CHAPTER- 1

INTRODUCTUCTION

Chapter 1

Introduction

1.1 Forest and Human Being

The word **“forest”** originates from the Latin word "**foris",** which means outside the village boundary or fence. According to the Glossary of Technical Terms (GTT 1985), the forest is defined as a plant community predominantly of trees and other woody vegetations usually with closed canopy".

Indian Forest Records (1936) has defined the forest as "an area set aside for the production of timber and other minor forest products or maintained under woody vegetations for indirect benefits which it provides, e.g., climatic or protective." It also defined as "land with tree canopy density of more than ten per cent and an area comprising of more than 0.5 ha" (FAO, 2000). The meaning of forest has changed over time along with the evolution of the social, economic and political elements in society and its historical development. As per the latest definition given by ISFR, 2015, the forest cover includes all lands with tree canopy density of 10 per cent & above and a minimum mapping unit of one hector. The forest cover reported in the ISFR does not make any difference between the origins of forest (whether natural or man-made) or tree species; and encompasses all type of land irrespective of their ownership, land use and legal status. Thus, all areas bearing tree species, including bamboos, orchard coconut palm, etc., within the recorded forest, private, community, or institutional lands meeting the above-defined criteria, have been termed forest cover (FSI, 2015).

Forest provides not only natural resources and forest land but also meets the social, economic, ecological, cultural and spiritual needs of human beings of the present and future generation (Tewari, 1992). Forest resources constitute an immense value by contributing directly and indirectly to the welfare of human

being. Directly, as a productive resource, it provides timber, fuel wood, bamboo and other non-timber forest products (NTFP) like fodder, honey, gums, resin, dyes, medicinal herbs and edible forest leaves. Indirectly, the forest also performs a protective, social and aesthetic function such as forest preserves biomass and bio-diversity, conserves moisture in the soil and prevents natural calamities like floods and droughts. Forest also performs irreplaceable ecological services. They assist in the global recycling of water, oxygen, carbon and nitrogen. It also provides shelter to wildlife, which is of scientific and recreational value (Shangpliang, 2013). Therefore, the forest is essential not only for the economic development and preservation of the global environment but also for maintaining all forms of life on the terrestrial.

This symbiotic relationship between forest and human being has existed since the early man and its society. During the early period of civilization, human beings are heavily dependent on nature for their various requirements. This relationship continues to exist even in the age of science and technology too. The rapid growth of population and rising standard of living has brought increasing pressure on forest both directly and indirectly. The excessive exploitation of natural forest for the mere fulfilment of human needs and greed lead to multiple effects on the natural ecosystem, disappearance of plant and species, degrades forest ecosystem, loss of wildlife habitation, etc.

1.2 Concept of Biological Diversity

Biodiversity has currently emerged as an issue of global concern. Almost all the countries of the world, irrespective of their location and socio-political characteristics have now come forward in an organized manner to address the issues relating to biodiversity as there has been increasing threat and pressure on the biosphere (Bhagabati, Kalita, & Barua, 2006). India is also no exception; the rapid loss of biodiversity in different parts of the country due to over-exploitation of its natural resources has prompted the people and government machinery to do something positive for their conservation and sustainability.

The term biodiversity or biological diversity refers to the variety of life on earth, starting from genetics to ecosystems and the ecological and evolutionary processes that sustain it. Biological diversity includes not only species we consider rare, threatened, or endangered, but every living thing -even organisms we still know little about, such as microbes, fungi, and invertebrates. The 1992 United Nations Earth Summit defined "biological diversity as the variability among living organism from all sources, including, inter alia, terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems".

Further, forest biological diversity refers to all life forms founds within forested areas and the ecological roles they perform. As such, forest biological diversity encompasses not just trees but also the multitude of plants, animals, and microorganisms that inhabit forest areas and their associated genetic diversity. Forest biological diversity can be considered in different levels, including the forest ecosystem, landscape species, population and genetics. The interaction amongst these allows the organism to adapt to continually changing environmental conditions and maintain ecosystem functions (https:// www.cbd.int/meetings/COP-2).

Thus, the forest diversity- genetic, species and forest ecosystem is an integral part of all the living beings and non-living beings of the biosphere. Forest is the main mechanism for the conversion of carbon dioxide into carbon and oxygen. It also provides essential ecological services, such as recycling nutrients, soil formation, plants absorb carbon dioxide ($CO_{2)}$ and release oxygen ($O_{2),}$ maintaining water level within the ecosystem, watershed protection, water flow, control of erosion and flood etc. The forest ecosystem gives us food, fodder, house building material, medicines and a variety of other products. Besides these, tropical natural forests are inhabited by millions of different types of species around the world.

1.2.1 Biodiversity of World and India

The diversity of biological resources we find today is basically the result of long and continued interaction between nature and culture. Such interaction evolved through time; however, it experienced different character and intensity in different stages of human development history (Bhagabati, Kalita, & Barua, 2006).

Presently, there are 1.8 million species in the world, and the majority of species are yet to be discovered. Among the bio-rich nations of the world, India is among the top 10 for its great variety of plants and animals. As a mega diverse country with only 2.4% of the world land areas, India accounts for 7-8 % of recorded species of the global biodiversity, including over 45,000 species of plants and 91,000 species of animals (Pande & Arora, 2014). It is situated at the tri-juncture of the Afro-tropical, Indo-Malayan and Palaearctic Realms, which support the rich biological diversity. As one of the 17 identified mega diverse countries, India has 10 bio geographic zones, such as Trans Himalayan, Himalayan, Indian Desert, Semi-arid, Western Ghats, Deccan Peninsula, Gangetic Plains, Coastal Zones, North Eastern Zones and Indian Islands. It is home to 8.58% of the mammalian species documented so far, with the corresponding figure for avian species being 13.66%, for reptiles 7.9%, for amphibians 4.66% for fishes11.72% and plants 11.80%. Out of 34 globally identified biodiversity hotspot, four biodiversity hotspot, namely the Himalayas, Indo-Burma, Western Ghats-Sri Lanka and Sundaland, are present in India. It is estimated that the number of unknown species could be several times higher than the known species (Pande & Arora 2014, Barucha 2005). North-east India comprises eight states: Arunachal Pradesh, Assam, Manipur Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, endowed with rich natural resources. The North-eastern region of India is a biodiversity-rich zone and falls in the Indo-Burma biodiversity hotspot line. The region that constitutes only 7.98 per cent of the country's geographical area accounts for nearly one-fourth of its forest cover. Because of its biodiversity richness, the region has been identified as one of the 34 biodiversity hotspots of the world.

