

Livelihood Adaptation Approaches in Forest: A Case Study of Forest Villagers in Alipurduar District, West Bengal

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Abstract

There is a description of various adaptation skills of sampled forest villagers. The physical site and location of forest villages has a profound direct or indirect influence on the way of life of villagers which have to adapt according to the indigenous technique capacities. So the manner, customs and behaviour related to forest environment i.e. land use, food habit, fuel used, plants used as traditional medicine, source of water facilities, house types and forest based other activities have been expressed to make the idea of lifestyle adaptation by forest villagers in Alipurduar district area. The study notified that land use pattern, food habit, fuel used, house type, water storage facilities, type of NTFPs collection of high altitude area is differ from low-lying area households. It is also depicted that although villagers adapted to natural environment but physical characteristics are the principal causes for variation in the socio-economic behaviour of high altitude and low lying area households of forest villages of this locality.

Key words: Forest village, NTFPs, Environment, Anthropogenic activities

1. Introduction

The study has been made up to depict the effects of physiographic nature on socio-economic as well as cultural livelihood of forest villagers. The relief is one of the responsible factors for the growth and development of settlement, population distribution, connectivity and accessibility, land use, agriculture and other socio-economic practices. In fact, livelihood in hill top, rugged, valley and slope and dense forests area is too tough and quite expensive in term of livelihood needs. To a great extent, existed natural parameters control the level of economic development although it is noticed that, due to ruggedness terrain; there is no scope for better development of agricultural farming, large-scale marketing, transport and communication network system etc. It could be referred that as various physical parameters have causes its own effective role for the growth, location, type and shape of settlements as well as development of specific cultural landscape. Here it is also tried to express how

villagers have been adapted in different physical sites and locations; and physiographic-economic interaction through several activities of high and low altitude location of villages.

2. Study Area

Alipurduar District of West Bengal covered an area of 2526.30 sq. km. (Statistical Hand Book of Jalpaiguri District, 2019). It is bounded by 26°23'11" and 26°52'30" North latitudes; and 89°02'30" and 89°53'07" East longitudes.

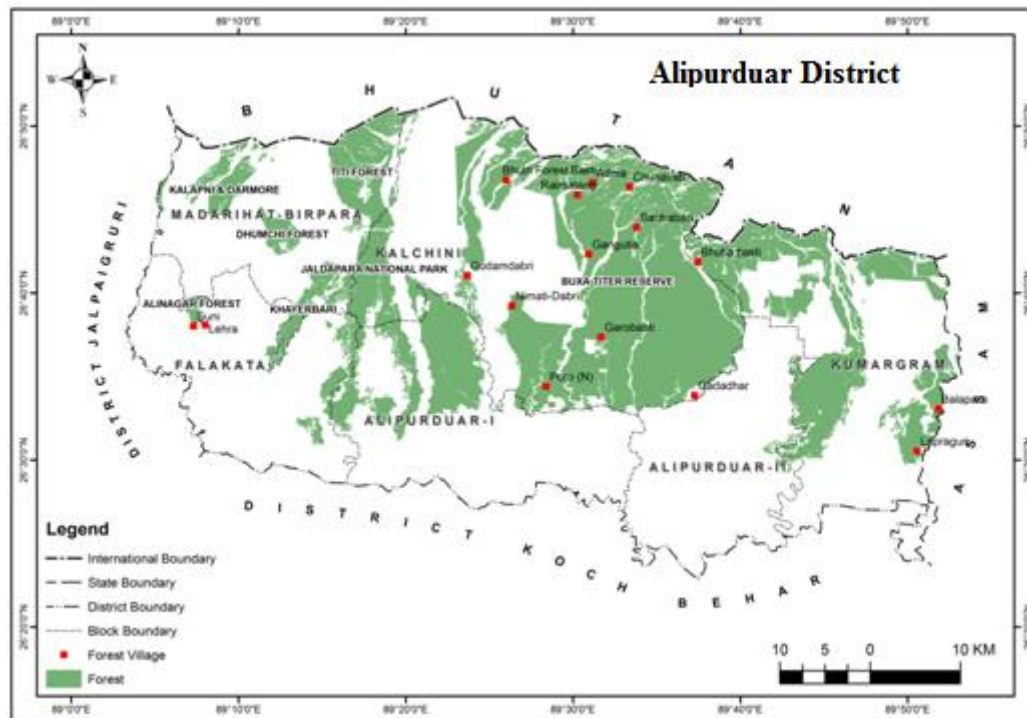


Figure 1, Alipurduar District and site position of sampled forest villages

The District has some special importance in terms of forests, tourism, hills, scenic beauty of tea gardens and variety of tribes communities like the Dukpa, Toto, Mech, Oraon, Rava, Santal etc. (Grunning, 1911). Northern terrain is adjacent to the Bhutan hill with high altitude where low lying plain area is extended in the southern part of the district. The important trees are sal, sissou, teak, gamari, chair, kamjal and simul (Grunning, 1911). There are two valuable biodiversity pockets which are protected in the district for wild animals without disturbance namely they are (a) Buxa Wildlife Sanctuary & Tiger Reserve, area 761.09 sq. Km and (b) Jaldapara Wildlife Sanctuary, area 216.51 sq. km, (State Forest Report, 2013). Major ethnic communities are Mechs, Ravas, Rajbanshi, Totos, Santals, Garos, Nepalees, Oraons (Kar, 2003). Total 39 forest villages of 2948 households are existed with more than twenty thousand residents in the district (Das, 2000) and more than ninety percent of the villagers are backward in terms of economy, education, culture and health (9th

working plan of Jalpaiguri Forest Division, vol. I, 2008-09). The district has one municipality and six Community Development (CD) blocks namely they are Alipurduar-I, Madarihat-Birpara, Kalchini, Alipurduar-II, Falakata & Kumargram.

3. Objectives

The objectives of the study are:

- i) To explain the adaptation of forest villagers within forests environment.
- ii) To study regarding dependency on forests of forest villagers for livelihood need.

