CHAPTER -4

DEPENDENCE ON FOREST RESOURERCES BY DWELLERS OF FOREST VILLAGE

Chapter: 4

Dependence on Forest Resources by Dwellers of Forest Village

4.1 Introduction

The symbiotic relationship between forest and human beings has its origin since man's existence in the world. The history of Forest in India, as anywhere else in the world, is related to the history of civilisation. The civilisation began in India much before the migration of the Aryans, which took place between 2500 and 2000 BC. The civilisation of Mohenjo-Daro, Harappa and Channudaro in Sindh, Panjab and Rajputana (the territory extending on either side of the international line dividing present-day Pakistan and India) respectively dates back to between 4000 and 5000 BC (Lal, 1989). Remain ancient relics reveal that most of them belong to the tribal community. So, environmentalist and sociologist claim that the tribal has lived in harmony with the forest for hundreds of thousands of years. The harmony was only disrupted with the advent of scientific forestry in the country. They began to use forest beyond their carrying capacity and cut wood in excess of the growth.

Therefore, dependence on forest resources is as old as the civilisation of man. Man depends on forests not only for the variety of needs viz. food, firewood, fodder, timber, medicine, etc. but also has cultural, spiritual and religious values associated with it. The nature of dependence on forest and their utilisation has changed over the years. The rapid encroachment on forest land due to excessive growth of population, rising standard of living and rapid industrialisation led to over-exploitation of the natural resource. These will impact not only the forest environment but also the sustenance of forest dwellers.

As such, the aims and objective of the present chapter are based on the endowment of forest resources such as climate, topography, geology and soil condition and types of forest vegetations etc. Further, the chapter analyst in-depth on the extent of dependence on forest resources, the benefit and cost of forest and non-forest products and assessment of their net present value will be the main focus. Through this study, the researcher highlighted forest resource use by the forest dwellers and its impact on the forest and biological diversity.

4.2 Endowment of Forest Resources

The endowments of natural resources of a particular place depend on its bio-physical factors such as climate, topography, geology, soil condition, etc. Climate is the most important from the point of view of forest distribution, growth and development. Other factors, viz. physiography, geology, soil, and biotic factors, play their parts within the general climatic zones (Dwivedi, 1980). Thus detailed knowledge about biophysical factors of a particular area is essential before knowing its natural resources.

4.3 General Profile

4.3.1 Location and Description of the Forest Division

Presently, there are three forest divisions under the Kokrajhar district, viz. Kachugaon, Haltugaon and Parbathjhora (i.e. Part of Dhubri division) forest division and the district is the part of Conservator of Forest, Western Assam Circle (CF, WAC). The Conservator of Forest, Western Assam Circle (CF, WAC), headquarter at Kokrajhar, is the Council Head of the Department of BTC (recently known as BTR), Assam.

The Ripu Reserve Forest of Kachugaon forest division and Chirang Reserve Forest of Haltugaon forest division are contiguous with Buxer Tiger Reserve of West Bengal and Phipsoo Wildlife Sanctuary of Bhutan. This forest division is also part of the Buffer Zone of Manas National Park. Further, the Reserve forest of Kachugaon forest division and Haltugaon forest division was

declared as the Chirang - Ripu elephant reserve in 2003. It is also recognised as a transboundary elephant corridor with Assam, West Bengal and Bhutan.

The Chakrashila Hill Reserve Forest of Haltugaon forest division was declared as Chakrashilla Wildlife Sanctuary in 1994, with an area of 45.658 sq. km, is well known for the existence of Golden Langur in the district. It is segregated from the main Indo- Bhutan habitat in the north (Forest Department, B.T.C., n.d.)

4.3.2 Configuration of the ground

The major portion of the Kokrajhar district is flat plain, the ground formation of land is gentle slope from northern foothills of Bhutan range to southward plain. From the north to a few kilometres of the south, the tract is composed of rock and pebbles and remains waterless most of the year, representing typical Bhabar characteristics. Further down, the streams are perennial, groundwater is high, and the soil is more productive, thus representing terrain characteristics.

The topography of the southern part is broken by several hillocks of varying altitudes. Some of important hills are Chakrasilla, Nandegiri, Manglajhora and Tipkai etc.

The major rivers and streams are Saralbhanga, Champabati, Gaurang, Bhur, Dholpani, Laopani, Hell, Dhordora, Jakhati (Pekua), Janali and Sankosh. Most of these rivers and streams are originated from Bhutan and fell into the Brahmaputra River in the south. The above rivers are the lifeline of the people of the Kokrajhar and Dhubri district.

4.3.3 Geology and soil

The Reserve forest of the Kokrajhar district has a unique geological formation. The area lies north by the foothills of Bhutan and south by the northern

bank of Brahmaputra. The rock and soil formation of the study area is distinctly alluvial. Bhabar tract is consists of coarse water-born pebbles, chiefly quarstone origin, upon which lies a thin layer of sandy loam and humus. On the other side, in terrain areas, the water level is high, and the amount of silt and clay is also higher than the bhabar tract. The presence of silt and clay along with high groundwater enhances moisture retention of the ground.

Again, the soil is sandy loam and rich in humus. This forms a fertile land along the Bhutan boundary's entire foothills, providing an excellent base of luxurious and evergreen forest vegetation growth throughout the year.

4.3.4 Climate

Kokrajhar district is blessed with diverse climatic conditions, which are reflected in the richness of forest flora and diversity of forest type ranging from mix-deciduous forest to Savanna forest. The district's climatic conditions have been recognised as four distinct seasons, namely- winter, summer and monsoon and post-monsoon. The winter season starts in the middle of October and continues up to February with moderate to strong cold. Hot and humidity is also experienced during the summer from March to May. Usually, the southwest monsoon starts from June to September. Post monsoon starts from October to December with starting cold and winter season. The frequency of rainfall is abundant for more than six months and an occasional shower throughout the rest of the year.

The Director of Economic and Statistics Government of Assam has recorded the annual rainfall of Kokrajhar district as 3772.2 mm, which higher than the state's annual rainfall of 2295.8 mm (table 4.1). During the monsoon, the average annual rainfall ranges between 1500 mm to 3000 mm. The average minimum and maximum temperature recorded are 10ºC and 30ºC, respectively, with a humidity of more than 90 per cent during the monsoon period and about 60 per cent during the hot period. This climate is congenial for the luxuriant growth

of mixed deciduous forests (Narzary, 2013). Table 4.1 shows the average monthly rainfall of Kokrajhar district and Assam in 2017.

Table 4.1

Average monthly rainfall of Kokrajhar district and Assam,2017 (in mm.)

Month	Rainfall in Kokrajhar district (in mm)	Rainfall in Assam (in mm)
	Normal	Normal
January	10.9	16.2
February	27.9	32.0
March	45.8	78.1
April	216.4	172.9
May	461.1	304.2
June	822.2	427.3
July	864.2	454.2
August	677.1	356.7
September	462.9	285.7
October	159.5	131.8
November	18.1	24.9
December	6.1	11.8
	3772.2	2295.8

Source: The Director of Economic and Statistics Government of Assam, 2017

4.4 Forest

As discussed above, the geological and soil formation of the Reserve forest of Kokrjhar district is very rich in terms of the fertility of land due to Bhabar and terrain characteristics. The physical setting of the region, coupled with the excellent climatic condition of Bhutan's foothills, provides luxuriant and evergreen forest vegetation growth all through the year of the area. These help in the growth of the high density of tree canopy of the areas. Thus, forest as a wealth of Kokrajhar district is very rich in terms of variety of species that are yet to be

inventoried and identified, especially those of having medicinal and commercial value.

There is only 9 (nine) district out of 28 (twenty-eight) districts of Assam (FSI, 2017) having more than 33 per cent of its geographical areas covered by forest. The nine districts are Cachar, Chirang, Dima Hasao, Kamrup metro, Hailakhandi, Kabi Anglong, Karimganj, Kokrajhar and Tinsukia. In terms of forest canopy density, Karbi Anglong district has the densest forest in terms of Very Dense Forest (VDF), followed by Kokrajhar district, which has been recorded as the second densest forest in terms of area under Very Dense Forest (VDF) (table 4.2) with 438 square kilometres. However, in terms of area under forest cover out of nine other districts, Kokrajhar district has the lowest percentage of its total geographical area under forest cover (FSI, 2017). Table 4.2 has shown the districts having 33 per cent forest cover of Assam as in Forest Survey of India, 2017.