Kokrajhar district of Assam is part of the biodiversity hotspot due to its rich forest resources and foot-hill of Himalayan Mountains. It is also part of Manas Tiger Reserve, Ripu-Chirang plant reserve, Manas Biosphere Reserve. The climatic condition and variety in physical features witness a diversity of ecological habitats such as forests, grasslands, wetlands that harbour and sustain wide-ranging floral and faunal species. The entire National park and sanctuaries of Assam cover only around 3 per cent of the state's total forest areas. The Manas National park is also a Biosphere reserve and forms the contiguous linear belt along the foothill of Himalaya. The floral diversity includes 543 plant species, and the faunal diversity includes 60 mammalian, 42 reptiles, 7 species of amphibians, 5 fish species, 103 invertebrate species and 327 species of birds (Environment and Forests, Assam Govt.2016). Due to incomplete reporting from certain areas like North Cachar hills, parts of Tinsukia that contain patches of the tropical rain forest and parts of Kokrajhar reserve forest, the exact number of species is still remained unknown in Kokrajhar district as well Assam as a whole (Bhagabati, Kalita, & Barua, 2006).

However, the rich biodiversity of the Kokrajhar district of Assam has threatened for their extinction due to diverse reasons such as

1. Anthropogenic pressure (change in land use, atmospheric carbon dioxide ($CO_{2)}$, nitrogen, loading and acid rains, climate and biotic exchange).
2. Habitat loss,
3. Excessive logging,
4. Hunting, and
5. Development activities undertaken by the government.

1. 3 Brief Overviews of Forest Cover of the World as well as of India

The forest cover has changed and deflated in recent years around the world due to diverse reasons from region to region. As per the Global Forest Resource

Assessment (FRA) coordinated by FAO, the forest of the world has declined from 31.6 per cent of the global land area to 30.6 per cent in between 1990 and 2015. But that pace of loss has slowed in recent years (FAO, 2018).

The loss of forest occurs mainly in developing countries, particularly sub-Saharan Africa, Latin America and Southeast Asia. As the population increases and forest land is converted for agriculture and other uses, forest areas are declined in every climatic domain except the temperate zone. In some parts of North America, Europe and Asia, forest area has increased since 1990 due to large-scale afforestation programme in several countries and natural reversion of low-productive agricultural land back to the forest (FAO, 2018).

According to the FSI, the Indian forest increased from 19.45 per cent of its total geographical area to 21.34 per cent between 1991 and 2015. Nevertheless, this pace of change has slowed in recent years (FSI, 2017).

The increase of forest area in India since 1990 is due to a large scale afforestation programme launched by the government to achieve the goal of 33 per cent forest cover of the country, commercial plantation, agroforestry practice, better conservation of forests, as well as protection of forest from degradation. On the other hand, the decrease in forest cover of some Indian states or districts is due to encroachment in forest lands, biotic pressure, rotational/clear-felling and shifting cultivation, diversion of forest land to non-forest activities and development works.

As per the Indian State of Forest Report (ISFR) 2015, India's total forest cover is 21.34 per cent of its total geographical areas, which is below the governments targeted afforestation programme to achieve 33 per cent forest cover of the country. The forest cover of each States and Union Territories of the country has shown in table 1.1. In terms of area wise, Madhya Pradesh has the largest forest cover (77,462 sq km) in the country, followed by Arunachal Pradesh (67,248 sq km), Chhattisgarh (55,586 sq km), Maharashtra (50,628 sq km) and Odisha (50354 sq km). The percentage of forest cover with respect to the total geographical area, Mizoram with 88.93 per cent has the highest, followed by

Lakshadweep (84.56 per cent), Andaman & Nicobar Islands (81.84), Arunachal Pradesh (80.30 per cent), Nagaland (78.21 per cent), Meghalaya (76.76 per cent), Manipur (76.11 per cent) and Tripura (74.49 per cent). At the same time, Punjab has recorded the lowest forest cover with 3.52 per cent of its total geographical areas and followed by Haryana 3.58 per cent, Rajasthan 4.73 per cent (FSI, 2015).

Table No.1.1

Forest cover in States/UTs in India, 2015 (Area in sq. km)

State/UTs	Geographical Area	Total forest Area	Percentage of the geographical area
Mizoram	21,081	18,748	88.93
Lakshadweep	32	27.06	84.56
Andaman & Nicobar Island	8249	6,751	81.84
Arunachal Pradesh	83,743	67,248	80.3
Nagaland	16,579	12,966	78.21
Meghalaya	22,429	17,217	76.76
Manipur	22,327	16,994	76.11
Tripura	10,486	7,811	74.49
Goa	3,702	2,224	60.08
Kerala	38,863	19,239	49.5
Sikkim	7,096	3,357	47.31
Uttarakhand	53,483	24,240	45.32
Dadra & Nagar Haveli	491	206	41.96
Chhattisgarh	135,191	55,586	41.12
Assam	78,438	27,623	35.22
Odisha	155,707	50,354	32.34
Jharkhand	79,714	23,478	29.45
Himachal Pradesh	55,673	14,696	26.4
Madhya Pradesh	308,245	77,462	25.13

Tamil Nadu	130,058	26,345	20.26
Chandigarh	114	22.03	19.32
Karnataka	191,791	36,421	18.99
West Bengal	88,752	16,828	18.96
Telangana	114,865	21,591	18.8
Daman & Diu	112	19.61	17.51
Maharashtra	307,713	50,628	16.45
Andhra Pradesh	160,204	24,424	15.25
Delhi	1,483	188.77	12.73
Puducherry	480	55.38	11.54
Jammu & Kashmir	222,236	22,988	10.34
Bihar	94,163	7,288	7.74
Gujarat	196,022	14,660	7.48
Uttar Pradesh	240,928	14,461	6
Rajasthan	342,239	16,171	4.73
Haryana	44,212	1,584	3.85
Punjab	50,362	1,771	3.52
Grand Total	3,287,263	701,673	21.34

Source: India State of Forest Report, 2015

1.4 Background of Forest Assessment of India

Forest Resources provide benefit to humankind and conserve the environment in the global concern for their protection. The deforestation and degradation of forest resources may have a detrimental effect on soil and climate and, hence, human and animal life on the earth. This motivated to formulate appropriate policies and plans at various levels (from global to local) for forest conservation and sustainable forest management. However, to prepare appropriate policies, draw effective management plans, and monitor changes in forests' status,

it is essential to make accurate and periodic assessments of forest resources (SFR, 2001).

The Forest Survey of India (FSI) came into existence in 1981 as a successor to the Pre-investment Survey of Forest Resources (PSFR), which was established in 1965 with the limited objective of assessing the wood and Bamboo availability in certain selected industrial catchments (SFR, 1989). The Forest Survey of India prepares the countries forest cover map at the interval of two years to monitor forest and tree cover for better planning of the forest resources and the environment's security. The first State Forest Report was published in 1987. Since then, every two years, the biennial State Forest Report was published.