4. Methodology

Several published projects, books, articles have been followed to collect relevant secondary data, such as Ninth Working plan of Jalpaiguri Forest Division, Directorate of Forest, Volume-I (2008-09); State Forest Report, 2005 to 2013, Directorate of Forests; Management-cum-working plan of Buxa Tiger Reserve, Forest Department, Govt. of West Bengal, Vol. 1(2000); Tiger Conservation Plan, BTR, 2016-17 to 2026-27; Statistical Handbook of Jalpaiguri District, 2011 to 2018; Eastern Bengal and Assam District Gazetteers, Jalpaiguri, 2008. Besides, questionnaire survey was conducted over 17 selected sample forest villages from three forest divisions. The questions of the questionnaire referred the demographic, physiographic as well as socio-economic features of forest village as well as forest villagers. The altitude, relief, population size, community, location and site were the prime criterion to be considering as sample village. Furthermore, distance of the village from transport accessibility and the village site i.e valley, hill-slope, hill-top, within forest are other considerable factors where survey were been applied through questionnaire of 878 household of 17 sampled forest villages.

5. Characteristics of sample villages and villagers adaptation

Some important parameters are utilised to express the physical site of the sample villages. These are forest type, altitude, relief, slope, settlement type and site, soil type around the village, climate which have been taken into observation during the time of field study.

5.1 Physical characteristics of villages

Villages were developed either in valley slope, inside the forest or beside river bank, on hill slopes as well as flat hill-tops site. The table 1 explains the details of different physiographic

characteristics of forest villages which are responsible for origin and growth of several types and pattern of settlements.

Table 1: Physical characteristic of the sample villages

Sl. No.	Forest village	Site of the Settlement	Type of settlement	Type of natural vegetation	Valley type	Soil type	Relief	Altitude
1	Lehra	B.F	SCA	P.F	-	Sandy clay	EV	156 m
2	Suni	B.F	SCA	P.F	FLA	Sandy clay	EV	156 m
3	Garo Basti	W.F	COM	STD	-	Sandy clay	EV	202 m
4	Gadhadhhar	B.F	SCA	PF	WID	Silt clay	EV	212 m
5	Poro	W.F	COM	STD	-	Sandy clay	UND	235 m
6	Nimati & Dabri	W.F	SCA	STD	-	Silt clay	UEV	235 m
7	Gangutia H.A	W.F & V.S	COM	STD	NAR	Sandy rocky	UND	306 m
8	Adma H.A	H.T	SCA	STD	-	Sandy rocky	HRUG	846 m
9	Raimatang H.A	H.S	SCA	STD		Sandy rocky	RUG	487 m
10	Bhutri F. basti H.A	H.S	LIN	STD	NAR	Sandy clay	UND	367 m
11	Gudamdabri	B.F	LIN	RF	-	Sandy clay	EV	179 m
12	Chunabati H.A	H.T	SCA	STD	-	Sandy rocky	HRUG	887 m
13	Bhutiabasti	W. F & R.B.A	COM	RF	FLA	Sandy Rocky	UEV	256 m
14	Sankosh	W.F & V.S	SCA	STD & RF	WID	Sandy loam	UND	312 m
15	Lapraguri	W.F	COM	PF	-	Sandy clay	EV	257 m
16	Santrabari H.A	W.F	SCA	STD	-	Sandy rocky	UND	467 m
17	Balapara	B.F	COM	PF	-	Sandy clay	EV	233 m

H.A=High Altitude, (Prepared by the author based on field survey, 2017).

Note: Settlement site: B.F=Beside forests, W.F=Within forests, H.T=Hill top, H.S=Hill slope, R.B.A=River bank area, V.S=Valley slope.

Type of settlement: LIN=Linear settlement, COM=Compact settlement, SCA=Scattered settlement.

Type of natural vegetation: STD=Sub-tropical moist deciduous, S.F=Savannah forests, P.F = Plain forests, R.F=Riverine forests.

Valley type: WID=Wide valley, NAR=Narrow valley, FLA: Flat valley.

Relief: EV=Even relief, UEV=Uneven relief, UND=Undulating plain relief, RUG= Rugged relief, HRUG= Highly rugged relief.

5.2 Natural vegetation

The natural vegetation works as agent of rain banker and rain holder of the earth. It has been explained that the trees works as millions of tiny dams and check the flow of water as barrage (Khullar, 2002). The district covered by immense dense forest of mixed character i.e evergreen, coniferous, deciduous, savannah and other classified forest. There are nine villages nearby the zone of sub-tropical deciduous type, five villages are within the area of plain mixed forests, and three are contiguous of riverine forests and left are in the area of savanna and mixed type. The pattern of altitude-vegetation has been grown according to relief height (table 1) as sub-tropical and mixed forest such as sal, teak, gamari, sisoo, khair, are found to occur at a height of above 500 m and are prominent the villages area of Adma, Chunabati, Bhutri, Gangutia of Buxa hill forests. In the middle and lower altitude (below 500

m), eight villages having plain mixed and riverine forests vegetation is found which have the trees of simul, asathwa, khair, neem, radha chura, amlaki, debdaru and villages are Sankosh, Lapraguri, Balapara. Furthermore mixed and savanna forests are extended around the villages that located in the lower flat surface namely Gudamdabri, Suni, Lerha, Garo Basti etc.

5.3 Soil

The soil is the main controlling factor for land use of any region. The formation of soil is influenced by the natural vegetation, climate and topography. The agriculture and agricultural pattern is very much controlled by physical and chemical characteristics as well as altitude, thick and distribution of soil. The soils are generally sandy dominated with mixtures of boulder, rock, clay and silt in varying ration. The sandy clay soil is found in 8 village site, whereas sandy rocky is available in 6 villages and only 2 villages with silt clay and another one is sandy loam soil (table 1). Most of the valley soils are composed of steep hard sandy rocks soil. However, high altitude soil is contained with sandy rocky and loam. The average soil depth in between 10 and 25 cm. but it differs from less than 10 cm. in high altitude to more than 40 cm. in the flat plain surface and river valley soil. The erosional status also shows the marked difference among plain, valley and high locations. In valleys, moderate to high erosion is noticed. There are only 5 villages having no erosion of soil in their valley portion while all other villages' located in valley suffers from severe erosion. In case of highland locations, however, 4 villages (Chunabati, Adma, Raimatang, Bhutri village) have severe erosion while 2 (Ganguitia, Santrabari) villages have moderate erosion.