Table 4.2

Districts having 33 per cent forest cover of Assam, 2017 (area in sq.km.)

Districts	Geographical Area (sq km)	2017 Assessment (in sq.km.)				Per cent of G.A.
		VDF	MDF	OF	Total	
Dima Hasao*	4888	209	1519	2482	4210	86.13
Karbi Anglong	10,434	586	3801	3596	7983	76.51
Cachar	3,786	93	1077	1053	2223	58.72
Hailakhandi	1,327	13	366	394	773	58.25
Kamrup Metro.	955	0	225	235	460	48.17
Karimganj	1,809	3	300	513	816	45.11
Tinsukia	3,790	410	356	823	1,579	41.66
Chirang	1923	402	108	184	694	36.09
Kokrajhar	3,296	438	267	453	1158	35.13

Source: ISFR, 2017

Notes: 1. Dima Hasao* is the present name of the North Cachar Hills district.
2. VDF = Very Dense Forest, MDF = Moderately Dense Forest and OF = Open Forest

4.5 Types of Forest

Kokrajhar district is known for its glorious *Sal* forest since the British colonial rule in Assam. But, due to massive deforestation in the district in the last decades, only a few patches of *Sal* trees are seen in Jharbari Block, ahead of Parallel IV in Haltugaon division, and left only a few patches of *Sal* trees in between Ride IV to Ride VI in the Central and Safan Ranges under Kachugaon forest division. However, these small patches of *Sal* trees are also under heavy threat of extinction.

Chamipion and Set (1968) defined forest types as "a unit of vegetation which possesses (broad) characteristics in physiognomy and structure sufficiently pronounce to permit its differentiation from other such units". Their classification of forest types is based on the distinct ecosystem, climate, soil or vegetation. Thus, based on the classification of forest types by Champion & Set (1968), the reserve forest of Kokrajhar district is identified as the following types:

Sal Forest

1. Bhabar Sal Forest:
2. Terrain Sal Forest
3. Eastern Heavy Alluvial Sal Forest
4. Eastern Hill Sal Forest

Mixed Deciduous Forest

Evergreen Forest

Savannah

1. Dry Savannah
2. Wet Savannah

Riverain Forest

A brief description of each type is given below:

4.5 .1 Sal Forest

4.5.1. a Bhabar Sal Forest

Bhabar Sal forest has been sub-classified into two, namely East Himalayan Upper Bhabar Sal (3C/C 1b (i))[1] and East Himalyan Lower Bhabar Sal (3C/C1b(ii))

The East Himalayan Upper Bhabar Sal (3C/C 1b (i)): This type is characterised by the presence of dense *Microstegium ciliatum*. Along with high-quality *Sal* (Shorea robusta), the other top canopy is occupied by *Ghogra* (Schima Willichii), *Sida* (Lagerstroemia parviflora), *Ajhar* (Lagerstroemia speciosa), *Bohera* (Terminalia balearica), *Haldu* (Adina cordifolia), *Odal* (Sterculiavillosa), *Kum* (Carea arberea), *Koroi* (Albejia Procera), *Kanchan* (Bauhinia spp.), *Simul* (Bombax ceiba), *Sonalu* (Casia fistula) etc. There are shrubs and plenty of climbers. This type is usually found in the Ripu Reserve Forest (RRF) of Kachugaon and Chirang Reserve Forest of Haltugaon Division.

The East Himalayan Lower Bhabar Sal (3C/C b(ii)): This type differs from the upper bhabar subtype, concentrated in areas with less incidence of grasses but more evergreen undergrowth condition. The quality is varied from I/II to II on well-drained alluvial soil. This type is also found in the Ripu Reserve Forest (RRF) of Kachugaon and Chirang Reserve Forest of Haltugaon forest division.

4.5.1. b Terrai Sal Forest (3C/C1c)

This type of Sal forest is generally found in relatively lower heights compared to the other two subtypes. The quality of Sal varies from I to III/IV.The principal associates of *Sal* are *Tita sopa* (Michellia champaca), *Hinguri* (Castanopsis indica), *Simul* (Bombax ceiba), *Bhelu* (Tetramales nudiflora),

[1] There is 18 Forest type in Assam belonging to five forest types group, viz, Tropical Wet Evergreen, Tropical Semi-Evergreen, Tropical Moist Deciduous, Tropical Dry Deciduous and Sub Tropical Pine Forest. The classifications of forest types have been undertaken by the Forest Survey of India with reference to Champion and Set classification.

Gambari (Gmelina arborea), *Ajhar* (Lagerstroemia speciosa), *Oxi* (Dillenia pentagyana), *Owtenga* (Dellenia indica), *Makari* (Sal Schima wallichii) etc. Shrubs and climbers are also available in plenty. This type is also found in the Ripu Reserve Forest (RRF) of the Kachugaon and Haltugaon forest division.

4.5.1. c Eastern Heavy Alluvial Plain Sal Forest (3C/C2d (ii))

This type of Sal forest has been classified as 3C/C2d (ii). All the plain forests of tropical red soil are covered by this type. The *Sal* (Shorea robusta) is followed by its associates like *Sain, Oxi, Sida, Gogra, Ajhar, Bohera, Panikadam, Gambari* etc. These types of Sal patches are found in the plains and foothills of the Bhohalpur range of Haltugaon and the red soil of Guma reserve forest of Parbathjhora forest division. This forest also has available shrubs and climbers.

Regeneration of Sal is not a problem in these forests. Whenever there are slight opening in the canopy, there is the profuse occurrence of *Sal's* whip seedling, and establishment of these is also rather easy.

4.5.1. d Eastern Hill Sal Forest (3C/C1a (ii))

This type of Sal forest has been classified as 3C/C1a). The associates of Sal (Shorea robusta) were *Ghogra, Kum, Parali, Amlokhi*, etc. *Kakobamboo* (Dendrocalamus hamintonii) is also found as middle storey. This type of Sal forest is found on the foothills of Bhutan under the Kachugaon and Hantugaon forest division.

4.5.2 Mixed Deciduous Forest (3C/C32s1)

The northern secondary moist mixed deciduous forest is classified as 3C/C32s1. This formation is found in Kahugaon and the southern part of the Chirang reserve forest. The prominent species occurring are *Bohera, Parali,*

Amari, Jam, Sida, Gohera, Oxi, Kum etc. Besides this, plenty of shrubs, herbs, grasses and climbers are also found.

4.5.3 Evergreen Forest (1B/C1) and 2B/C1

The Wet evergreen forest is found in Bamba and Singimajuli blocks of the Northern part of Ripu-reserve forest and Ultapani, Loapani, Dholpani and Saralpara blocks of the Chirang reserve forest. The dominant species are *Bagipoma* (Chikrasia tabularises), *Bhelu* (Tetramalies nudiflora), *Badam* (Mansonia dipikae), *Bonsum* (Phoebe goalparensis), *Titasap* (Michelia champaca*), Lali* (Amoora Wallichii), *Nahar* (Mesua ferea), *Cham* (Arto carpuschaplasa) etc. Besides this, various types of shrubs, herbs, grasses and climbers are also found.

4.5.4 Savannah (3/1S1)

This type of forest vegetation is divided into two dry Savana and wet Savana. Dry savannah occupies extensive areas into Bhabar terraces, and locations are subjected to fierce annual fire. The scattered tree species such as *Simul, Koroi, Amlakhi, Oxi Palash* etc., are also found in grass areas.

On the other hand, Wet Savana is found in low lying locations with little change of composition. Only a few species of trees are coming up in such locations, such as *Koroi, Urium, Owtenga, Simul*, etc. The grass species found are *Kush, Khagari Ekara* etc. Both the subtypes of forest are found in the Kachugaon and Haltugaon forest division.