Over the years, FSI has improved forest cover assessments by employing the latest satellite data with higher resolution and scale, with more intensive coverage underground verification and superior interpretation techniques.

The first remote sensing-based nationwide forest cover assessment of 1987 was carried out using LANDSAT-MSS satellite data with a spatial resolution of 80 meters. The scale of mapping was 1:1,000 000, and the mode of interpretation was visual with a Minimum Mappable Unit (MMU) of 400 hectares. In 1989, the LANDSAT-MSS satellite was replaced by the LANDSAT-TM satellite with a spatial resolution of 30 meters. The mapping was carried out at 1: 250, 000 and reducing Minimum Mappable Unit (MMU) from 400 hectares to 25 hectares (SFR, 2017).

Since 1995, FSI started using indigenous remote sensing satellite data, and the mode of interpretation was partly shifted from visual to digital. The satellite data used for forest cover assessment since 2001 is LISS-III with a spatial resolution of 23.5 meters and scale of interpretation of 1:50,000. The mode of interpretation was shifted from visual to digital, and the Minimum Mapable Unit (MMU) is further reduced from 25 hectares to 1 hectare (SFR, 2017). The various assessment technique employed by the FSI is given in table 1.2.

Table No.1.2 Forest cover mapping over the years (ISFR, 1987-2017)

Year Period	Sensor	Spatial Resolution	Scale	Minimum Mappable Unit (hectare)	Mode of Interpretation
1987	LANDSAT-MSS	80 m	1:1 million	400	Visual
1989	LANDSAT-TM	30 m	1:250,000	25	Visual
1991	LANDSAT-TM	30 m	1:250,000	25	Visual
1993	LANDSAT-TM	30 m	1:250,000	25	Visual
1995	IRS-1B LISSII	36.25 m	1:250,000	25	Visual & Digital
1997	IRS-1B LISSII	36.25 m	1:250,000	25	Visual & Digital
1999	IRS-1C/1D LISS III	23.5 m	1:250,000	25	Visual & Digital
2001	IRS-1C/1D LISS III	23.5 m	1:50,000	1	Digital
2003	IRS-1D LISS III	23.5 m	1:50,000	1	Digital
2005	IRS-1D LISS III	23.5 m	1:50,000	1	Digital
2009	IRS-P6- LISS III	23.5 m	1:50,000	1	Digital
2011	IRS-P6- LISS III & IRS-P6 AWiFS	23.5 m 56 m	1:50,000	1	Digital
2013	IRS P6- LISS –III IRS-Resourcesat-2 LISS III	23.5 m	1:50,000	1	Digital
2015	IRS P6- LISS –III IRS-Resourcesat-2 LISS III	23.5 m	1:50,000	1	Digital
2017	IRS P6- LISS –III IRS-Resourcesat-2 LISS III	23.5 m	1:50,000	1	Digital

Source: Indian State Forest Report, 2017

1.4.1 Recorded Forest Area and Forest Cover

The term 'Forest Area' (Recorded Forest Area) refers to all the geographic areas recorded as 'Forests' in government record. Recorded forest areas primarily consist of Reserved Forest (RF), Protected Forest (PF) and Unclass State Forest, which have been constituted under the provision of the Indian Forest Act of 1927. However, the term 'Forest Cover' used in the State Forest Reports (SFR) refers to all lands more than one-hectare area with a tree canopy density of more than 10 per cent. Thus, the 'Forest Area' denotes the land's legal status, whereas 'Forest Cover' indicates the presences of trees on any lands irrespective of their ownerships (SFR, 2011).

The definition and mode of assessment used by the Indian State Forest Report on forest cover have changed over the years. In 1987, FSI defined forest cover as all land with a tree canopy of 10 per cent & above and a minimum mapping unit of 400 hectares. The mapping unit has changed from 400 hectares to 25 hectares in 1989 and extended up to 1999. In 2001, FSI defined forest cover as all lands with more than one hectare area having a trees canopy density of 10 per cent and above irrespective of its land ownership. The forest cover assessment before 2001 was mainly confined to the wooded lands as depicted by green wash on Survey of India (SOI) toposheets, and other lands use were excluded from forest cover. However, from 2001 onwards, ownership of land use was not considered while classifying forest cover (e.g., delineating tree lands as orchards, coffee/tea plantations, public parks, agro forestry plantations, etc.).

In 1987, FSI classified the forest cover into two canopy density classes, viz. Dense Forest and Open Forest. **Dense forest (DF) i**ncludes all lands with a forest cover of trees with a canopy density of above 40 per cent, and **Open Forest (OF)** includes all lands with a forest cover of the tree with a canopy density between 10 to 40 per cent. This classification of forest cover has continued till the SFR 2001. In 2003, FSI classified forest cover into three canopy density classes viz. very dense forest (VDF), moderately dense forest (MDF) and opened forest

(OF). **Very Dense Forest (VDF)** includes all lands with a forest cover of trees with canopy density of 70 per cent and more, **Moderately Dense Forests (MDF)** with the canopy density of 40 per cent and above but less than 70 per cent and **Open Forest (OF)** with canopy density of 10 per cent and above but less than 40 per cent as against earlier two density classes. This classification is still following in the recent assessment of forest cover.

1.5 Forest Cover Assessment of Assam

The magnitude of changes in forest cover differs from region to region due to diverse reasons. In Assam, the decrease in forest cover is mainly due to encroachment in forest land, biotic factor, rotational felling in tea gardens and shifting cultivation, illegal logging, and forest land conversation to non-forest activities. Simultaneously, the positive change in recent years is mainly due to plantations within and outside the forest areas.

As discussed in the preceding section, the first biennial State Forest Report (SFR) on forest cover was published in 1987. Since then, every two years, the biennial State Forest Report on forest cover was published. In 1991, the Forest Survey of India (FSI) started its assessment of its district-wise forest cover. Still, an independent figure on forest cover of all the districts of Assam was not available until the State Forest Report (SFR) of 1999. Thus, from 1999 the data on assessment of district wise forest cover of Assam is available with the Forest Survey of India (FSI). The status of the forest cover of Assam from 1999 to 2017 has shown in table 1.3.