5.4 Land use pattern

Man is a bio-geographical factor that has modified the natural landscape to cultural landscape. Therefore, it is essential to deal with both, the physical as well as cultural landscape before any observation is concluded on the use of the land (Giri, 1976). Land use pattern directly or indirectly regulated by relief. It is also referred that the relief indirectly influences farming culture by modifying the climate and by affecting the degree of accessibility, the case of cultivation and the consequential changes in soil, erosion and patterns (Singh, 1974). The land use pattern is an important aspect which gives the knowledge of adaptation with topography, forests environment and other works i.e cultivation as well as the land lying unused and other practice etc. There are large areas under the categories of cultivable waste and area not capable for cultivation and it is apparent among highland village area. It is observed that the majority of lands uses were covered

under food crop and it accounted for about 69.68 % of the total owned land of sample households. The higher proportion of land under agriculture shows better opportunity of livestock rearing. The land holding size for horticulture is recorded 134.20 acre (16 %), for cultivable waste land, it is 72.66 acre (8.67 %); for uncultivated land and barren land it is 19.54 acre (2.33 %) and 27.81 acre (3.32 %) respectively.

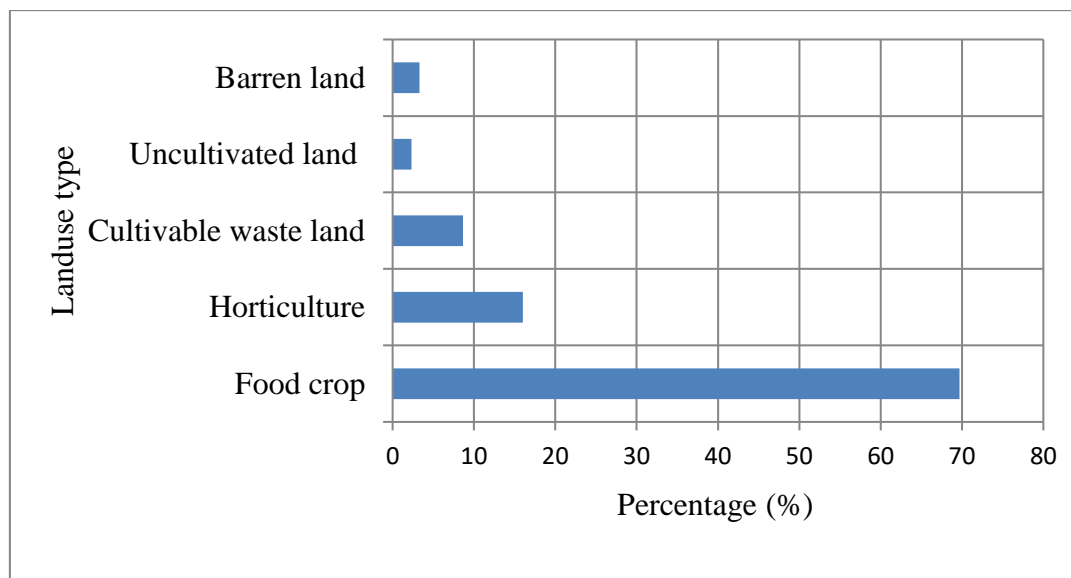


Figure 2, Land use pattern

The uncultivated land mainly identified around the high altitude forest villages as well as barren land is noticed in low land or plain area villages. The horticulture farming practice is food in number among high altitude villagers i.e Amda, Bhutri, Chunabati, Santrabari and comparatively less practice observed in plain area villagers. It is totally reverse in case of food crop practice.

5.5 Food habit

The food habits of the Mech community of Gudamdabri and Balapara villages are rice, fish, duck, goat meat, buffalo meat, fowl, pigeon, pig and a variety of vegetables. They used mustard oil for cooking food. The pig blood is cooked with vegetable curry. 'Kharodoi-bodai' is used for flavouring curries which is prepared from different kinds of pulse called 'kalai', mustard plant, the roots of the cotton plants. Along with the rice, they consumed several wild edible tubers, roots, green leaves, flowers, fruits, Jackfruit which are easy to collect from forest. The staple food consumption of the Bhutias of Chunabati, Adma villagers are rice, beef, pork, ducks, deer, fowls, marua, barley, dried and fresh fish, butter, Indian corn, cheese and cultivable and wild vegetables. Among fruits pineapples, oranges, jack,

mango, plantains and other fruits are common and popular. There is a preference of dried fish, pork and beef; Pig blood is mixed with meat finely minced which is made into 'sausages'. The main food of the Ravas of Suni, Ghadhar, Poro (N), Garo Bsati villagers' is rice, fish, flesh of pig, deer, ducks, goat, pigeons and fowls. Sometimes, large grasshoppers, locusts are also consumed as food. Vegetables of wild and cultivable are eaten. Indian corn is grown by the Ravas and is eaten raw when tender or is boiled, and roasted or parched when too ripe. Milk is drunk but they enjoy curd with beaten rice. The pig blood is cooked up with vegetable but mustard oil is generally utilised for cooking curries. The staple food of Nepalese inhabitants of Gangutia, Sankosh, Raimatang, Santrabari, Bhutri forest basti, Bhutia basti villagers' is rice and wheat; moreover, they consume different vegetables, roots and tubers, tender stem of bamboos and mushrooms that are collected from the forest. They also eat poultry, fish and meat like goat, cow, pig, and fruits like oranges, apples, mangos, bananas, and other wild fruits. People use mustard oil for cooking. Some people are addicted to smoke and alcohol. Santals community of Lehra and Gadhahar villages' usually take foods includes rice, snakes, frogs, earthworms, rats, shells and snails. However, now rice and wheat is their staple food other popular food is local river fish, meat of goat, pig and poultry. They prefer having 'Tari and Haria' local made wine on the occasions also like non-alcoholic drinks i.e coffee, milk and tea. Besides consumption pulses, roots and tubers are common along with other wild and farming vegetables. The Oraons of Garo basti and Gadhahar village also non-vegetarians, they like animal meat for a long time and usual food habits are rice, wheat, snakes, frogs, earthworms, shells and snails. Moreover people taking pulses, roots and tubers of several plants and vegetables that are common in the local markets and produce by locals, consumes local made drinks namely 'Tari' and 'Haria' wine on the special occasions also smoke beddies, tobacco, and brand cigarettes.

