Land use change and its impact on Human-Animal Relationship in Dooars of North Bengal

A Dissertation submitted

To

Sikkim University

In Partial Fulfilment of the Requirements for the

Degree of Master of Philosophy

By

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Declaration

I, Himangshu Sen, hereby declare that the dissertation entitled **"Land use change and its impact on Human-Animal Relationship in Dooars of North Bengal"** is the record of work done by me, that the contents of this did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and this dissertation has not been submitted by me to any other University or Institute.

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All the assistance and help received during the course of the investigation have been duly acknowledged by him.

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"Land use change and its impact on Human-Animal Relationship in Dooars of North Bengal"

Submitted by **Himangshu Sen** Under the supervision of **Dr. Abdul Hannan** of the Department of Geography, School of Human Sciences, Sikkim University, Gangtok 737102, India.

Signature of the Candidate Countersigned by Supervisor

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Contents

List of Tables

List of Figures

List of Plates

Chapter- 1

1.1 Introduction

"The world has enough for everyone's need, but not enough for everyone's greed"

– Mahatma Gandhi

All the major human activities, like agriculture, industry, power generation, urbanization, grazing, logging, mining etc. are directly associated with a specific piece of land. Generally, land use is constrained by soil characteristics, topography, vegetation, climate, and other such environmental factors. The land is one of the important and finite resources available for the human activities. Land use always influenced by the cultural background and natural endowments of any particular place (Karwariya and Goyal, 2011).

In other words, it took several hundred years to people to convert forest lands to other land use- using fire, primitive tools and grazing. In fact, thousands of years ago hunting and agriculture were the prime factors. Today, humankind has greater scientific and technological capacity than ever before to bring about rapid land use change on a very large scale. Humankind has converted forest land and other wastelands to agricultural use for thousands of years as a part of the process of economic development. Deforestation was most predominant in the temperate climatic region until the late 19th century and is now greatest in the tropical climatic area. In the tropical area, net annual loss of forest area from 2000 to 2010 was about 7 million hectares, and which reflects on the net annual increase in agricultural land area was more than 6 million hectares. Though there were significant regional variations in the Central and South America, sub-Saharan Africa and South and Southeast Asia all had net losses of forest and net gains in agricultural land. The largest net loss of forest area and the largest

net gain in an agricultural area in 2000-2010 was in the low-income group of countries, with net forest loss the associated with increasing rural populations (FAO, 2016).

There have been severe changes in land use over contemporary periods. Efforts have been made to enumerate the nature and extent of anthropogenic changes in land cover on national and local scales. The primary mode of human-modified land use has been the conversion and modification of natural ecosystems for agriculture (Ramankutty and Foley, 1999). Forest is a biological aspect having an immense social and economic importance. The forests support different communities, which have a vital role in maintaining balanced eco-system of the world. While in case of India too, forest plays a significant role in maintaining 'ecological' and 'economical' situation in relation to people. In fact, India is endowed with an immense variety of forest resources. However, with continuing pressures of an ever increasing population and the succeeding growing needs resulted in depletion and degradation of forests and subsequent adverse changes in the ecosystem are taking place (Pant, Groten, and Roy, 2000).

Now withstanding the rise of issues of forest degradation and depletion, one of the fundamental challenge that is evolved in the due course of time is the Human-Animal Relationship as well as maintaining a sound relationship. It has become one of the debated issues in recent times as it leads to a major threat to the survival of many wildlife species in different parts of the world. At the same time, it has also become a significant threat to local human populations residing nearby to the forest areas especially in the regions which are rich in biodiversity. The relationship between human and animal has been degraded with the passes of time. The increasing human population and the continuous loss of natural habitat have further adverse effects on it. The changing scenario in the forest cover is reached relatively unsatisfactory compared to

the desired level, however, the number of few selected species have been increasing day by day like Indian bison, Indian leopard, and Asian elephant in recent past due to protectable forest policies of the government and community consciousness. The Human-Animal Relationship has been worsening due to the different activities of anthropogenic agents, which further results in deterioration of Relation between Human and Animal (Krishna et al., 2014). The increase of wild species and the decrease in forest cover leads to an imbalance in the ecological food chain. Thus Human-Animal Relationship has become one of the most challenging problems not only to the animals but also for the wildlife management agencies. Therefore, the study of Human-Animal Relationship has become an important issue for better management of biodiversity and sustainable development.