Table No. 1.3

Forest cover of Assam from 1999 to 2017 (area in sq. km)

Year	GA	VDF	MDF	OF	Total	% GA	Biennial Change (in sq.km)
1999	78438	14517	-	9171	23688	30.20	-
2001	78438	15830	-	11884	27714	35.33	4026
2003	78438	1684	11358	14784	27826	35.48	112
2005	78438	1444	11387	14814	27645	35.24	-90
2007*	78438	1452.5	11472.5	14743.5	27668.5	35.27	23.5
2009	78438	1461	11558	14673	27692	35.30	23.5
2011	78438	1444	11404	14825	27673	35.28	-19
2013	78438	1444	11345	14882	27671	35.28	-2
2015	78438	1441	11268	14914	27623	35.22	-48
2017	78438	2797	10192	15116	28105	35.83	567

Sources: ISFR, 1999 to 2017

Notes: (1)* Indicate the interpolated figure of Indian State Forest Report, as no report is available in 2007.

(2) [1]GA= Geographical Area, [2]VDF= Very Dense Forest, [3]MDF= Moderately Dense Forest, and [4]OF= Open Forest.

From table 1.3, it shows that there is a positive change of 4026 square kilometres of forest cover in 2001, as compared to the assessment of 1999. The huge change of forest cover as compared to 2001 assessment with 1999 assessment was due to the use of the different technique (digital, in place of visual) and scale (1:50,000 in place of 1:250,000) of interpretation. Besides, the

[1] Geographical Area of Assam

[2] **Very Dense Forest (VDF)** includes all lands with a forest cover of trees with canopy density of 70 per cent and more

[3] **Moderately Dense Forests (MDF)** with the canopy density of 40 per cent and above but less than 70 per cent

[4] **Open Forest (OF)** with canopy density of 10 per cent and above but less than 40 per cent

significant extent of the area outside continuously wooded lands, excluded from forest cover assessment earlier, has been included in the 2001s assessment. Therefore, the difference between forest cover as assessed in 2001 from that assessed in 1999 is not entirely due to change on the ground during the intervening period. The substantial proportion of this difference (positive or negative) may have occurred over a longer period of time but could be detected or included in the assessment of 2001 due to the reasons explained above (SFR, 2001). The loss of forest cover in 2005 is attributed mainly due illicit felling in insurgency affected areas and shifting cultivation in hill districts. Further, table 1.3 shows that the forest cover increased to 567 square kilometre in 2017 due to plantation outside the forest area. The decrease in forest cover of some districts is mainly due to rotational felling in tea gardens, shifting cultivation and development activities (SFR, 2017).

1.6 Status of Forest Cover in Kokrajhar District

Kokrajhar district is known for its forest since the British Colonial Rule for its valuable trees such as *Sal, Teak, Titasopa* etc. It was the main supplier of *Sal* timber for Railways sleeper, bricks for the rail line, and building bridge and house during the British Rule. The 2nd Tram line of India in the forest was built in the Kachugaon forest division of Kokrajhar district to extract the timber from the forest. Therefore, like other parts of the region, forest degradation started during the British Colonial Rule in the Kokrajhar district. Recently, the change in forest cover of the district is primarily witnessing encroachment on forest land for agriculture and residential purposes, illegal logging and infrastructural development, rehabilitation of erosion by floods and riots etc.

Although the Indian State Forest Report (ISFR) started its assessment on district wise forest cover in 1991, independent figure on forest cover of Kokrajhar district was not available until the SFR of 1999. Thus for simplicity, the independent figure of forest cover assessment of State Forest Report from 1999 to

2017 was adopted to see the present change of forest cover in the Kokrjhar district.

The forest cover of Kokrajhar district based on SFR's assessment from 1999 to 2017 has given in the following table no 1.4.

Table No.1.4

Forest cover assessment of Kokrajhar district's from 1999-2017

(area in sq. km).

Year	GA	VDF	MDF	OF	Total	Percentage of GA	Biennial Change (sq. km)
1999	3538	1401	-	229	1630	46.07	-
2001	3538	1203	-	161	1364	38.55	-266
2003	3538	207	709	267	1183	34.43	-181
2005	3296	207	709	267	1183	35.89	0
2007*	3296	207.5	723.5	242	1173	35.58	-10
2009	3296	208	738	217	1163	35.28	-10
2011	3296	208	716	220	1144	34.71	-19
2013	3296	208	701	211	1120	33.98	-24
2015	3296	207	678	222	1107	33.58	-13
2017	3296	438	267	453	1158	35.13	51

Source :(Census India, 2001, 2011 & SFR 1999 to 2017)

Notes: (1) The geographical area of Kokrajhar district has changed in 2005 due to reorganisation of the district.

(2) * Indicate the interpolated figure of Indian State Forest Report, as no report is available in 2007.

From table (1.4) it observed that the area of forest cover has negatively changed over the years except in 2005 in the Kokrajhar district. The maximum change in forest cover took place in 2001 with a loss of 266 square kilometres,

followed by 2003 with a loss of 181 square kilometres. As discussed in the previous section 1.5, the main reasons for the positive change of forest cover in Assam in 2001, compared to 1999, was mainly due to the shift of definition on the forest cover and inclusion of forest irrespective of its land ownership. However, even with this change in definition on the assessment of forest cover and inclusion of forest irrespective of its land ownership, Kokrajhar district is experiencing a huge loss of its forest cover. The important reasons for the change of forest cover in the district are due to encroachment in forest land for agriculture and human settlement, illegal logging, clearing forest for extension of agriculture activities, illegal logging and other development activities. Table (1.4) also shows that the Kokrajhar district has lost 523 square kilometres out of its total forest cover during the period of 1999 to 2015. Thus, the district is experiencing a total forest loss of 32 per cent out of its total forest area within the span of two decades. In spite of that, a positive change in forest cover saw in 2017; with an addition of 51 square kilometres in existing forest cover due to the afforestation programme in the district.

Table (1.4) also showed that the Dense Forest cover is 1401 and 1203 square kilometres in 1999 and 2001 compared to 2003 onwards. This vast difference in forest cover is due to the classification of forest cover into two canopy density classes, viz. Dense Forest (DF) and Open Forest (OF) for 2001 and earlier assessment. But, from 2003 onwards forest cover has classified into three canopy density classes viz. Dense Forest (DF), Moderately Dense Forest (MDF) and Open Forest (OF). Thus, the dense forest cover has declined from 2003 and onward due to the bifurcation of dense forest canopy into two viz. Dense Forest and Moderately Dense Forest cover.

1.7 Forest Village of Assam

The creation of forest villages (FV) was initiated during the British colonial rule for the management of forest in the early part of the 20th century (Sonowal, 2007). During the British rule, the reservation of the vast tract of forest

in Assam pushed the villagers from the proximity of the forest and alienated people from the forest and their legitimate right. This leads to a serious challenge for the forest department to meet the required demand for raw material for railways and generation of revenue due to the acute shortage of labour.