5.6 Fuel wood consumption

It is noticed from table-2, that villagers has been using dry benches and leaves, wood of forest as fuel for cooking. About 99.20 % of the households are utilised wood for cooking which is being collected from nearby forest and almost all households of survey villages has dependency on forest wood as fuel for cooking and other purpose. Only inhabitants of six sampled household of 0.80 % is being engaged for gas use as fuel along with forest wood. So, it express that most important is forest wood which continuously used by the villagers where other sources have negligible and was not regularly used throughout the year except rainy season.

Table 2: Fuel used for cooking (households-wise)

Sl. No.	Forest village	Fuel used for cooking (Sampled households)					Total sampled households
		Forest wood	Coal	Kerosene	Gas	Cow Dung	
1	Lehra	22 (100)	-	-	-	-	22 (100%)
2	Suni	28 (100)	-	-	-	-	28 (100%)
3	Garo Basti	71 (98.61)	-	-	1 (1.39)	-	72 (100%)
4	Gadhadhar	61 (96.83)	-	-	2(3.17)	-	63 (100%)
5	Poro	61 (100)	-	-	-	-	61(100%)
6	Nimati and Dabri	68(100)	-	-	-	-	68 (100%)
7	Gangutia H.A	54 (98.18)	-	-	1 (1.82)	-	55 (100%)
8	Adma H.A	55 (100)	-	-	-	-	55 (100%)
9	Raimatang H.A	55 (100)	-	-	-	-	55 (100%)
10	Bhutri F. basti H.A	45 (100)	-	-	-	-	45 (100%)
11	Gudamdabri	63 (100)	-	-	-	-	63 (100%)
12	Chunabati H.A	54 (100)	-	-	-	-	54 (100%)
13	Bhutiabasti	29 (96.67)	-	-	1(3.33)	-	30 (100%)
14	Sankosh	59 (98.33)	-	-	1 (1.67)	-	60 (100%)
15	Lapraguri	47 (100)	-	-	-	-	47 (100%)
16	Santrabari H.A	64 (98.46)	-	-	1 (1.54)	-	65 (100%)
17	Balapara	35 (100)	-	-	-	-	35 (100%)
Total		871 (99.20)			7 (0.80)		878 (100%)

H.A=High Altitude, (Prepared by the author based on field survey, 2017).

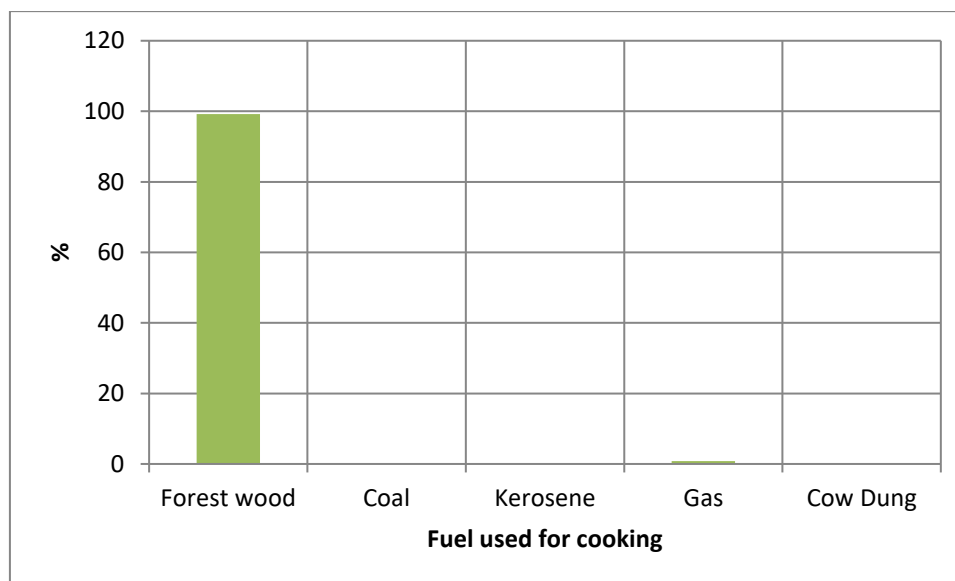


Figure 3, Fuel used consumption for cooking

5.7 Water availability

Water of rivers, natural reservoirs and springs are the prime traditional source of water. During winter and summer season they face difficulty and face shortage of drinking and other uses of water, since springs, rivers and reservoirs are getting dried up. The table 3 given the situation of source of available water facilities that has been following by inhabitants is tube

well water (59.34 %), spring and pine line water (26.42 %) and well water (14.24 %) respectively.



Plate 1: Fuel woods collection for consumption by the villagers at Gangutia village



Plate 2: Pipe line drinking water facility at Chunabati village

Households of high altitude villages (Adma, Chunabati, Raimatang, Santrabari and Bhutia basti village) has been depended on spring and pipe line for water facilities. Above 80 % households of nine villages are having water facilities through tube well and villages are Balapara, Santarabari, Sankosh, Gudamdabri etc. So the observation marked that remote villages, high altitude and hilly area villages have not obtained proper drinking water and water for other domestic purpose. Even there is no water tank or canal facility.

Table 3: Availability of water facilities (village-wise)

Sl. No.	Forest village	Source of water facilities (Sampled house hold)							Total sampled households
		Canal	Well	Tap	Spring and Pipe line	River	Pond	Tube well	
1	Lehra	-	5 (22.73)	-	-	-	-	17 (77.27)	22 (100%)
2	Suni	-	4 (14.29)	-	-	-	-	24 (85.71)	28 (100%)
3	Garo Basti	-	8 (11.11)	-	-	-	-	64 (88.99)	72 (100%)
4	Gadhadhar	-	6 (9.52)	-	-	-	-	57 (90.48)	63 (100%)
5	Poro	-	14 (22.95)	-	-	-	-	47 (77.05)	61 (100%)
6	Nimati & Dabri	-	11 (16.18)	-	-	-	-	57 (83.82)	68 (100%)
7	Gangutia H.A	-	9 (16.36)	-	40 (72.72)	-	-	6 (10.91)	55 (100%)
8	Adma H.A	-	-	-	55 (100)	-	-	-	55 (100%)
9	Raimatang H.A	-	-	-	55 (100)	-	-	-	55 (100%)
10	Bhutri F. basti H.A	-	45 (100)	-	-	-	-	-	45 (100%)
11	Gudamdabri	-	7 (11.11)	-	-	-	-	56 (88.88)	63 (100%)
12	Chunabati H.A	-	-	-	54 (100)	-	-	-	54 (100%)
13	Bhutiabasti	-	-	-	30 (100)	-	-	-	30 (100%)
14	Sankosh	-	6 (10)	-	-	-	-	54 (90)	60 (100%)
15	Lapraguri	-	-	-	-	-	-	47 (100)	47 (100%)
16	Santrabari H.A	-	8 (12.31)	-	-	-	-	57 (87.69)	65 (100%)
17	Balapara	-	-	-	-	-	-	35 (100)	35 (100%)
Total		-	123 (14.01)		234 (26.65)	-	-	521 (59.34)	878 (100%)

H.A= High Altitude, (Prepared by author based on field survey, 2017).