4.5.5 Riverain Forest

Coloniser species of riverbanks and islands characterise rive rain forest. This type of species is found in abandon and silted up courses of rivers and streams, away from the present channels. The dominant species are *Sisoo* and *Khoir* with other associates like Simul, Koroi etc. These types of forest are found in and around the Sankosh, Pekhua, Hell, Saralbhanga and Bhur river banks under Kachugaon and Haltugaon forest division.

4.6 Forest Resources

The vast types of forest, ranging from Bhabar *Sal* forest to Terrain *Sal* Forest, evergreen forest to Savana Forest, witness rich natural forest resources in the study area. The legacy of the glorious *Sal* forest of Kachugaon forest division and its management is well known during the British colonial period. Forest Department of British colonial rule, try to protect the forest fire by digging the forest ride and parallel within the forest. Simultaneously, to manage the best *Sal* forest of Kachugaon forest division, Tramline was constructed to supply water and labourer in the forest, and rapid transportation of timber from the forest to Fakiragram Station of the Eastern Bengal Railway (Handique, 2004). Thus, *Sal* forest is an important source of government revenue and extensively used by the local peoples till today. Besides firewood, *Sal* tree is also used for making plough, cart, poles of house, furniture, handloom frames, etc. Apart from departmental logging, illegal logging by forest villagers took place for cash income. As a result, mature *Sal* forest was dwindled way and found only in between ride IV and VI of the Kachugaon forest division and in few patches of Haltugaon forest division.

The non-timber forest product of this area is also very rich due to vast types of forest. Some of them are known for commercial purpose but most of them are yet to be inventoried and identified, especially those of having medicinal and commercial value. The important and valuable non-timber forest product (NTFP) found in this area were medicinal herbs, edible green leaves, mushroom, honey, oilseeds, resin etc.

Apart from timber and non-timber forest product, the forest also provides agricultural land to the people. The forest dwellers socio-economic and cultural values are related to forest and uses of forest land. The demand for forest land is all-time high in this area as the majority of the community is based on subsistence agriculture. As a result, today, the prime *Sal* forest has been replaced by agricultural fields.

The forest also provides grazing land for the local communities. There are lots of *Bhatwn / Khutis* in these forest areas. But uncontrolled grazing is highly detrimental to forest regeneration. Grazing impacts the soils, reduces aeration, upsets the soil water regime, and increases runoff and risk of erosion (Dwivedi, 1980).

4.7 Population composition of Kokrajhar district

The demography of the Kokrakjhar district is mainly dominated by Bodos, an aboriginal tribal community of Assam. Besides Bodos, the other tribal communities inhabited in the district are Rabhas, Garos etc. The other general communities are Adivasis (Santhal, Urao, Munda), Koch Rajbongshi, Bengali, Muslim, Assamese speaking Assamese, Maroari, Bihari, Nepalese and Schedule Caste people are also found in certain percentage in the areas. The table (4.3) shows that out of the total population, 3 per cent of Scheduled Caste , 32 per cent are Schedule Tribe and 65 percent General category of population are in the district. The following table 4.3 and figure 4.1 shows the composition of the population in the Kokrajhar district.

Table No.4.3

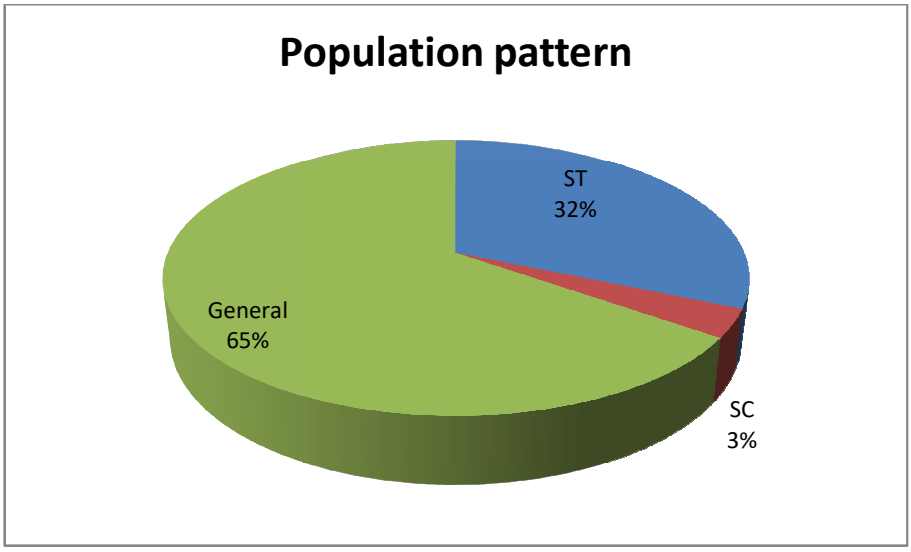
Population Composition of Kokrjhar district, (census, 2011)

ST	SC	General	Total population
278665	29570	578907	887142
31.41	3.33	65.26	100 (per cent)

Sources: Population Census of India, 2011.

Figure No. 4.1

Population Composition of Kokrjhar district



Source: Population Census of India, 2011.

4.7.1 Population composition of Forest Villages of Kokrajhar District

The study is based on the recognised forest villages of the tree forest divisions of the Kokrajhar district. There are altogether 145 Government recognised forest villages in the Kokrajhar district. Out of this 106, forest villages are in the Kachugaon forest division, 25 forest villages are in the Haltugaon forest division, and the remaining 14 forest villages are in the Parbathjora forest division. This forest village has been created or set up/established during the pre and post-independence period. The process of recognition of these villages as a revenue village remained incomplete due to the promulgation of the Indian Forest (conservation) Act of 1980. Similarly, 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 conditions of forest villages in Assam remained unchanged (Sonowal, 2007). The

communities residing in the forest villages of the Kokrajhar district are Bodo, Rabha, Garo, Santal, Uraon, Munda, Rajbangsi and Nepali. Among them, Bodos, as a tribal community, is the dominant and aboriginal tribe in the district. Recently, many new villages have encroached within the reserve forest areas, but they have been excluded from the present study.

From table 4.4, it is observed that out of total population of forest villages of Kokrajhar district, 57 percent is ST, 42.54 percent is Other categories and less than 1 percent is SC categories of people. In terms of Division wise, 54.87 percent ST population live in Kachugaon forest division, 74.02 percent in Haltugaon forest division, and 21.77 percent in Parbathjhora forest division. Similarly, 44.84 percent of Other category of people are reside in Kachugaon Forest division, 25.17 percent in Haltugaon forest division and 77.08 percent in Parbathjora forest division. Again in case of SC categories, less than 1 percent of people are in Kacuhgaon and Haltugaon Forest division and Parbathjora is the only forest division having more than 1 percent of SC category of people.

