23' E
88° 38' E
27° 37' N
27° 22' N
27° 07' N
26° 52' N
26° 37' N
RAMMAM BASIN
DARJILING-SIKKIM HIMALAYA
0 2.5 5 Km.
88° 03' E
88° 13' E
27° 16' N
27° 11' N
27° 06' N
SORENG SUB-DIVISION
WEST DISTRICT
Rammam River
DARJILING SADAR SUB-DIVISION
DARJILING
Source: Survey of India

Map No. 1.1



Map No. 1.2

Source: Topographical Map, S.O.I.

1.8. Database &Methodology

The entire study is based on field survey and primary data as well as secondary data with some aids of previous literatures related to the nature of present study. The research work has been divided onto three stages:

a) **Pre-field stage**

In this stage the Base map has been prepared after demarcating the basin boundary from the Topographical Maps (Map Nos. 78 $\frac{A}{4}$ & 78 $\frac{A}{8}$) of Survey of India. Then the village boundaries have been drawn following the topographical maps as well as census maps of the C.D. Blocks of Darjiling-Pulbazar for the southern part of the Basin and Map of Soreng Sub-division of West District of Sikkim for the northern part of the Basin. As the study area is a geomorphic unit rather than an administrative unit, so the boundaries of the Basin in the northern and southern part did not coincide with the boundaries of administrative units of Darjiling-Pulbazar C.D. Block in the south and Soreng Sub-division in the north. It has been found that four villages in the southern part of the Basin namely Lamagaon, Kaijalia, Samalbong and Goke are partly located under the study area, and in the northern part Hilley Forest block, Soreng Forest Block and Nayabazar Forest Block are located partly under the basin. At the same time these three forest blocks namely Hilley Forest Block, Sombaria Forest Block and Soreng Forest Block, in the northern part, have no clear cut boundary in the census map. As these three Forest Blocks have been considered as village units in this study, so the boundries between these Forest Blocks were required to present the demographic as well as other data. Therefore, maps in this thesis paper follow their drawn-out boundaries (especially on the basis of Physiographical barrier).

The Topographical Maps (Map Nos. 78 $\frac{A}{4}$ & 78 $\frac{A}{8}$) of Survey of India have also been studied for the illustration of the terrain characteristics of the basin. Contours have been extracted from Cartosat DEM (cdng45d_3r1 and cdng45e_3r1) downloaded from Bhuvan website. The morphometric indices have been calculated and mapped using GIS software.

b) **Field stage**

During this stage primary and secondary data have been collected. For population data at village level, District Census Handbook of Darjiling and Sikkim, 2011, have been considered, however, the hamlet and ward wise data have been collected from C. D. Block offices as well as from Gram Panchayat Offices during the period of 2017-2021. Apart from collecting population related data, hamlets were also enumerated along with GPS survey as well as data of location has also been collected from Gram Panchayat Offices. Some settlements have been surveyed and layouts of these have been prepared during this stage.

As mentioned earlier that four villages namely Lamagaon, Kaijalia, Samalbong and Goke are partly falling within the study area, so the population related data (Total Population, Male Population, Female Population and Number of Literate Persons) of these four villages have been calculated only on the basis of the hamlets located under the study area. Due to unavailability of hamlet wise data on SC, ST Population as well as Data on Workers along with Industrial Category of Main and Marginal Workers and Non-Workers, and data on amenities available in the villages located partly under the basin (Lamagaon, Kaijalia, Samalbong and Goke), these villages have been represented by census data of whole village.

The village Lodhama has been mentioned in the Topographical Map (Map Nos. 78 $\frac{A}{4}$) as well as Census Map. But in the census, 2011 the population of the hamlets falling under this village (except Lodhama Bazar) have been added to the village Namla. In the census, 2011 village Lodhama only represents Lodhama Bazar (excluding other four hamlets namely Upper Lingsaybong, Lower Lingsaybong, Upper Bansbotay and Lower Bansbotay). In this thesis paper, the village Lodhama has been considered as consisting of above mentioned four hamlets along with Lodhama Bazar. The population related data (only Total Population, Male Population, Female Population and Number of Literate Persons) of the village Lodhama has been calculated keeping in mind the five hamlets mentioned above. On the other hand the population related data of Namla village has been calculated considering two hamlets, Namla Busty and Fatingtar. Thus the population related data (Total Population, Male Population, Female Population and Number of Literate Persons) of these two villages will differ from the population data of census, 2011. For study of Services and Amenities available in the villages of the basin, Census Data of 2011 on Village wise services and amenities have been taken

into consideration along with data collected during field survey from 2017-2022. Burikhop and Dodok are villages under two separate Gram Panchayat Units of the same name but Population data of the villages in the census have been presented together under the village heading of Burikhop Dodok. Therefore in the thesis Burikhop and Dodok have been taken as a single settlement unit as Burikhop Dodok though the boundary between the Gram Panchayat units has been marked in the map.

c) **Post field**

In this stage, all data and information collected in the previous stage have been analysed and the thesis has been completed.