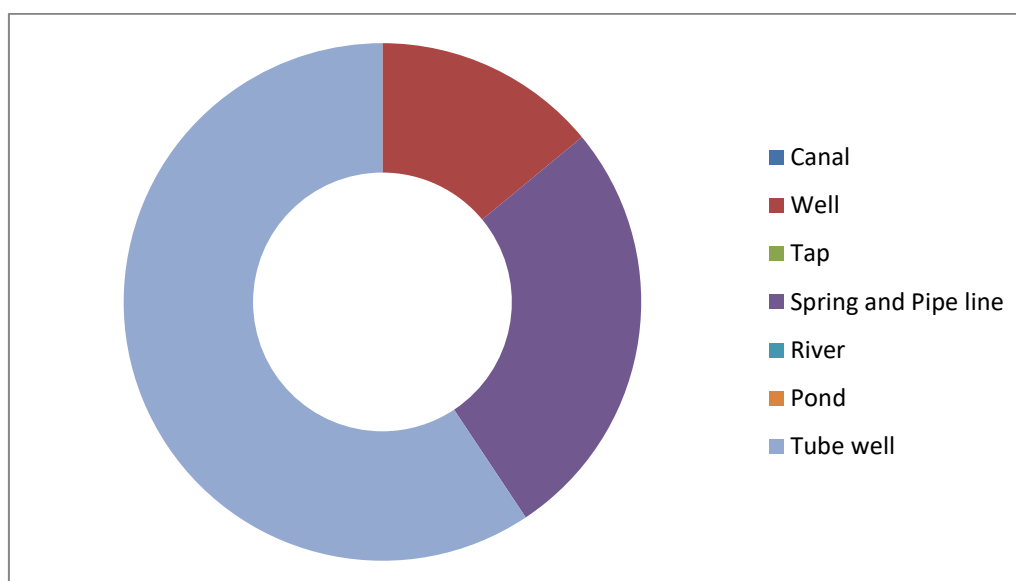


Figure 4, Type of availability of water facilities

5.7.1 Proximity of water sources

The observation explains the contiguity of water source of sampled household of villagers. Out of 878 households, about 822 that are 93.62 % households have proximity of source of water from outside through street pipe, street tube well or well facilities. It has been observed in the villages of Gangutia, Adma, Raimatang, Chunabati, Bhutia basti, Suni, and Bhutri forest Basti. On the other hand only 56 households (6.38 %) having water facilities inside the house premise and nearby surrounding.

5.7.2 Water storage type

Villagers store water in drum, cistern, utensil, pitchers and bucket. Observation shows village wise water storage facilities of respondents where it is noticed that out of 878 households, about 398 households (45.33 %) and 365 households (41.57 %) are utilised buckets and drums as main water storage (table 4). Only about 6.95 %, 4.78 %, and 1.37 % of households are following pitcher, utensil and cistern to store water for daily need.

Table 4: Water storage facilities (village-wise).

Sl. No.	Forest village	Cistern	Drum	Utensil	Bucket	Pitcher	Total sampled households
1	Lehra	-	-	7 (31.82)	11 (50)	4 (18.18)	22 (100 %)
2	Suni	-	-	11 (39.29)	15 (53.57)	2 (7.14)	28 (100 %)
3	Garo Basti	-	15(20.83)	7 (9.73)	50 (69.44)	-	72 (100 %)
4	Gadhadhar	-	-	10 (15.87)	47 (74.60)	6 (9.52)	63 (100 %)
5	Poru (N)	-	11 (18.03)	4 (6.56)	37 (60.66)	9 (14.75)	61(100 %)

6	Nimati &Dabri	-	16 (23.53)	-	44 (64.71)	8 (11.76)	68 (100 %)
7	Gangutia H.A	-	51 (92.73)	-	4 (7.27)	-	55 (100 %)
8	Adma H.A	-	55 (100)	-	-	-	55 (100 %)
9	Raimatang H.A	-	55 (100)	-	-	-	55 (100 %)
10	Bhutri F. basti H.A	-	35 (77.78)	-	10 (22.22)	-	45 (100 %)
11	Gudamdabri	-	-	3(4.76)	46 (73.02)	14 (2.19)	63 (100 %)
12	Chunabati H.A	-	54 (100)	-	-	-	54 (100 %)
13	Bhutiabasti	8 (26.67)	22 (73.33)	-	-	-	30 (100 %)
14	Sankosh	-	-	-	55 (91.67)	5 (8.33)	60 (100 %)
15	Lapraguri	-	-	-	39 (82.98)	8 (17.02)	47 (100 %)
16	Santrabari H.A	4 (6.15)	51(78.46)	-	8 (12.31)	2 (3.07)	65 (100 %)
17	Balapara	-	-	-	32 (91.43)	3 (8.57)	35 (100 %)
Total		12	365	42	398	61	878 (100 %)
		(1.37 %)	(41.57 %)	(4.78 %)	(45.33 %)	(6.95 %)	

H.A=High Altitude, (Prepared by the author based on field survey, 2017).

It has been noticed that almost 100 % inhabitants of high altitude villages followed drums to store water drinking and other purpose since villagers have lot of scarcity of water and only within one time water supply availability through pipe line connection and it is observed in Gangutia (92.73 %), Adma (100 %), Raimatang (100 %), and Chunabati village (100 %). Specially Chunabati and Adma villages’ water supply has been provided through pipe line connection from the Bhutan hill water reservoir.