The population pattern of the three forest division of Kokrajhar district is shown in the following table (4.4)

Table No. 4.4

Population composition of the forest village of Kokrajhar district (in 2011)

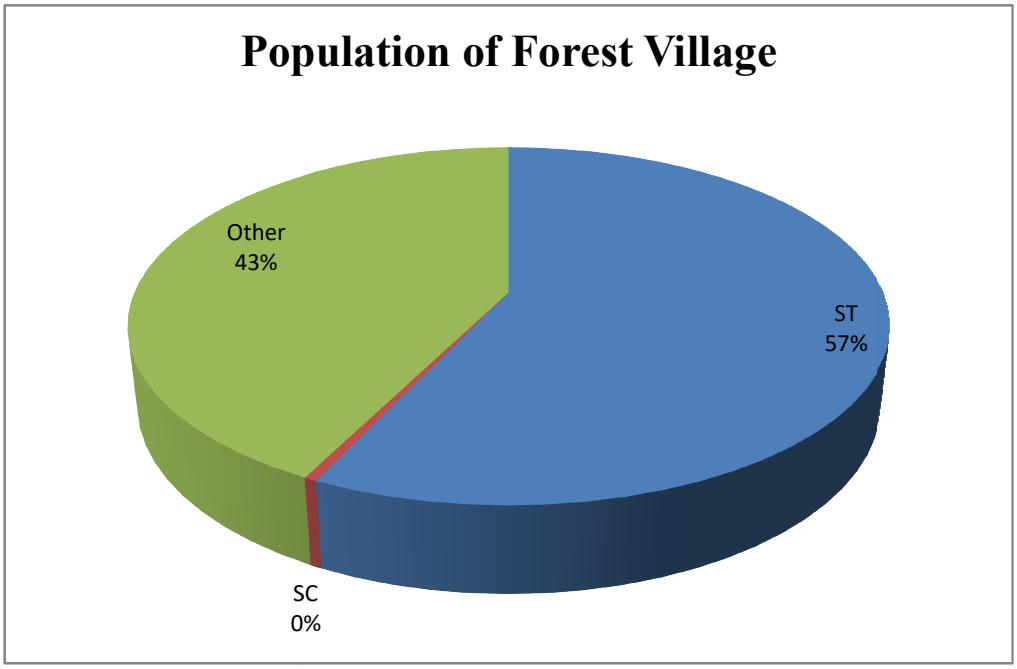
Forest Div.	Total Household	Total Population	ST	SC	Other
Kachugaon	17933	90837(100)	49845(54.87)	263(0.29)	40729(44.84)
Haltugaon	5545	28269(100)	20925(74.02)	229(0.81)	7115(25.17)
Parbathjora	1660	8161(100)	1777(21.77)	93(1.14)	6291(77.08)
Total	25138	127267(100)	72547(57.00)	585(0.46)	54135(42.54)

Source: Adapted from Census of India, 2011.

Note: The value of the parenthesis represents the percentage of the respective value.

Figure No. 4.2

Population composition of the forest village of Kokrajhar district (in percent)



Source: Adapted from Census of India, 2011.

As shown in above figure (4.2), 57 per cent of the population is Schedule Tribe, 43 per cent is Other Class, and less than one per cent is Schedule Caste population in the three forest division of the district. In Kokrajhar district Bodo, Rabha and Garo, and Hajong are Schedule Tribe (ST) category and Rajbongshi, Santhalis, Nepalis were the group in Other categories in the district.

4.8 Dependence on Forest Resources

As discussed in the preceding sections, it is clear that forest resources are inevitably an important source of livelihood for forest-dwelling communities. Forest products are important not only in terms of supplementing income but also equalising the flow of income throughout a year (Sato, 2000). The extent of dependents on forest products differs from region to region. The forest dwellers of

Kokrajhar district collect the forest products like timber for house building, furniture, and minor forest products such as firewood, edible green leaves and fruits, medicine and honey. Apart from that, clear-felling and encroachment of forest lands for agriculture and residential purpose, grazing and other developmental work were done by the nearby villages and government machinery.

To assess the extent of dependence on forest resources by the dwellers of forest village, the researcher has collected households' primary data from the three forest divisions viz: Kachugaon, Haltugaon and Parbothjora forest division of Kokrajhar district. Altogether, 365 sample households have been selected for the collection of information through the schedule, as shown in Chapter 3. Thus, the present study on the dependency of forest resources, benefits, and cost of both forest and non-forest products and their net present value is analysed extensively.

4.9 Benefit from Forest Products

The present study is based on the primary data. It is observed from Table 4.5 that the total benefit earned by the dwellers of forest village from the non-timber forest product (NTFP) is amounting to Rs. 18,500.5. Out of which, Rs. 6283.00 per annum are earned by the households of Kachugaon forest division, Rs. 5611.5 per annum by households of Parbathjohora forest division and Rs. 6606.00 per annum by the households of Haltugaon forest division. On an average, a villager from both the Kachugaon and Haltugaon forest divisions has to travel more than 2 km inside the forest to collect firewood and 1 km for other forest products. On the other hand, forest villagers from the Parbatjhora forest division have to travel more than 2 km to collect firewood and other forest products. On an average, 140 bundles of firewood were collected by the dwellers of forest villages. In order to calculate the value of firewood, the existing local market price of Rs.30 per bundle was multiplied by the total numbers of firewood. On an average, 2.40 kg per annum of honey were collected by the villagers from the forest and to calculate the monetary value, and it was multiplied with the

existing local market price of Rs 350 per kg. Out of these, only 1.31 kg of honey was collected from the Parbothjhora forest division. As observed from the field study, the lowest collection of honey from Parbathjora forest division is due to less cover of dense forest in the area. The wild edible green leave, roots and others are important source of ingredient for fringe forest villagers. As such, on an average, 10 kg (per annum) of green and edible leaves and roots were collected by the forest dwellers and to assess the monetary value, it was multiplied with the existing local market price of Rs.60 per kg.

The medicinal plant, leaves, herbs etc., were important for the various uses of forest dwellers and other rural communities. The deep-rooted tradition, culture and accustomed have bonded both the tribal and non-tribal forest dweller with the forest. It has been seen from the sample that, on average, 1.42 kg per annum of medicinal herbs were collected by the forest villagers, and its value has been put by multiplying the existing local market price of Rs. 400.00 per kg. The forest villager of the Parbothjhora division has recorded the lowest collection of medicinal herbs due to the non-availability of medicinal herbs and roots in the areas. The details of the benefits from forest product are given in the following table no. 4.5.

Table No. 4.5

Benefit from forest products of sample household of Kokrajhar district (in Rs.)

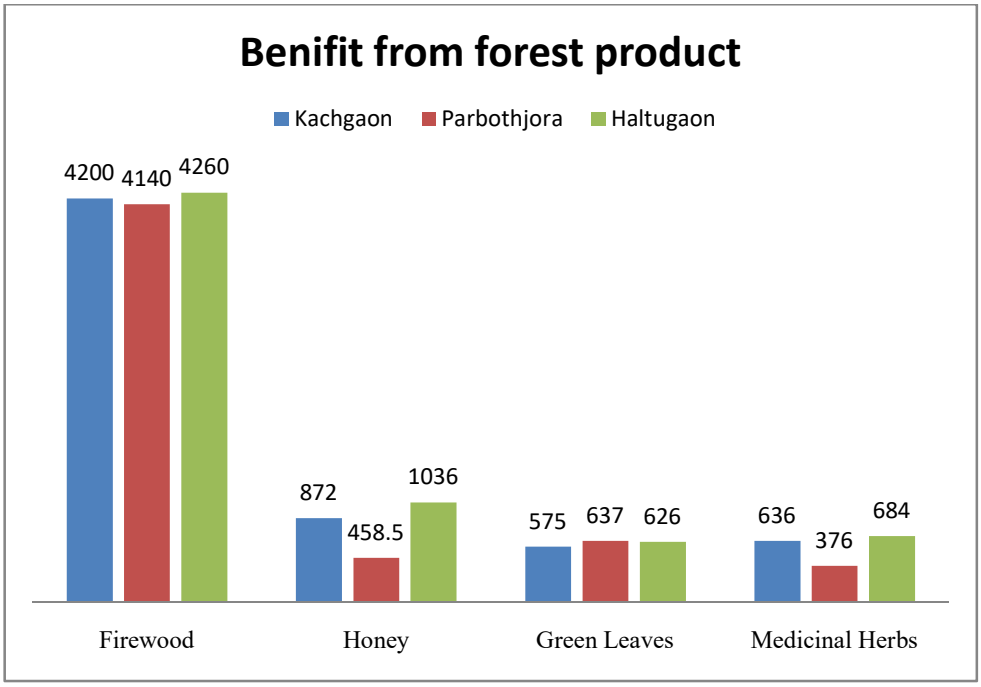
Forest Villages (under different forest divisions)	Variables	The average time taken for collection (hrs per week)	Average distance to travel (km)	Average Quantity collection (per annum)	Price per bundle/ kg (in Rs.)	Value (Rs. per annum)
Kachugaon	Firewood	2.89	2.36	140	30	4200

Forest	(in bundles)					
Division	Honey (in Kg)	1.34	1.43	2.49	350	872
	Wild edible green leave(in kg)	1.12	1.43	9.59	60	575
	Medicinal herb (in kg)	1.40	1.84	1.59	400	636
					Sub -Total	6283
Parbathjhora Forest	Firewood (in bundles)	2.96	2.39	138	30	4140
Division	Honey (in kg)	1.87	2.57	1.31	350	458.5
	Wild edible green leave (in kg)	1.31	2.56	10.62	60	637
	Medicinal herb (in kg)	1.76	2.35	0.94	400	376
					Sub-Total	5611.5
Haltugaon Forest	Firewood (in bundles)	2.97	1.57	142	30	4260
Division	Honey (in Kg)	1.57	1.29	2.96	350	1036
	Wild edible green leave(in kg)	1.30	1.29	10.43	60	626
	Medicinal herb (in kg)	1.53	1.33	1.71	400	684
					Sub- Total	6606
					Total	18,500.5

Source: Compiled from primary data

Figure No.4.3

Benefit from Forest Products of sample village of Kokrajhar district (in Rs.)