Thus, the formation of 'Forest Villages' (FV) was closely linked with the question of labour. The labour question was a very difficult one in Assam. It was often alleged that 'Assamese were unwilling to do any work if they could avoid it. When the work in the forest was limited to a little more than the annual clearing of the boundary lines, not much labour was required, but when the work becomes more intensive, there arose great difficulty in securing a sufficient supply of labour. Therefore, the establishment of forest villages was thought to be a way out to solve the labour crisis (Handique, 2004). Initially, labour was met through the introduction of the *'taungiya*' system, as was earlier practised in Burma and Malaysia. This system involved the engagement of outside labourers and granting of cultivable rights over patches of forest cleared in coupes through clear-felling for three to four years. The migrant labourers were treated as serfs and forced to render free services for specific days in the year to the forest department , but later they were provided homestead and one hector of land in lieu of their services (Sonowal, 2007).

The establishment of any forest villages within the reserve forest had to be approved by the Conservator of Forest in writing. The forest department decides the forest villagers based on their adaptability and the habit of the people. According to the Assam Forest Regulation Act of 1891, once a person or family was settled within the forest, they were given 12 bigas of patta land and revenue was fixed at the concessional rate. Every adult villager was required to render 20 days of manual labour annually in return for ordinary wages. Further, a family were entitled to ten card loads of fuel every year in return for another ten days of labour, and these privileges were given to the shifting cultivators, too (Saikia, 2011). However, the ownership of the land of forest villages is vested in the hand of the Forest Department (FD); people cannot mortgage it to get any loan from the

financial institutions. The ownership right over the land will automatically transfer to its kin in case of departure of the guardians or parents.

Therefore, to mitigate the labour problem, the then Forest Department of Assam established the first 'Forest Village' at Kachugaon in the then Goalpara (presently Kokrajhar) district within the Reserved forest in 1901. And in 1902, two more forest villages namely-Panbari and Bamunjhora were established. Those who came to be part of these forest villages belong mostly to the tribal communities of Bodo and Rava (Saikia, 2011). By 1937, 312 forest villages in Assam spreading over 9,713 acres, mostly in Goalpara, Cachar and Kamrup, were recorded. These forest villages were inhibited by different caste and communities. However, the majority of forest villages were occupied by the Schedule Tribe population (Handique, 2004).

The creation of forest villages was abandoned in 1931 by the British Empire in India. But, after independence due to lack of strict forest policy in India, it was continued until the introduction of the Forest Conservation Act of 1980. This act restricted the regional government from converting forest land for non-forest purpose without prior approval from the central government.

The Forest Department's record shows that till 31st March 1984, the forest department of Assam had the record of a total of 499 forest villages with a definite number of household record and landholding under the department. It also shows another 49 settlement as *Taungya* settlement in the state with no definite record of household and population. The forest villages were distributed in 22 forest division in the state. The highest number of forest villages were found under the Kachugaon division (102), followed by Kamrup division (60) and Silchar (57) and Karimganj (43) (Sonowal, 2007). In response to the recommendation of the Ministry of agriculture in 1984, in the State of Maharashtra, Madhya Pradesh and Gujarat, several forest villages were converted to revenue villages, but the condition of forest villages in Assam remained unchanged.

Recently, the forest dwellers in general and Schedule Tribe, in particular, were happy with the new forest Dwelling Act of 2006 passed by the Government of India thinking the conversion of forest villages to revenue villages. But the process of implementation in Assam as a whole and Kokrajhar district in particular is yet to gain momentum due to diverse reasons.

1.7.1 Forest Village in Kokrajhar District

As discussed above, the first forest village (FV) was established at Kachugaon under Gaolpara (presently Kokrajhar) district in 1901. The terms and condition laid down by the forest department for the formations of forest villages are by and large similar to the rules prevalent in the country's other forest villages.

Kokrajhar district is under the erstwhile Goalpara district, was rich in *Sal* trees and other valuable trees. So the management of this area is out most important for the British Forest Policy for the regular supply of hard *Sal* trees for making railways sleeper, log bricks for railway tracks and bridges etc. Therefore, looking at the *Sal* forest's immense importance and other valuable trees, the British Empire established the forest Tramway line at Kachugaon forest division in 1900-1901. The forest tramway line was connected between the Kachugaon forest range to Fakiragram on the Eastern Bengal Railway. The construction of the tramway line was completed in 1924 (Hillaly, 2016). The main reasons for the construction of the Tramway line were the availability of high-quality *Sal* timber, high and profitable demand from the construction of Eastern-Bengal Railway trunk line and Gangatic Railways network, transportation of timber from Kachugaon forest division to Fakiragram railway station, labour and water transportation for plantation work undertaken inside the forest, timber harvesting from forest etc.

Therefore, the establishment of forest villages became very important for the British forest policy in the district. However, after settling the forest, the forest

villagers had to render compulsory beggar (forced labour) for a minimum of five days per adult member per year. According to their whims, the forest official had the power and authority to increase the minimum days of free labour. Presently, the forest villagers have stopped rendering free labour to the forest department. But the system has not abolished the departmental procedure. The forest officers still maintain the book to monitor the free labour due to the forest villagers. It has been reported that the forest villagers stopped rendering beggar to the forest department by 1980, and in lieu of that, they paid forest land revenue (Sonowal, 2007).

The growth of forest villages started from the Kachugaon forest division of the Kokrajhar district and extended up to the entire forest division of Assam during 1911-12. By 1937, there were a large number of forest villages in the Kokrjhar district, as furnished in the following table 1.5 (Handique, 2004).

Table No.1.5

Division wise forest villages of Kokrajhar District, 1937

Name of Forest Division	Reserve Forest	No. of Forest Villages
Haltugaon	Manas	11
	Chirang	2
	Bengtal	2
Kachugaon	Kachugaon	90
	Ripu	3
	Guma	12

Source :(Adapted from Handique, 2004, page no.77).

Like other parts of the country, after the Forest Conservation Act of 1980, forest villages' creation was stopped, and restriction was imposed on the forest land occupation in the forest division of Kokrajhar district.

The establishment of forest village over the decades has increased, and till the last decade, there are 499 forest villages in Assam (Forest Department,Assam, 2011-12).

After the Bodoland Territorial Council (BTC) Accord of 2003, the forest division of the Kokrajhar district of Assam has been re-organized into three viz. Kachugaon, Haltugaon and Parbathjhora forest division. The total number of forest villages in Kokrajhar district with its boundary of 2011 stood at 145. Table (1.6) shows the division wise forest villages of Kokrajhar district.