Human-Animal Relationship has become acuter due to shrinkage of animals habitats, loss of fodder and prey base in the forests and increased developmental activities around the forests (expansion of agricultural land, developmental projects like housing and road building etc.) has been accelerated the process of deterioration. The rapid expansion of human habitations, value-added agriculture (plantation agriculture replacing the forests) has been not only encroached upon the forests and grasslands but also cut off the biological corridors needed for migration of wide-ranging animals like Asian Elephant, Rhinoceros, etc. Moreover, excessive grazing of cattle in the forest fringes and other forest areas have created acute pressure on available fodder for the large herbivores. Reduction of natural grassland and conversion of natural forests into value-added plantations (tea, rubber etc.) reduced the existing natural vegetation which has further adverse effects on existing food chains. A few decades back introduction of plantation agriculture in Dooars of North Bengal has restricted the fodder bases of the Asian Elephants and other wild animals, as well as poaching of deer and other smaller

prey-animals, are responsible for the reduction in prey-base of big cats like Tiger and Leopard, thereby leads a situation where Human-Animal Interactions are inevitable.

With changing the size of the society and the needs associated with them has created certain changes in the land they settled in. Such changes have brought certain issues and challenges with them especially in the case of stabilizing the past relationship between Human-Animal. The rising conflicts, tensions, and challenges in managing the Human-Animal Relationship would be drawn into attention by building the land use changes perspectives.

1.2 Review of literature

The review of the related literature is as follows:

1.2.1 Land use

The land is a basic and essential resource for agriculture. Its quality and extent largely determine the variety and magnitude of agriculture production. Extreme focus perhaps on crop yields and cropping pattern which have recorded share changes in recent years and a relatively static situation in the various uses of land are responsible for this neglect (Nadkarni and Deshpande, 1979).

Land use is refined form of earth surface creating physical, chemical, biological system, and process together with socioeconomic transformation and behaviour in space and time. The monitoring of this complex system includes the diagnosis and prospects of changes in human-land interaction in a holistic manner at various levels. Land use change may be examined by considering the conversion of forest to crop and agricultural land, loss of productive land through various factors, conversion of wetlands to agriculture and urban use, and conversion of other types of land to various human uses, etc. (Stamp, 1984).

Mohammed (1978) Studies, how land use pattern has received a good deal of attention from Indian geographers in the past and has been continuously drawn their attention. Presently the land use patterns are being minutely investigated at the regional or micro-regional rather than at the national level. In the view of the recent extension of irrigation and other facilities, North-Western India and some parts of South-India have received comparatively more attention from the research works. He said that in Utter Pradesh and Bihar, research publications on this aspect of agriculture appear to be more numerous than in other parts of the country. Indian geographers have long been attracted to study the problems of land use in the country with a view to finding out ways and means for scientific utilization of land. Such studies range from inventories of land use surveys to isolated topical or regional descriptive accounts of land use variations both in space and time. According to him a rational assessment of land and its scientific utilization has become important. He stressed on the micro level study of land use at district, block or even at village level.

Shing (1999) with his one of the famous edition India: a regional geography has presented a comprehensive volume on the regional geography of India. The country like India with its physical and cultural complexity, it has always been a difficult task to combine them in a single edition. But this book made it successfully and gives a detailed information about the nook and corner of the country. The book is unique, as it is based on the grassroots information of every region of the country.