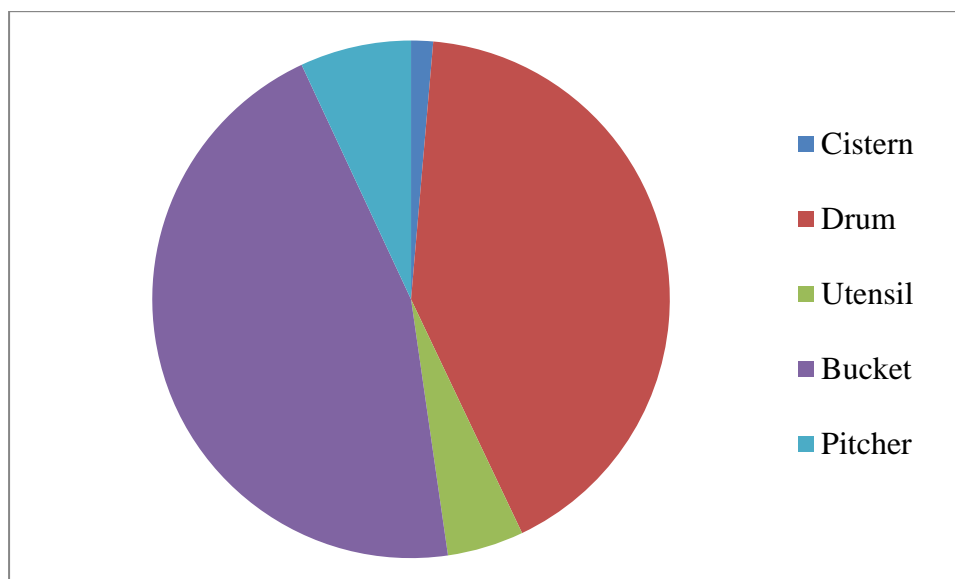


Figure 5, Water storage facilities

5.8 House type

The table 5 expresses the type of houses of among 878 households of the study area. It is observed from the table that majority of the households that is about 770 households (87.70 %) are living in combination of wood and tin constructed house.

Table 5: Types of house (village-wise).

Sl. No.	Forest village	Stone & Tin	Wood and Tin	Pucca (concrete with tin)	Thatched and wood	Tiled	Total sampled households
1	Lehra	-	7 (31.82)	15 (68.18)	-	-	22 (100 %)
2	Suni	-	5 (17.86)	23 (82.14)	-	-	28 (100 %)
3	Garó Basti	-	65 (90.28)	-	7 (9.72)	-	72 (100 %)
4	Gadhadhar	-	45 (71.43)	-	18 (28.57)	-	63 (100 %)
5	Poro (N)	-	57 (93.44)	4 (6.56)	-	-	61(100 %)
6	Nimatí and Dabrí	-	61(89.71)	-	7 (10.29)	-	68 (100 %)
7	Gangutíá H.A	-	55 (100)	-	-	-	55 (100 %)
8	Adma H.A	-	51 (92.73)	-	4 (7.27)	-	55 (100 %)
9	Raimatang H.A	-	47 (85.45)	-	8 (14.55)	-	55 (100 %)
10	Bhutrí forest basti H.A	-	45 (100)	-	-	-	45 (100 %)
11	Gudamdabrí	-	58 (92.06)	-	5 (7.94)	-	63 (100 %)
12	Chunabati H.A	-	52 (96.30)	-	2 (3.70)	-	54 (100 %)
13	Bhutiabasti	-	30 (100)	-	-	-	30 (100 %)
14	Sankosh	-	53 (88.33)	4 (6.67)	3 (5)	-	60 (100 %)
15	Lapragurí	-	47 (100)	-	-	-	47 (100 %)
16	Santrabari H.A	-	61 (93.85)	4 (6.15)	-	-	65 (100 %)
17	Balapara	-	31 (88.57)	-	4 (11.42)	-	35 (100 %)
Total			770 (87.70 %)	50 (5.69 %)	58 (6.61 %)		878 (100 %)

H.A=High Altitude, (Prepared by the author based on field survey, 2017).

Only about 58 (6.61 %) and 50 (5.69 %) households have thatched and pucca house. Due to easy availability of wood, most of the houses have been constructed by forest wood specially for walls, windows, door even stage like floor or platform for environmental adaptation. Villagers used tin for roof which has long serviceable than wood although some pucca house have seen in Lera (68.18 %) and Suni (82.14 %) village, since this two forest village had under ‘Gitanjali Project’ through which beneficiaries got pucca house with tin roof.

5.9 Dependency on forest produces

The forests not only provide them food, materials to build houses, fuel for cooking and lightening but also satisfy deep rooted sentiments with forest environment. It has been expressed that in Gujarat, forest dominated a central position for the village economy through a provision of a variety of Non-Timber Forest Products (NTFPs) and other goods and services for local use like fuel wood, fodder, fruits, materials for agricultural implements and bulbs and wild tubers as vegetables, etc. (Kant et al., 1993). Ravi et al., (2006) noticed that NTFPs acts a key role in the economy and life of the tribal community resided within and around the protected areas of Kote region. The income derived from NTFPs is the single largest and important source but it was not sufficient alternative to fulfill even their subsistence requirement of food and other needs. So several sorts of forest products are significant lifeline and collection, selling and consuming of forest products is one of the important livelihood ways of life.

Table 6: Dependency on forest produces (village-wise)

Sl. No.	Forest village	Yes	No	Total sampled households
1	Lehra	18 (81.82)	4 (18.18)	22 (100 %)
2	Suni	25 (89.29)	3 (10.71)	28 (100 %)
3	Garo Basti	66 (91.67)	6 (8.33)	72 (100 %)
4	Gadhadhar	53 (84.13)	10 (15.87)	63 (100 %)
5	Poro (N)	61 (100)	-	61(100 %)
6	Nimati and Dabri	56 (82.35)	12 (17.65)	68 (100 %)
7	Gangutia H.A	55 (100)	-	55 (100 %)
8	Adma H.A	55 (100)	-	55 (100 %)
9	Raimatang H.A	55 (100)	-	55 (100 %)
10	Bhutri forest basti H.A	45 (100)	-	45 (100 %)
11	Gudamdabri	54 (85.71)	9 (14.29)	63 (100 %)
12	Chunabati H.A	54 (100)	-	54 (100 %)
13	Bhutiabasti	30 (100)	-	30 (100 %)
14	Sankosh	58 (96.67)	2 (3.33)	60 (100 %)
15	Lapraguri	43 (91.49)	4 (8.51)	47 (100 %)
16	Santrabari H.A	61 (93.85)	4 (6.15)	65 (100 %)
17	Balapara	29 (82.86)	6 (17.14)	35 (100 %)
Total		818 (93.17 %)	60 (6.83 %)	878 (100 %)

H.A=High Altitude, (Prepared by the author based on field survey, 2017).