Table No. 1.6

Division wise forest villages of Kokrajhar District, 2011

Name of Forest Division	Reserve Forest	No. of Forest Villages
Kachugaon	Kachugaon	80
	Ripu	26
Haltugaon	Chirang	21
	Bengtal	2
	Manash	2
Parbatjhora	Guma	14
	Total	145

Source: Profile on forest and Wildlife of BTC, Dept. of Forest BTC (n.d)

In terms of district-wise comparison of forest villages, Kokrajhar district has the maximum numbers of forest villages in Assam. Further, in terms of forest division- wise comparison of forest villages of the district, the Kachugaon forest division has the maximum number of forest villages, 106 and the Parbatjhora forest division has the lowest with 14 forest villages.

The forest villages of Kokrajhar district have their own GPS location code number which was initially used by the census of India, 2001. The details of forest villages of the district have attached in the appendix of the thesis.

1.5 Significance of the Study

Kokrajhar district is blessed with rich natural resources. The climatic condition and wide variety in physical features witness a diversity of ecological habitats such as forests, grasslands, wetlands which harbour and sustain wide-ranging floral and faunal species in the district. In terms of area, it shares only 4 per cent of the total geographical area of Assam, but in terms of the dense forest, it shares 15.66 per cent of the total dense forest of Assam (FSI, 2017). The majority (57%) of forest dwellers in the district are belong to the Schedule tribe community, including Bodo, Rabha, Garo and Hajong. Besides cultural and traditional belief and attachment to the forest by the tribal people, the maximum villagers depend on the forest for their daily requirement for fuel wood, herbs, medicine, thatches, leaf, food, fruits, timber, etc., combined with the demand for forest land for cultivation. Traditionally, the forest dwellers in a general and tribal community, in particular, seemed to be having a culture that kept a balance between human and ecological needs. However, the recent experience of the world as well as from other parts of India suggest that excessive exploitation of natural forest led to the loss of biodiversity due to increasing threat and pressure on the biosphere.

Kokrajhar district also witnessed high pressure on its natural resources due to illegal encroachment in forest lands for agriculture and residential purposes, excessive exploitation of forest resources, illegal logging, grazing, infrastructural development, and rehabilitation of people due to erosion by floods and riots etc. As a result, so far, 523 square kilometres of forest land were encroached/ lost in between 1999 to 2015 in the district as per SFR. As such, the anthropogenic disturbance on the forest is not only affecting species, flora and fauna but also

affecting the age-old dependence on the forest by tribal and marginal section of communities in the study area

.

Thus, in spite of the study on the extent of dependence on forest resources by the forest dwellers, in-depth study on the attitude and perception of forest dwellers is required along with tribal culture, belief and traditions for the conservation of forest and biodiversity in the study area. Therefore, an attempt has been made in the present study to incorporate and elaborates extensively on all the points mentioned above, keeping in view of sustainable uses of forest resources and conservation of biodiversity. Lastly, it will help the government to adopt a policy on the conservation of forest and biodiversity not only for this part but also for the other parts of the regions.

1.6 Objectives of the Study

To highlights the importance of forest resources and their uses by the forest-dwelling community of Kokrajhar district, the present study is undertaken with the following objectives:

a. To assess the extent of dependency on forest resources by the dwellers of forest village.
b. To study the socio-economic status of forest villagers of Kokrajhar District.
c. To study the role of forest villagers in biodiversity conservation.

1.7 Hypothesis

The following hypotheses have framed based on the objectives set above.

1. The extent of dependency on forest resources is high among the forest-dwelling community of Kokrajhar district.
2. There is an adverse effect on biodiversity conservation due to excessive pressure on the forest in the study area.

1.8 Study Area

The study has been conducted in the Kokrajhar district of Bodoland Territorial Council, Assam. The district is the northern belt of Brahmaputra, which lies between 26^0 $07^/$ $36^{//}$ and $26^0 51^/$ $10^{//}$ North Latitudes and $89^0 50^/$ $58^{//}$ and $90^0 25^/$ $15^{//}$East Longitudes. It occupies a total geographical area of 3269 sq. km. which accounts for 4.16 per cent of the total area of Assam (78,438.00 sq. km). It is bounded in the north by the Kingdom of Bhutan, in the east by the district of Chirang and Bongaigaon, in the south by the Dubri district and in the west by the state of West Bengal. The population of the district is 886,999, of which 832,249 (93.83 %) resides in rural areas, and 54,750 (6.17%) are in urban areas. There are 1068 villages, out of which 145 are forest villages in the district (Census of India, 2011).

The district's major portion is flat plain and characterized by its configuration, drainage pattern, and geological structure. The northern part forms the foothills topography of the Bhutan range. The Ripu-Reserved Forest, Kachugaon Reserved Forest and Chirang Reserved Forest extend on this foothills area. The district is mainly sloping from north to south. The region is mainly drained by the Sankosh, the Hel, the Jakati, the Saralbhanga and Dholpani rivers. Most of the rivers originated from the Bhutan Range and became the tributaries of the Brahmaputra River.

The study is concerned with the Reserved Forest of Kokrajhar district, where forest villages were located. The reserve forest of the district is divided into three different forest divisions viz. Kachugaon Forest Division, Haltugaon Forest Division and Parbathjhora Forest division. These three forest divisions have 24 number of reserved forests, out of which only six reserve forest (as represented by star mark) have forest villages (Table1.7). The forest villages were mostly concentrated in the Kachugaon forest division, followed by the Haltugaon forest division. The Parbathjhora forest division has the lowest number of forest villages. The total number of reserve forest in the Kokrajhar District is given in table no.1.7.

Table No. 1.7

Total number of reserve forest in Kokrajhar District (as of 2011)