Source: Compiled from primary data

Table 4.5 and figure 4.3 shows that the benefit obtained from firewood is highest among the other forest products. As described by forest dwellers, firewood is their main source of energy for heating, cooking and other uses. In the case of benefit, dwellers of forest villages of the Kachugaon forest division obtained an average of Rs. 4200 per annum from firewood, while it was Rs. 4140 for Parbathjora and Rs.4260 for Hahaltugaon Forest division, respectively. This showed that the maximum benefit from firewood is obtained by the dwellers of forest village of the Haltugaon forest division, followed by Kachugon and Parbathjora forest division.

Further, in the case of honey, forest villagers of the Haltugaon forest division obtained benefit of Rs. 1036 per annum, followed by Kachugaon of Rs.872, and Parbathjora with Rs.458.5. The maximum benefit of Rs. 637 per

annum of green leaves is obtained by the forest dwellers of the Parbthjora forest division, followed by Haltugaon and Kachugaon. In case of benefit from medicinal herbs, Rs.684 per annum is obtained by forest dwellers of Hatugaon forest division followed by Kachugaon division with Rs.636, and Rs. 376 by Parbothjhora forest division.

4.10 Grazing Benefit

4.10.1 Sources of Grazing

Fodder for livestock's like Cows, Buffalo, Sheep, Pigs etc., has been classified into two categories (i) Green fodder and (ii) Dry fodder. Forest is an important source of green fodder, and processing fodder is called dry fodder (Benerjee, 2016). The villagers obtain grazing benefit from the forest in two ways- one by small and marginal cattle rears and secondly by the cattle ranchers' *mwswoh bathwn*[2] in the forest. As an open access, excessive grazing in the forest will affect the diversity of plants, animals, and species and lead to degradation of the forest. Thus, to assess the grazing benefit obtained by the dwellers of forest village, only grazing of Cattle and Buffalo has been considered here. The following table no. 4.6 shows the sources of grazing of sample households of three forest divisions.

Table No.4.6

Sources of grazing of sample household of the three forest divisions

(in percentage)

Forest Division	Forest	Agriculture land	Community land
Kachugaon FD	159(78.32)	28(13.79)	16(7.88)
Parbathjhora FD	54(80.59)	8(11.94)	5(7.46)
Haltugaon FD	79(83.15)	7(9..47)	7(7.36)
Total	292(80.00)	43(11.78)	28 (7.67)

Source: Compiled from primary data.

Note: The parentheses represent the percentage of the respective figure.

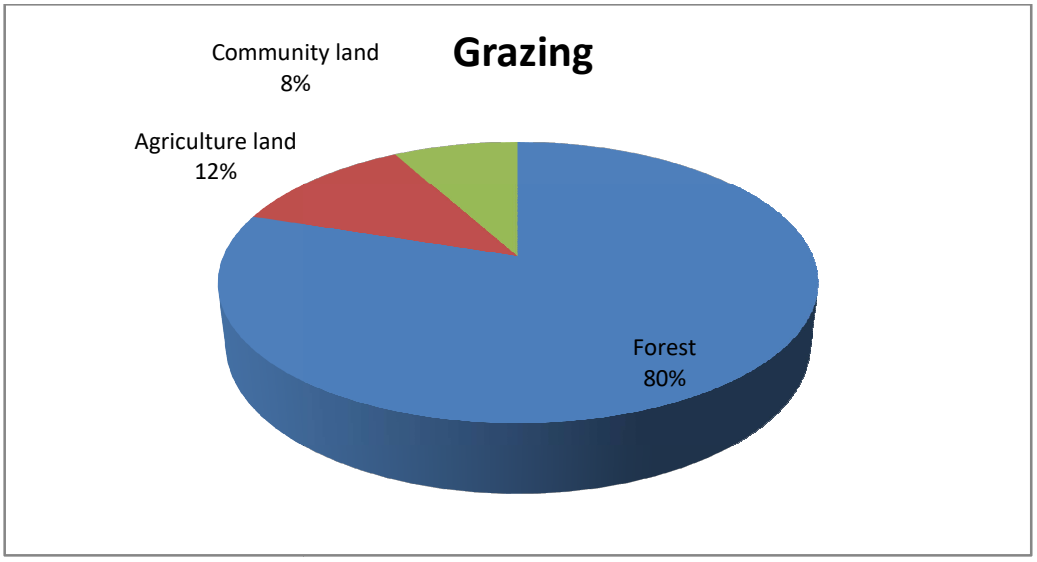
[2] *Mwswh Bathwn* is the local word of cattle rancher.

Table 4.6 shows that the main sources of fodder for cattle are obtained from the forest, followed by agricultural land and community grazing land. Forest provides 80 per cent of grazing, followed by 12 per cent from agriculture and 8 per cent from community grazing land. In term of division wise, the forest village of the Haltugaon division obtained a maximum of 83 per cent of grazing benefit from the forest, followed by Parbatjhora and Kachugaon forest division. Kachugaon forest division obtained 14 per cent of its grazing benefit from agricultural land, followed by Parbathjora and Haltugaon forest division. In case of grazing on community land, almost all the forest division has the same grazing benefit from community land.

Figure 4.4, shows the sources of grazing of three forest division of Kokrajhar district. From this figure we can observed that 80 percent of grazing sources is came from forest followed by 12 percent from agriculture and community lands.

Figure No. 4.4

Sources of grazing of the sample household (in percent)



Source: Compiled from primary data.

4.10.2 Benefit from Grazing

The benefit from grazing of the sample households is obtained by multiplying the average number of cattle per household with the ongoing local market price of green fodder. The benefit from grazing by the sample villages of Kokrajhar district is given in the following table no. 4.7.

Table No.4.7

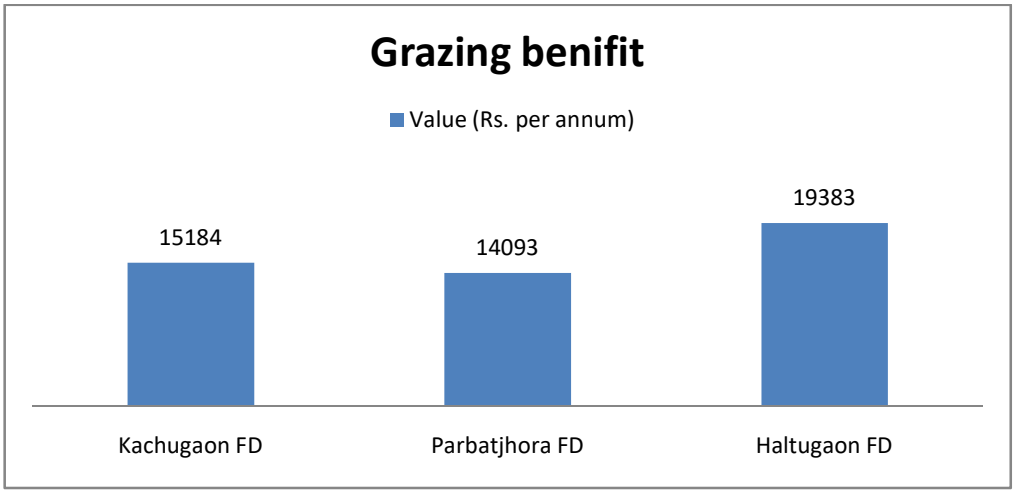
Benefit from grazing of the sample household of the district (in Rs.)