Rao et al., (1990) focused on the land use and in its spatial context which is essential to understand the area of optimum land use and degraded areas, the comprehensive study of land use is of immense value to ensure better returns from the land to meet future requirements for food, and industrial raw materials and for successful planning of agricultural growth, organized urbanization, regional

development and thereby to accelerate the process of development in the country. It is also useful for planners to evaluate the possibilities and limitations of further spatial development to avoid or restrict undesirable trends of land exploitation to adjust the forms of land use to the land capability and to direct the expansion of intensive land utilization into suitable areas. Planning and land use should be related intimately and that was summary of the study.

Chandra et al., (2009) points out that environmental degradation is a major problem in developing country, where the rate of population growth is quite alarming and rate of industrial development is very insignificant. People are mostly depending on primary activity mainly in agriculture and allied sectors. The available per capita land holding is very meagre in third world countries. Therefore a large portion of society depends on the common property resources for their livelihood and survival. But the present policies of forest governance prevent the local people to access the common property and start regulating by the influential section of the society such as local businessman, politician, administration all join together to prevent the common to enter in the common property resources in the name of conservation. The common property resources include the community forest, village pasture, wasteland, waste dumping place, watershed, stream rivulets and river bed. The people use this land without considers the adverse impact on the environment because they are trying to maximum utilization of such land considering that this is not their own land. The article reveals the political economy of common property and their history of evolutionary ruins.

Singh (2012) highlights the problems related to land use change and its impact on the environment. Human beings are the main agent of land use change, though during the initial stage of *homo-sapiens* their action was not such a degree that could

influence environment adversely, the passage of time human-induced activities has multiplied such a way which leads a great adverse effect on the environment. More recently, industrialization has encouraged the concentration of human populations within urban areas (urbanization) and the depopulation of rural areas, accompanied by the intensification of agriculture in the most productive lands and the abandonment of marginal lands. All of these causes and their consequences are observable simultaneously around the world today. Changes in land use and land cover are important drivers of water, soil, and air pollution. Perhaps, the most important issue for the human's future on the earth, the future food security of ever-increasing population need to be secured.

Chawla (2012) in his paper 'Land use Changes in India and its impacts on Environment' made an attempt to find out the key policy and governance challenges in India originated as a result of land use changes resulting in urban sprawl. Land use changes result from population growth and migration of poor rural people to urban areas for economic opportunities. Changes in land use directly influence the regional air quality, energy consumption and climate at global, regional and local scales. Controlled, coordinated and planned urbanization is a gift to the human society. However, unplanned urbanization can be a disaster. Therefore, it is very important to examine causes of urban spread out, its associated problems and possible solutions in India. This paper provides a valuable basis to understand the major issues faced by urban citizens in India as a consequence of land use changes. Their suggested solutions are very helpful for the strategic planning in future.

1.2.2 Human-Animal Relationship (HAR)

Mullin (1999) stated that the humans' relationships with animals have become an ever-increasing subject of controversy, which has long been of interest to those

whose primary aim has been the better understanding of Human-Nature Relationship. Human-Animal Relationship has undergone to a considerable re-examination that reflects key trends in the history of social analysis, including concerns with connections between anthropology and colonialism as well as the construction of race, class, and gender identities. There have been many attempts to integrate structuralist or symbolic approaches with those focused on environmental political and economic dimensions. Human-Animal Relationship is now much more likely to be considered in dynamic terms, and consequently, there has been a much interdisciplinary exchange between anthropologists and historians. His research directly engages moral and political concerns about animals, but it is likely that socio-cultural research on Human-Animal Relationship will need to continue as much, which will create a non-human (wildlife) friendly world.

Aaltola (2005) highlighted the animal ethics which has presented convincing arguments for the individual value of animals. Animals are not only valuable instrumentally or indirectly but also the very important part of the ecology. Few study has been written about interest conflict between humans and animals. The motive of this paper was to analyze different approaches of increasing conflict, and how the conflict will be minimized with the help of people's awareness and participation.