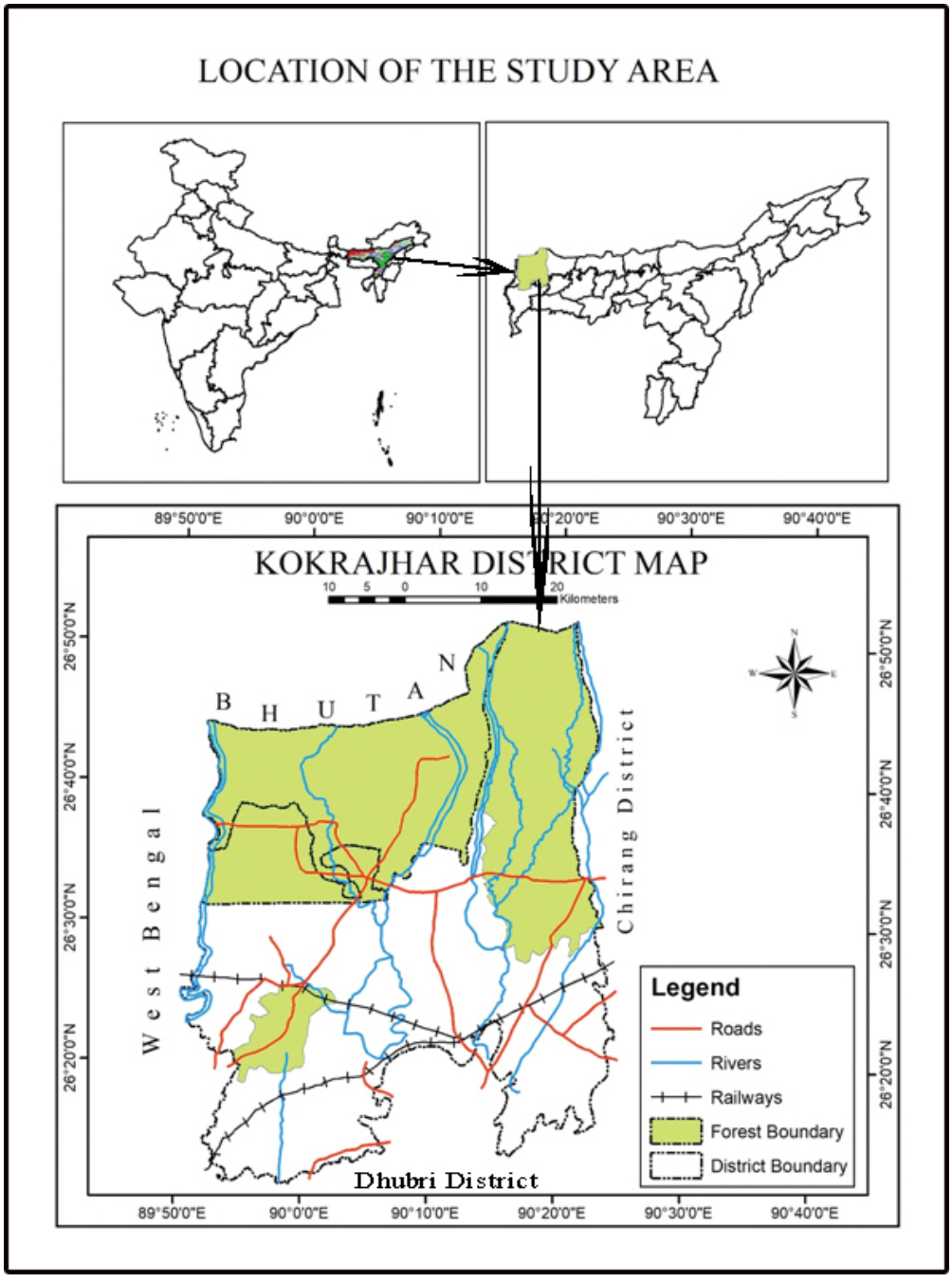
Name of Forest Division	Name of reserve forest	Area Ha.
Kachugaon FD	1. Ripu-Reserve Forest *	60,526.89
	2.Kachugaon-Reserve Forest *	21,445.00
	3. Elasijhar-Reserve Forest	226.00
Haltugaon FD	1. Chirang *	59,254.12
	2. Manas(Part) *	2,962.00
	3. Bengtal (Part)*	1,071.00
	4. Nandagiri Hill	1,019.80
	5. Satbhendi	273.20
	6. Phukagaon	161.00
	7. Buxamara	136.80
Parbathjhora FD	1.Mahamaya	9,917.81
	2. Tipkai	216.38
	3. Bhelakoba	1,722.93
	4. Chilkikhata	174.41
	5. Dudumari	49.76
	6. Paroura	302.63
	7. Katrigasha	706.88
	8. Bamunijhora	248.18
	9.Manglajhora	4,620.45
	10. Atharokota	966.80
	11. Rupsi	123.34
	12. Guma*	6,944.13
	13. Sakati	22.63
	14.Tilapara	117.41

Source: Profile on Forest and Wildlife of Bodoland Territorial Council, Forest Dept.BTC

Note: * marks represent reserve forest having recognized forest villages in the forest divisions.