The main NTFPs collected items are cane, cane fruits, purundi fruits, dry branches, woods and leaves, naglata, pan leaves, totola pods lycopodium stick and seeds, golden and sponge mushrooms, fern bud, mahogany floral axis, odal fruit, lali fruit, simul floss and floral

axis, thatch, broom stick etc. There are some traditional medical plants which are also used as herbal medicine to remove fever, jaundice, stomach problem, cataract, asthma, skin disease, bone fracture join etc. The table 6 explained dependency of villagers on forest produce where out of 878 respondents, 818 (93.17 %) depends on forest produce for livelihood and other purpose and only 60 households (6.83 %) depends from other sources. Dependency is more among villagers of remote and interior forest area and that are Gangutia, Raimatang, Adma, Chunabati, Bhutri Forest basti and Bhutia basti, Santrabari where 100 % dependency were noticed during field study.

5.10 Use of forest plants as traditional medicine

There are approximately 122 species of plants are identified to be utilised as herbal medicine as first aid for recovering diseases which is transmitted through traditional practice of the forest villagers. The application of plant parts as medicines are mostly leaves, flowers, roots, rhizome, stem, wood, seeds and whole plants such as tree leaves, shrubs, herbs are the most useful parts such as of *Justicia adhatoda* L. plants for chronic bronchitis, cough and cold (Joshi, et al., 2021); *Acalypha indica* plant leaf for nasal and wounds (Mandal, et al., 2021); and *Lippia alba* (Mill.) for skin disease (Pascual, et al., 2001); roots of *Crinum amoenum* plant is utilised to recover jaundice and diarrhea; *Glycosmis arborea* DC plant parts (Khandokar, et al., 2021) for hepatopathy, fever, wounds, eczema, skin diseases, liver disorder; use of whole plant of *Ammannia baccifera* for fever and child diseases (Poornima, et al., 2014). However, leaves of the plants are huge preferred which applied for herbal medicine (Hassan, 2018). But field observation noticed that other parts are also been utilised for making of medicines of different diseases among them, leaves of plants (28.69%) are identified to be the most common parts and it has been followed by roots, seeds, oil seeds (18.58 %), whole plants (12.30%), bark, stem (11.48%) as well as plant flower & flower oil (9.02%), fruit, dried fruits (8.20%), bulb (7.38 %). It is also noticed that one medicinal plant has had more than one part to apply as medicine for various disease recovery. Such important plant species are *Andrographis paniculata* (known as kalmegh; Chirata), (Mishra et al., 2007); *Butea monosperma*, (Jhade, et al., 2009); *Nelumbo nucifera* (Mehta et al., 2013), *Cadiospermum helicacabum* (Manju et al., 2019).

5.11 Conflict with Wild Animal

The forests of the district are highly rich bio-diversity and terrestrial ecosystem area but presently faced challenging issues due to regular man-animal conflict within and fringe area. Human interferes in terms of development i.e changes in land use pattern, Jhum cultivation, tea garden extension, conversion of forest cover area into agricultural, habitat lands, road and railway extension, tourist cottage construction are the main issue for loss of ecosystem, bio-diversity that hampered natural corridors of animals and develop man-animal conflict regularly. However, tea gardens have been used as ideal dens for breeding of leopard; illicit liquor, brewing attracts of wild animals specially elephants and bison in nearby settlement area. The conflicts of humans with tiger, elephant, leopard, wild boar, monkeys, gaur, and rhino have become a regular picture (Das, 2013). In this connection the table 7 explains the conflict of men-wildlife on the basis of field observation household where it is noticed that out of the 878 households 759 that is 86.45 % gave positive view and 119 that is 13.55 % household opined negative view on wild animal conflict with human. About 100% positive opinion is given by inhabitants except high altitude.

Table 7: Villagers’ response on Man-Wildlife conflict (village-wise)

Sl. No.	Forest village	Yes	No	Total sampled households
1	Lehra	22 (100)	-	22 (100 %)
2	Suni	28 (100)	-	28 (100 %)
3	Garobasti	72 (100)	-	72 (100 %)
4	Gadhadhar	63 (100)	-	63 (100 %)
5	Poro (N)	61 (100)	-	61(100 %)
6	Nimati and Dabri	68 (100)	-	68 (100 %)
7	Gangutia H.A	55 (100)	-	55 (100 %)
8	Adma H.A	12 (21.82)	43 (78.18)	55 (100 %)
9	Raimatang H.A	23 (41.82)	32 (58.18)	55 (100 %)
10	Bhutri forest basti H.A	45 (100)	-	45 (100 %)
11	Gudamdabri	63 (100)	-	63 (100 %)
12	Chunabati H.A	10 (18.52)	44 (81.48)	54 (100 %)
13	Bhutiabasti	30 (100)	-	30 (100 %)
14	Sankosh	60 (100)	-	60 (100 %)
15	Lapraguri	47 (100)	-	47 (100 %)
16	Santrabari H.A	65 (100)	-	65 (100 %)
17	Balapara	35 (100)	-	35 (100 %)
Total		759 (86.45 %)	119 (13.55 %)	878 (100 %)

H.A=High Altitude, (Prepared by the author based on field survey, 2017).