Forest Division	Total number of livestock per household (average in total number)	Green fodder (average fodder required 13 kg per day per cattle × 12 months)	Local market rate of fodder (Rs. per kg.)	Value (Rs. per annum)
Kachugaon FD	6.40	30368	.50	15184
Parbatjhora FD	5.94	28185.3	.50	14093
Haltugaon FD	8.17	38766.65	.50	19383
Average	6.84	32440	.50	16220

Source: Compiled from field survey.

Figure No. 4.5

Benefit from grazing of the sample household (in Rs.)



Source: Compiled from primary data.

From table 4.7 and figure 4.5, it is observed that the average dwellers of forest villages have owned 6.84 numbers of livestock per household. In order to estimate the value of green fodder used by the forest villagers for grazing their animals in the forest, the existing local market price of Rs. 0.50 per kg was multiplied with the total amount of green fodder required by the standardised animals unit per day. The total amount of green fodder required by the standardised animals unit per day is 13 kg (Mishra & Sharma, 1990). Thus, the forest village dwellers earn a total value of Rs.16220.00 per annum as grazing benefit from the forest. In case of division wise, forest villages of Haltugaon division have obtained the maximum benefit of Rs.19383 per annum, followed by Kachugaon with Rs. 15184 and Parbathjhora with Rs. 14093.

Since grazing is the free gift of nature, the forest villagers obtained the benefit from grazing for their cattle's in the open forest or reserve forest of Kokrajhar district without any cost of collection. So, no cost of grazing has been calculated from the grazing benefit. Thus, in total benefit of grazing is also representing equivalent to its net benefit in the present study.

4.11 Benefit from Non-Forest Products

The benefit from non -forest product comprises the three main activities like agriculture, horticulture and plantation. Paddy cultivation is the main activities of agriculture, followed by horticulture, including oilseeds and battle-nut plantation as in the localities. The total benefits of the non-forest products are calculated by multiplying the total average quantity of products with the ongoing market prices. Table 4.8 and figure 4.6 shows that the average total benefit from non-forest products is Rs 21315, out of which Rs.12827 comes from agriculture, Rs. 2808 from Horticulture, and Rs.5680 is from the plantation. From this observation, it is found that paddy cultivation is the highest among all the activities of non-forest products, followed by plantation and horticulture. The main reason is that agriculture is the main occupation of the entire district due to a lack of alternative source of the avenue.

In terms of division wise comparison, maximum benefit from agriculture is obtained by forest dwellers of Parbathjora forest division with Rs. 13971 followed by Kachugaon division amounting to Rs.13395 and Haltugaon with Rs 11115. On the other hand, the forest villagers of the Haltugaon forest division have obtained maximum benefit from non-forest products of both plantation and horticulture activities with an amounting to Rs.7200 and Rs. 4328 per annum, respectively. The maximum benefit obtained from the plantation is due to the large scale plantation of battle nut in and around the Saralpara and Ultapani forest villages of the Haltugaon forest division. Since the soil is suitable for battle nuts plantations, so most of the forest villagers of the Haltugaon division is growing more battle nut plantation than other activities.

Table No.4.8

Benefit from Non- forest product of the sample households (in Rs)

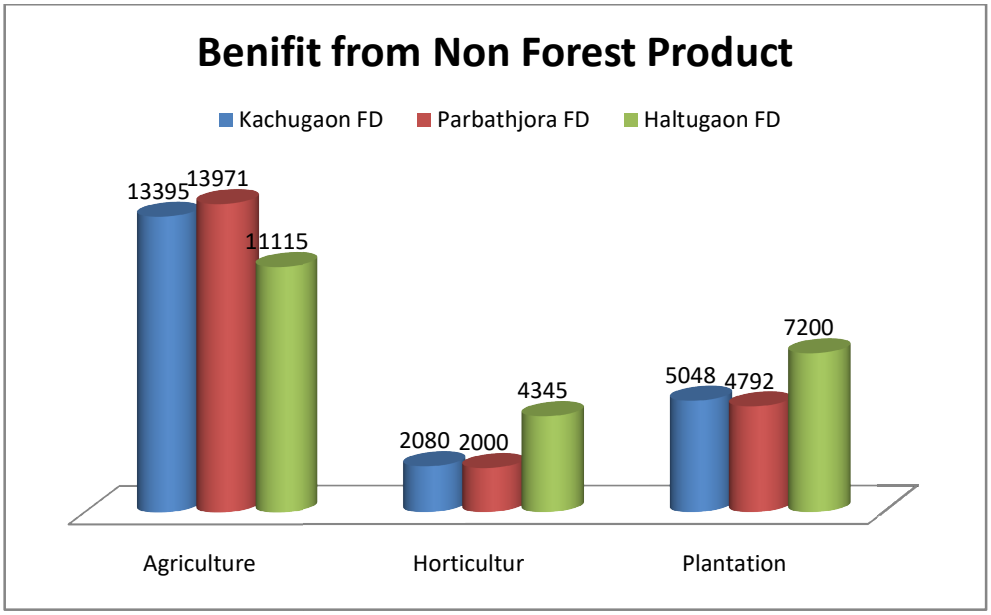
Forest Divisions	Activities	Agriculture (moon per household)	Horticulture (moon per household)	Plantation (moon per household)
Kachugaon Forest Division	Quantity in Average	44.65	4.16	6.31
	Price per moon	300	500	800
	Value in Rs.	13395	2080	5048
Parbathjhora Forest Division	Quantity in Average	46.57	4.00	5.99
	Price per moon	300	500	800
	Value in Rs.	13971	2000	4792
Haltugaon Forest Division	Quantity in Average	37.05	8.69	9.00
	Price per moon	300	500	800
	Value in Rs.	11115	4345	7200
Average of total values		12827	2808	5680

Source: Compiled from primary data.

Note: One moon equivalent to 40 kg.

Figure No. 4.6

Benefit from Non- forest product of sample household (in Rs.)



Source: Compiled from primary data.

4.12 Total benefit/revenue from forest and non-forest products

The total benefit includes both forest and non-forest products. The sample households earned an average benefit of Rs. 43702.16 from both forest and non-forest products (table 4.9). Out of that average benefit of Rs. 22386.83 is obtained from forest products and average Rs. 21315.33 benefit is obtained from non-forest products.

Division wise, forest dwellers of the Haltugaon forest division earned maximum benefit from both forest and non-forest products compared to Kachugaon and Parbathjhora forest division. Table no.4.9 and figure no. 4.7 showed that the Hatugaon forest division earns a total benefit of Rs. 48649, out of which total benefit of Rs. 25989 is obtained from forest products, and Rs.22660 is obtained from the non-forest product. This is because forest dwellers of the

Haltugaon forest division earned more benefit from grazing due to more cattle rearing in the division than the other two forest division, as shown in table no. 4.7. However, despite low paddy production in Hatugaon forest division compared to Kachugaon and Parbathjhora forest division, the benefit obtained from the non-forest product is high due to more incomes from plantation and horticulture as shown in table no. 4.8.