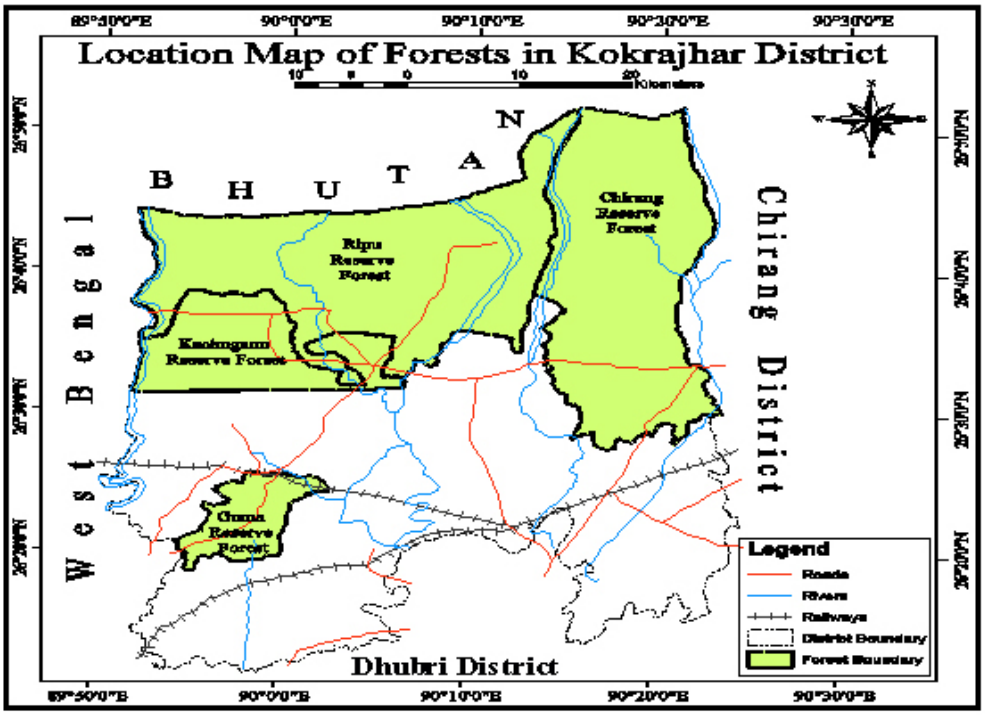
Map No. 1.1

Location map of the Kokrajhar district of Assam State and India

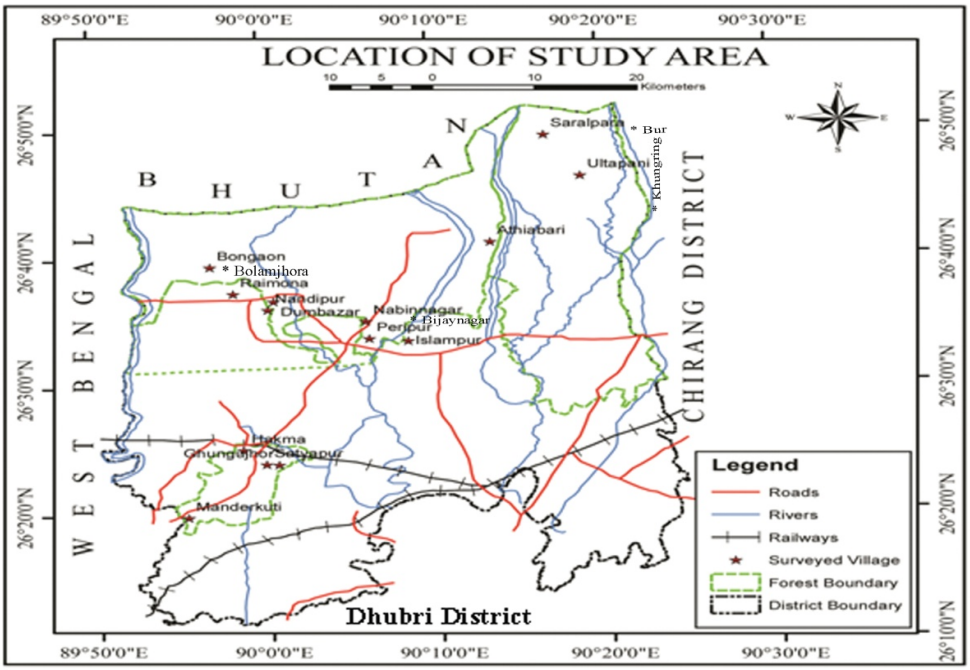


Map No. 1.2

Location map of the reserve forest in Kokrjhar district

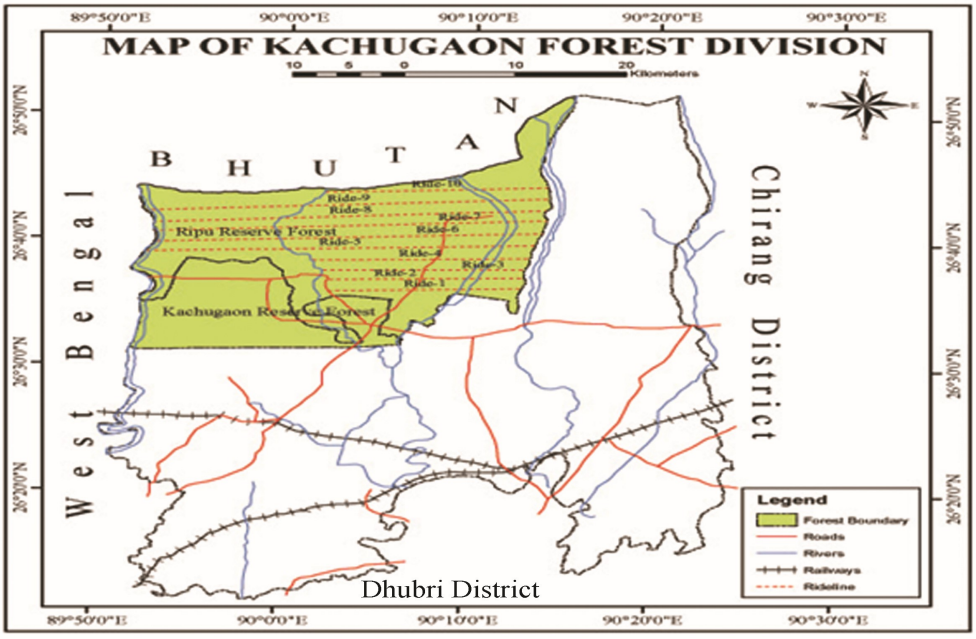


Map 1.3: Location map of the study area in the district



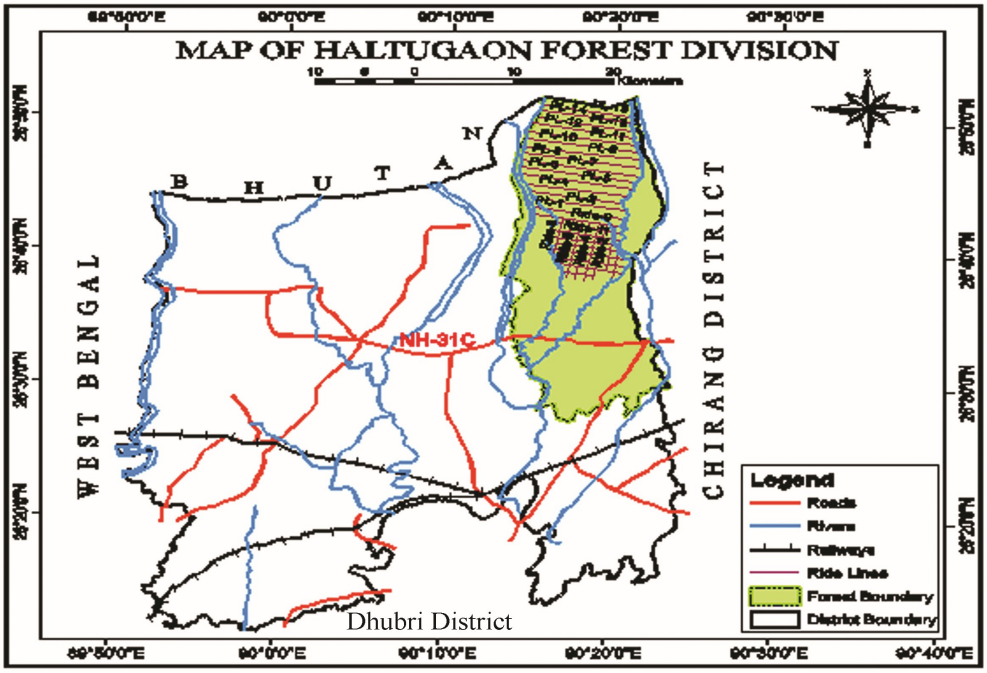
Map No. 1.4

Location map of the Kachugaon forest division



Map 1.5

Location map of the Haltugaon forest division



1.9 Organization of the Chapter

The present study has been organized in the following chapters.

Chapter-I: Introduction

Chapter-II: Literature Review

Chapter-III: Methodology and Data Collection

Chapter-IV: Dependence on Forest Resources by the Dwellers of Forest Village

Chapter- V: Socio-Economic Status of Forest Villagers and Its Impact on Income from Forest Products

Chapter- VI: Role of Forest Dwellers in Bio-diversity Conservation

Chapter-VII: Summary and Conclusion