To fulfill the objectives of the study and to prove the above mentioned hypotheses the following methods have been followed:

1. The influence of terrain characteristics on the spatial distribution and spacing of settlements have been interpreted by different methods of quantitative analyses such as–

- Spacing of hamlets in the villages of the basin has been computed with the help of Mather's (1944) formula of spacing.

  $$D=1.0746\sqrt{A/N}$$

  Where,

  D is average distance of a settlement to its six nearest neighbours,

  A is the total area of study; and N is the number of settlements

- Dispersions of hamlets in the villages of the basin have been calculated following the method of Nearest Neighbour Analysis by Clark and Evans (1954)

  Rn= rA/rE

  Where, rA is actual mean distance between the hamlets in a village

  rE is expected mean distance between the hamlets in a village

  rA may be calculated as follows:

  rA = $\sum d$/n,

  where, d is distance between nearest hamlets; n is number of hamlets

  rE= $1/2\sqrt{n/a}$ where 'n' is number of hamlets and 'a' is area of the village

The ‘Rn’ value should range from ‘0’ meaning complete cluster through ‘1’ meaning randomly distributed to ‘2.1491’ meaning uniformly distributed.

- To represent terrain characteristics altitude and various morphometric indices (Dissection and Ruggedness Index) of the Settlements of the basin have been computed

- To test the hypothesis, Pearson’s Correlation has been applied and Correlation Coefficient ‘r’ between Altitudinal Zones, Morphometric Indices (Dissection and Ruggedness Inices) representing terrain characteristics and dispersion and spacing values of settlements have been calculated

$r = (\sum(Xi-\bar{X})(Yi-\bar{Y}))/\sqrt{(\sum(Xi-\bar{X})^2 \sum(Yi-\bar{Y})^2)}$

Where,

r =Correlation Coefficient

Xi = Values of the X-variable in a sample

$\bar{X}$= Mean of the values of the X-variable

Yi = Values of Y-variable in the sample

$\bar{Y}$ = Mean of the values of Y variable

2. The second hypothesis is ‘settlement types depend on the functional characteristics of settlements in the study area.’

- The types of the settlements have been found out with the help of the formula devised by R.B.Singh in 1969,

Hamlets	Villages	Settlement Types
Hn=	Vn	= Compact
Hn=	Vn+1 to Vn X 2	=Semi-compact
Hn=	$VnX2+1 to \frac{OUnX\ 2}{3}$	=Hamleted
Hn=	$\frac{OUnX\ 2}{3} + 1$ to OUn	=Dispersed

Where Hn represents the number of hamlets, Vn is the number of villages in an administrative unit and OUn is the number of occupancy units in the same area.

- Besides, Dispersal Index devised by R. B. Mandal (1972) has also been computed to find out type of settlements in the study area.

- The functional characters of the settlements have been computed with the help of census data on workers under various categories and the villages have been categorised into various categories on the basis of percentage of workers engaged in agricultural activities.

- To test the hypothesis Chi square test has been applied. The formula for Chi ($\chi 2$) square test is as follows:

  $$\chi 2 = \sum \frac{(Oi - Ei)2}{Ei}$$

  Where,

  $\chi 2$ = Chi-square

  Oi = Observed Value

  Ei = Expected Value

3. The third hypothesis is 'Settlements are mostly grown in the middle and lower part of the basin with their distinctive service centres'. Service centres have been identified and the hierarchies of the service centres have been derived using the Composite Functionality Index. The Composite Functionality Index of a particular settlement has been computed by the following formula:

$$CFI = \frac{FCI + WIj + NWIj}{3}$$

The formula for computing FCI is as follows:

$$FCI = \sum \frac{Wij}{W} \; x \; 100$$

Where,

FCI is Functional centrality Index,

Wij is Weightage of j^{th} centre and

W is Total Weightage of all the centres.