Table No. 4.9

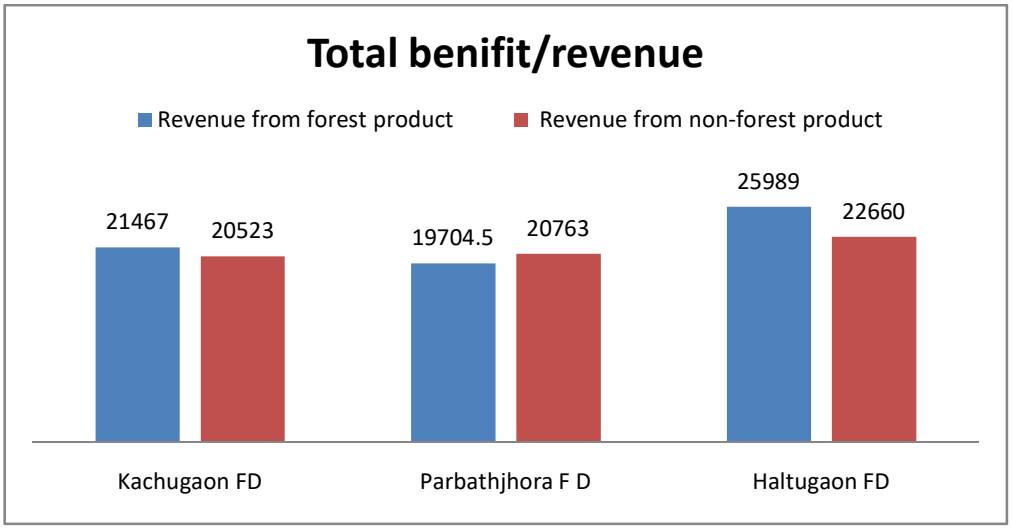
Total Revenue from forest and non-forest products of sample households (in Rs.)

Forest Division	Revenue from forest product	Total Revenue from non-forest product	Total
Kachugaon FD	21467	20523	41990
Parbathjhora F D	19704.5	20763	40467.5
Haltugaon FD	25989	22660	48649
Average revenue of Sample household	22386.83	21315.33	43702.16

Source: Compiled from primary data.

Figure No. 4.7

Total Revenue from forest and non-forest products of sample household



Source: Compiled from primary data.

4.13 Costs of Production

The total cost of production includes both Forest and Non-Forest Products. The cost of forest products includes the total cost of collecting forest products, and on the other hand, the cost of non-forest products includes the implicit cost (costs of own family labour) and explicit costs incurred for the production of non-forest products. Therefore, to calculate the costs of collecting forest products, the time spent by the dwellers of forest village for the collection of forest product has been transformed into man-days, and it is multiplied by the ongoing market wage rate. Thus to calculate the costs of forest product, the basis of estimation is taken from Focus Group Discussion (FGDs), which comprises 10 to 15 members of forest villagers of each respective sample villages, viz. villages headman and forest officials of the districts. From the FGD discussion, it was understood that, on average, villagers collected firewood about 7 to 8 month of the year, which was sufficient for their use and commercial purpose. However, the collection of firewood is not possible during the entire year due to the rainy and winter season. Other forest products such as honey collection are available only for 2/3 months, and the average time taken for the collection of wild edible green leaves were 1.20 per week for 10 months. The remaining two month is not collected due to floods. Again, in the case of medicinal herbs, the collection is done throughout the year. The total cost of collecting forest product has been shown in the following table 4.10

From table 4.10, it is observed that the existing local wage rate is only Rs. 120 per man-days of two forest division of Kokrajhar district viz. Kachugaon and Haltugaon forest division. On the other hand, the local wage rate is Rs. 130 per working days in the Parbathjora forest division. It is observed that this higher wage rate in the Parbathjora forest division is due to scarcity of available forest resources and the requirement of more time for the collection of forest products. The natural growths of *Sal* and non-*Sal* trees were felled during the Bodoland movement lead by the All Bodo Students Union (ABSU) during the 1980s and 1990s in the district and subsequently encroached on forest land for agriculture

and human settlement. Table no. 4.10 showed that an average of Rs.3390.03 is incurred as extraction cost by forest dwellers in the district. In terms of division wise, the Parbathjora forest division's forest dwellers have to spend more costs for collecting forest products than the Kachugaon and Haltugaon forest division due to more degradation of its forest.

Table No.4.10

Cost of collecting forest product by sample household (in Rs.)

Forest Villages Under different forest divisions	Variables	Total Average time for collection (hour per week × total week)	Man days (Total time taken /8 hours) 3/4	The local wage rate of the district	Total Cost 4 × 5
1	2	3	4	5	6
Kachugaon Forest Division	Firewood	2.89 ×28 =80.92	10.11	120	1213.2
	Honey	1.34 ×8 =10.72	1.34	120	160.8
	Green Leaves	1.12 ×40=44.8	5.6	120	672
	Medicinal herbs	1.40 ×48=67.2	8.4	120	1008
				Sub-Total	3054
Parbathjhora Forest Division	Firewood	2.96 ×28 =82.88	10.36	130	1346.8
	Honey	1.87×8 =14.96	1.87	130	243
	Green Leaves	1.31 ×40=52.4	6.55	130	851.5
	Medicinal herbs	1.76 ×48=84.48	10.6	130	1378
				Sub-Total	3819
Haltugaon Forest Division	Firewood	2.97 ×28 =83.16	10.39	120	1246.8
	Honey	1.57 ×8 =12.56	1.57	120	188.4
	Green Leaves	1.30 ×40=52	6.5	120	780
	Medicinal herbs	1.53 ×48=73.44	9.18	120	1101.6
				Sub-Total	3316.8
				Grant Total	10190

Source: Compiled from primary data.

Further, table 4.10 showed that the total cost of collecting forest products, including firewood, honey, edible green leaves and medicinal herbs, was Rs 10169. Out of this, the average sample household of the Parbathjhora forest division incurs Rs. 3819 as cost of collecting forest product, followed by Haltugaon with Rs 3316.8 and Rs 3045 by the Kachugaon forest division.

4.14 Production cost of Non-forest products

The total production cost of Non-Forest Products – includes implicit costs (costs of own family labour) and explicit costs. Costs of own family include costs of man-days spent, and explicit costs includes hired human labour days (i.e. 8 hours per man-days), hired animal, seeds, pesticides. Apart from that, to scare and protect the crops from wild animals, the forest villagers also spent some external costs such as to purchase torchlight, jute stalk and the cost of building huts on the tree. From the field studies, it has been observed that, on average, cultivation or processing for agriculture and allied activities required 180 hours and 58 hours for male and females, respectively. Therefore, to calculate the families own revenue, the labour hour spent on each production activity has been transformed into man-days by dividing it by 8 hours and then multiplied by the prevailing local market wage rate. The existing wage rate was Rs. 120 for male and Rs.100 for female. In this way, it has estimated that Rs. 3425.00 were the cost from own family's man-days for producing agriculture and allied activities of both Kachugaon and Haltugaon forest division. Simultaneously, the existing local wage rate was Rs. 130 and Rs 105 for male and female of the Parbathjora forest division. From this, it was estimated that the Rs. 3686 were the implicit cost of the household of the forest villages of Parbathjora forest division. However, this wage rate is lower than the prevailing Mahatma Gandhi National Rural Guarantee Scheme (MGREGS).

Thus from table 4.11 and table 4.12, it is observed that on average, Rs. 8020 is incurred as total costs (implicit and explicit production cost) on the non-

forest product in both Kachugaon and Haltugaon forest division. At the same time, on an average Rs. 8106.66 is incurred as total costs (implicit and explicit production cost) on non -forest product in the Parbathjora forest division. Therefore, on average, Rs.8048.66 of implicit and explicit cost is incurred for the production of non-forest products in the district. The explicit cost includes hired human labour and animal for non-forest products, pesticides, seeds, tools and fertilisers. Besides this cost, torchlight, jute stalks, and temporary huts on the tree were built to protect the agricultural fields from wilds animals.

Table No. 4.11

Cost of Non- forest products (in Rs.)