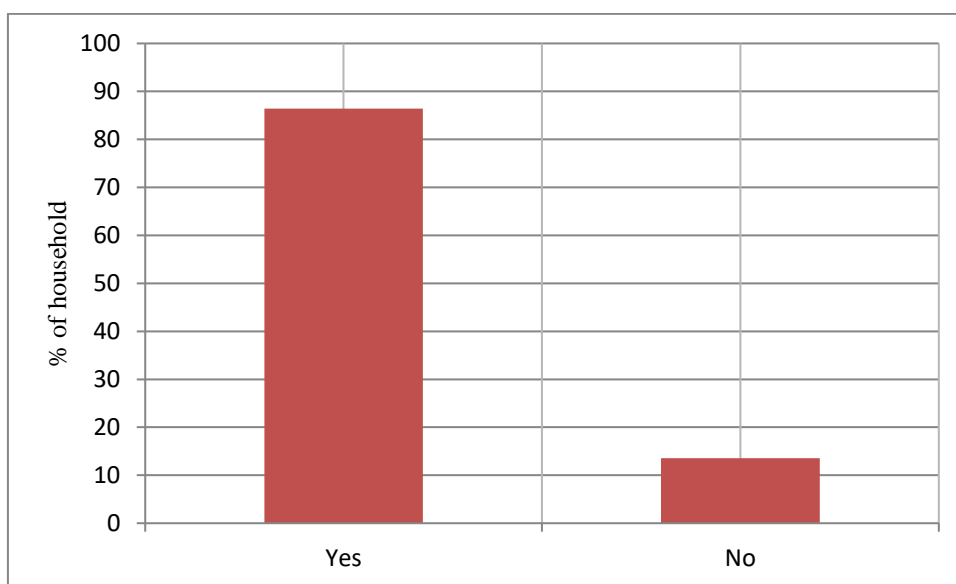


Figure 6, Villagers' response on conflict of men-animal attack.

Besides, table 8 depicts the cattle lifting statement of different ranges area of BTR in this District. The most affected area of ranges are N. Rydak, Jainti, Kumargram, Buxaduar, S. Raidak, Hatipota, Hailtongaunj and Pana where maximum number of cattle lifted by wildlife specially leopards. Human death and injuries are reported in BTR mainly from tea gardens and fringe villages by elephants. Forest villages were also affected and human death and injuries are regular occurrence caused due to elephants and leopards attack.

Table 8: Cattle lifting in Buxa Tiger Reserve by tiger and leopard

Year	BTR (West) Division							BTR (East) Division							Total
	PANA	HMTG	NMT	EDPO	WDPO	ERVK	WRVK	JNT	BDR	NRD	SRD	BH	KGM	HPA	
2004	-	-	-	-	-	-	-	8	11	23	-	-	5	-	47
2005	3	-	1	-	-	1	-	24	9	26	6	-	11	-	81
2006	6	-	3	1	-	1	-	8	12	24	5	-	8	-	68
2007	10	-	1	-	-	1	4	7	10	27	2	2	13	-	77
2008	4	-	-	1	-	1	-	10	8	26	2	-	8	-	60
2009	2	1	2	-	-	1	4	-	-	-	-	1	1	2	14
2010	3	2	3	-	-	1	1	-	-	2	-	-	2	5	19
2011	-	2	-	2	2	1	-	-	-	4	-	-	1	-	12
2012	-	3	-	-	5	-	-	27	-	-	4	-	3	-	42
2013	1	2	-	-	-	1	1	-	2	-	1	1	1	1	11
Total	29	10	10	4	7	8	10	84	52	132	20	4	53	8	431

Source: Tiger conservation plan, 2016-17 to 2026-27, DFD, East & West BTR, Forest Office, Alipurduar.

The table 9 discloses the range and year wise human death and injuries figures in BTR by elephants, bison and leopards. Elephant, wild boar, bison and monkey damages agricultural crops in peripheral and forest villages’ surroundings. Maximum damage to the crop takes place from August-September to December –January for paddy and winter crops and damage mainly paddy, maize, wheat, mallets etc.

Table 9: Human death and Injury by elephant and leopard/ tiger in BTR (2005-13)

Year	BTR, West Division		BTR, East Division		Total	
	Person killed	Person injured	Person killed	Person injured	Person killed	Person injured
2005-06	4	10	13	8	17	18
2006-07	4	6	5	4	9	10
2007-08	2	7	5	9	7	16
2008-09	4	15	8	10	12	25
2009-10	6	0	4	8	10	8
2010-11	3	8	2	5	5	13
2011-12	4	16	3	17	7	33
2012-13	6	23	10	11	16	34
Total	33	85	50	72	83	157

Source: Tiger conservation plan, 2016-17 to 2026-27, DFD, East & West BTR, Forest Office, Alipurduar.

Similarly table 10 tries to give year wise idea about the magnitude of crop and hut damage as well as compensation in BTR of this District. Elephants are involved in house, schools, office or hut damage in forests villages, peripheral villages and tea garden labour lines.

Table 10: Crop and hut damages by wildlife in Buxa Tiger Reserve (2005-13)

Year	BTR, West Division				BTR, East Division				Total Compensation paid in BTR (Rs.)
	Crop damage		Hut damage		Crop damage		Hut damage		
	No. of cases	Compensation paid (Rs.)	No. of cases	Compensation paid (Rs.)	No. of cases	Compensation paid (Rs.)	No. of cases	Compensation paid (Rs.)	
2005-06	675	270000.00	86	97200.00	967	363173.00	93	54600.00	784973
2006-07	708	318600.00	82	80400.00	897	390500.00	102	51350.00	840850
2007-08	723	289200.00	102	110800.00	1283	389200.00	490	157400.00	946600
2008-09	958	475350.00	108	122000.00	849	418400.00	107	52000.00	1067750.00
2009-10	800	395750.00	140	147850.00	1448	71520.00	90	106400.00	721520.00
2010-11	1303	775200.00	167	221000.00	768	425700.00	148	240500.00	1662400.00
2011-12	521	303500.00	219	308999.00	805	329300.00	113	186500.00	1128299.00
2012-13	1617	1109750.00	699	962750.00	2125	1074710.00	421	707270.00	3854480.00

Total	7305	3937350	1603	2050999.00	9142	3462503	421	1556020.00	11006872.00
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Source: Tiger conservation plan, 2016-17 to 2026-27, DFD, East & West BTR, Forest Office, Alipurduar.

6. Conclusion

Through conclusion, it could be stated that, natural factors weather directly or indirectly controlled livelihood existent of forest inhabitants. The observation express that the forest inhabitants are adapted, adjusted and lived to survive in the forest environment. There are some differences of anthropogenic activities in the change of physical conditions such as inhabitants in high altitude villagers pipe line and spring water are the only source of water where as in low lying reside villagers, core area and fringe area forest villagers are followed well and tube well facilities to fulfil demand of drinking and other water. Finally, it could be summarised that variation in different physical factors are the main causes of directions for the variation of socio-economic characteristics villagers between high altitude and low lying area which they adopted according to their knowledge and capacity for livelihood progress.

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