The following formula has been adopted to assign weightage to the functions in the study area:

$$Wi = \frac{N}{Fi}$$

Where,

Wi is the Weightage of the ith function

N is total number of settlements

Fi is number of settlements having that function

(ii) Working Population Index (WI) has been expressed as:

$WIj = \frac{Wj}{Wt}\ x\ 100$

Where,

WIj is the Working Population Index of jth Centre,

Wj is Working population of jth centre and

Wt is total working population in the Basin

(iii) Non-working Population Index (NWI): This has been calculated using the following formula:

$NWIj = \frac{NWj}{NWt}\ x\ 100$

Where,

NWIj is Non-worker Index of jth centre,

NWj is Non-worker population of jth centre

NWt is total Non-working population in the Basin

- To test this hypothesis distinctiveness of hamlets as well as service centres (following Nelson's Method) in the Upper, Middle and Lower parts of the basin have been found out.

As per census of India (2011), "the basic unit for rural areas is the revenue village, which has definite surveyed boundaries. The revenue villages may comprise of one or more hamlets but the entire village is treated as one unit for presentation of data". In this study, revenue villages, and Notified Bazar Area and Forest Blocks with fixed boundary (the boundaries which are defined and settled by a revenue survey or cadastral survey), as defined by the Census of India, have been taken as synonymous to the term settlement and thus the term settlement is defined as a percel of land consisting of homesteads and agricultural lands whithin fixed boundary. Such settlements may consist of one or more agglomeration of habitation or hamlets. All the anslyses have been done taking revenue villages, Notified Bazar Area or hamlets as unit of study. While studying relationship between terrain characteristics and spatial distribution of settlements all hamlets (188 hamlets) have been taken into consideration. For understanding functional characteristics of the settlements all village and Notified Bazar units, and Forest Blocks (33 village units and one Notified Bazar Area and Four forest Blocks) have been taken into consideration. For understanding type and pattern

of settlements, all the hamlets have been taken into consideration. For the study of morphology of settlements, 26 hamlets (13.83% sample) located under two Gram Panchayats have been taken into consideration. The analyses and interpretations have been done by various cartographic and statistical tools and techniques.

1.9. Chapter Plan

The thesis has been divided in to the following chapters:

Chapter 1: Introduction

This chapter deals with the location and administrative set up of the study area along with Objectives, Hypotheses, Database and Methodology of the study.

Chapter 2: Physical and Socio-Cultural Background of the Rammam Basin

This chapter provides an idea about the Physical and Socio-Cultutaral Background of the study area. Terrain Characteristics, Drainage, Lithostratigraphy, Natural Vegetation, Weather and Climate, and Soil have been discussed under the heading of Physical Background and Population, Ethnic Groups, Economic Composition, Agriculture, Transport and Communication, and Markets have been depicted under Socio-Cultural Background.

Chapter 3: Spatial Distribution of Settlements in the Rammam Basin

Settlement Size, Spacing and Dispersion of Settlements along with Morphometric Indices have been computed in this chapter. The relations between Terrain characteristics and Dispersion and Spacing of hamlets have also been analysed in this chapter.

Chapter 4: Site, situation and functional characteristics of settlements in the Rammam Basin

This chapter deals with Site and Situation of Settlements along with the functional categories of the villages.

Chapter 5: Type, Pattern and Morphology of settlements in the Rammam Basin

In this chapter Type, Pattern and Morphology of Settlements have been illustrated and the relation between Type of Settlements and Functions of Settlements has also been explained.

Chapter 6: Role of Service Centres in the growth of settlements in the Rammam Basin

Primary, Secondary and Tertiary Service Centres have been identified and depicted in this chapter. The distribution and distinctiveness of settlements as well as service centres in the various parts of the basin have also been discussed in this chapter.

Chapter 7: Problems and Prospects of Settlements in the Rammam Basin

This chapter deals with the Problems and Prospects of Settlements in the basin.

Chapter 8: Summary and Conclusions

In this chapter a summary of the study has been presented and an attempt has been made to draw a conclusion of the study.

1.10. Limitations

(1) Large areal extent and rugged terrain imposed a serious problem while collecting primary as well as secondary data from the field and from the Gram Panchayat Offices. (2) Some hamlets are accessible only by trekking and accessible only in favourable season (3) In case of villages partly falling under the basin, the whole villages have been considered due to lack of hamlet-wise data on working population, and thus analysis done on the basis of data of whole villages have imposed serious problem in finding out the real scenario of these villages.

1.11. Conclusion

The study will help to understand the distributional pattern of settlements on the Rammam Basin and the factors, especially, how terrain influences the distribution of settlements on the basin. Besides, it will elucidate favourable sites and situations of human habitation on the hilly tracts of Darjiling-Sikkim Himalaya. It will also throw lights on the people belonging to various ethnic groups living on the tract and the way they interact with their habitat. The study will also help to understand the distribution of service centres on the tract, especially, on the upper, middle and lower part of the basin.

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