Forest Divisions	Types of Cost	Man Days	Local Wage Rate	Costs
Kachugaon Forest Division	Cost of Own Family (Implicit cost)	22.5 for male	120	2700.00
		7.25 for female	100	725.00
	Explicit Costs	22.5 for hired labour	120	2700.00
		22.5 (hired animal)	13.15	295.00
		Pesticides		200.00
		Seeds		700.00
		Tools		200.00
		Fertilisers		100.00
		Torchlight (in No.)	1	100.00
		Jute stalk(20 Boza)	5	100.00
		Costs of huts on tree		200.00

			Total	8020.00
Parbathjhora Forest Division	Cost of Own Family (Implicit cost)	22.5 for male	130	2925.00
		7.25 for female	105	761.00
	Explicit costs	22.5 for hired labour	130	2925.00
		22.5 for hired animal	13.15	295.00
		Pesticides		200.00
		Seeds		500.00
		Tools		200.00
		Fertilisers		300.00
			Total	8106
Haltugaon Forest Division	Cost of Own Family (Implicit cost)	22.5 for male	120	2700.00
		7.25 for female	100	725.00
	Explicit costs	22.5 for hired labour	120	2700.00
		22.5 (hired animal)	13.15	295.00
		Pesticides		200.00
		Seeds		700.00
		Tools		200.00
		Fertilisers		100.00
		Torchlight (in No.)	1	100.00
		Jute stalk (20 Boza)	5	100.00
		Costs of huts on tree		200.00
			Total	8020.00

Source: Compiled from primary data

Table No.4.12

Total Cost for Non-Forest Product (in Rs.)

Forest villages in different forest Division/cost	Kachugaon Forest Division	Parbathjhora Forest Division	Haltugaon Forest Division
Costs of Own Family (Implicit cost)	3425	3686	3425
Actual costs	4595	4420	4595
Total Costs	8020	8106	8020

Source: Compiled from primary data

4.15 Extent of Dependence on Forest

The extent of dependence on the forest resources by the forest dwellers is shown in table 4.13. From the table, it is observed that dwellers of forest village earned total net benefits of Rs. 32256.9 per annum from both forest and non-forest product. Out of these, dwellers of the forest village earned Rs. 18990.17 from forest product, which is 58 per cent of the total net revenue. Similarly, if we include the cost of production in the net revenue, the same pattern of result will be obtained. Generally, the cost of forest product is much lower than the non-forest product, as shown in table 4.7 and table 4.8. Forest as a common resource can be collected by dwellers of forest villages without any major production cost. But the excessive and unsustainable use of forest resources led to the degradation of the forest. From table 4.13 and figure no.4.8, it is clear that more than 58 per cent of net revenue shared is obtained from forest products as against non-forest products. This showed that forest dwellers were more dependent on forest product than non-forest product.

In terms of division, forest villagers of the Haltugaon forest division earned maximum net revenue of Rs. 37312.2 per annum on an average, while

Kachugaon earned Rs.30916 and Parbathjora Rs. 28542.5 per annum from both forest and non-forest products. Dwellers of forest villages of the Haltugaon forest division earned Rs.22672 from forest products, which was 60.76 per cent of total net revenue from forest products, while it was 59.55 and 55.66 per cent of total net revenue shared from forest products for both Kachugaon and Parbathjora forest division. This showed that more than 58 per cent of dwellers of forest village of three forest divisions of Kokarjhar district were dependent on the forest for their livelihood.

Table No.4.13

Extent of dependence on the forest by dwellers of forest village in three forest divisions (in Rs)

Forest Division	Total revenue	Total Cost	Net Benefit	Revenue from Forest Products	Cost of Collecting forest products	% share of 5/2	Net revenue from forest products	% share of 8/4
1	2	3	4	5	6	7	8	9
Kachugaon FD	41990	11074	30916	21467	3054	51.12	18413	59.55
Parbathjhora F D	40467.5	11925	28542.5	19704.5	3819	48.69	15885.5	55.66
Haltugaon FD	48649	11336.8	37312.2	25989	3316.8	53.42	22672	60.76
Average of total values	43702.16	11445.27	32256.9	22386.83	3318.76	51.22	18990.17	58.87

Source: Compiled from primary data

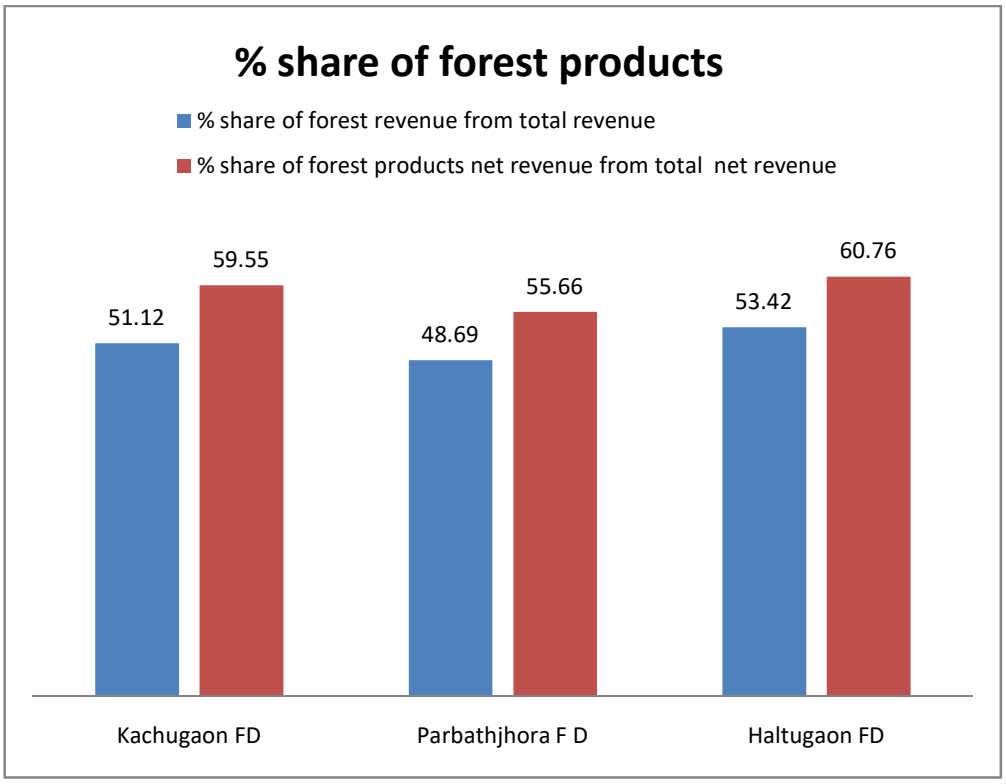
Further, from column 7 of table 4.13 and figure 4.8, it is observed that the percentage share of the forest revenue from total revenue is 51.22 percent. The overall forest revenue earned by the three forest division is Rs. 22386.86 in the

district. Out of which Rs. 21 467 (51.12 %) is earned by the sample households of Kachugaon forest division, Rs.19704.5 (48.69 %) by the Parbathjora Forest division and Rs. 25989 (53.42 %) is earned by Haltugaon forest division. In division wise earning of the revenue, Haltugaon has the highest followed by Kachugaon and Parbthjora forest division.

Thus from the percentage share of revenue from forest product out of total revenue and the percentage share of benefit of forest products from the total products, it is clear that the dwellers of forest villages of three forest divisions were highly dependents on forest products compare to non-forest products.

Figure No.4.8

Benefit/revenue of forest product from total and net revenue (in per cent)



Source: Compiled from primary data

4.16 Conclusion

The findings of the above study show that the forest villagers depend on both the major and minor forest products in the district. The net benefit earned by the dwellers of forest village of the three forest divisions viz. Kachugaon, Parbathjora and Haltugaon forest division was positive and significant and validated the first hypothesis of the study. Almost all the sample villages were dependent on minor forest products, viz. fuel woods, green leaf, honey and medicinal purpose. Besides that, they have benefited from grazing on the forest and encroaches forest land for agricultural activities.

In spite of these, activities like illegal commercial logging, poaching and hunting wild birds and animals are still going on in the three reserve forest division of the Kokjrajhar district. However, due to the lack of availability of data with the concerned department, we cannot provide the actual figure on this. So, we left it as a scope for further studies on it.

Thus from the above studies, we can conclude that because of excessive use and exploitation of natural forest resources in the district, affecting not only forest ecosystems, loss of wildlife habitations, and disappearance of biological diversity, but also affecting the age-old relationship between man and forest. In spite of that, it is also eroding the livelihood of the poor and marginal section of the people in the district