Nandini (2010) highlights the current conservation policies of India that carries the latest in research news from the natural and social science facets of conservation, such as conservation biology, environmental history, anthropology, sociology, ecological economics and landscape ecology. This article focused that, can we actually turn landscapes of (human-wildlife) conflict into landscapes of co-existence. The studies showcased in this issue and illustrate that while there is no easy solution, there

are case-specific measures that can be helped to mitigate or prevent conflict situations between human and wildlife.

Urbanic (2012) worked out in the field of animal geography, which gives a systematic description of the evolution of animal historiography. There are three main themes in the book which discussed about the evolution of animal geography. First is the cultural dimension of animal geography, second is an economic dimension and the third is the ethical dimension of the society. There is enough insight on the Human-Animal Relationship and how on earth this relationship has been diversified. His work undoubtedly leads animal geography into a new paradigms.

Krishna et al., (2014) have carried out their study on the Human-Animal Conflict in India. Their study mainly focused on current trends of rising Human-Animal Conflict in India. The study shows that we human beings are being insensitive to the value of wildlife and to the importance of living in harmony with nature. They found this subject particularly important because the author was born and spent his childhood in an area which was rich with nature's bounty of flora and fauna. It seemed, really respected the importance of coexistence between different species, but this harmony has been breaking down somewhere that leads conflict between Human and Animal. They further explore the issues that, growing human population and the resultant overlap of the same with established wildlife territories have been the major cause of Human-Animal conflict. Conflict creates fear in the mind of people. It is higher when the conflict is with larger animals like tiger, leopard, or an Asian Elephant. For people who encounter this on a regular basis, the initial fear turns into long-term worry and frustration about dealing with the situation. This is mainly influenced by how the situation is affecting them economically, physically, or psychologically. Such feelings

may give rise to another conflict situation. The retaliatory killing of wild animals is one of the expressions of such frustrations.

Baruah (2014) stressed out his thoughts towards a political ecology which is symmetrical and challenges the disciplines humanist focus. Political ecology has had a long connection with materials, giving back to some of its ecclesiastical concerns. This paper is mainly focused on the role of materials in mediating people's relationship with elephants in the country side of North East India. The paper shows that Human-Elephant Conflict is not only a simple outcome of interactions between human and elephants but materials in the case alcohol plays an important role. Baruah has done an ethnographic study, how alcohol shapes the Human Elephant relationship with a focus on the socio-political well-being of people and vis-a-vis.

Baruah et al., (2014) highlights the togetherness, vulnerability, and killings of humans and nonhumans. Their main stress was to enrich people's understanding of the ethics of peaceful living with nonhumans (wildlife). This paper is a philosophical debate of animal ethics towards vulnerability and killings of non-humans by human. Ethical consideration of human towards wildlife have flourished togetherness with non-humans and unethical is vice-versa. They have pointed out the ultimate results of vulnerability is killings of not only the non-humans but human being are also the victim in either way.

Das (2014) has depicted the rising problems of Human and Asian Elephant Conflict in Dooars. The North Bengal (primarily Dooars) has experienced with increased intensity of HAC due to several development activities which are being implemented with little consideration for the region's legacy as a richly bio-diverse zone. The conflict is most unambiguously manifest in the accidental death of numbers of Asian elephants upon collision with trains. The situation is grim as of now since,

over the years, the pathetic deaths of so many Asian elephants have brought forward a newer and more severe dimension of Human-Asian elephant Conflict. The severity transcends the nature of mere Human-Asian elephant Conflict, the conflict is between technological development (which multiplies the potential of man as a destroyer of natural order manifold) and Asian Elephants in a more immediate sense. Apart from the role of Railways, the study also looks into other factors which lead to long-run loss of habitat for Asian elephants in Dooars.

Baruah (2015) revealed how encounter towards animal has played an important role in between human and animal. Encounter creates such situations where culture, history, and society come together and they are directly related to histories of world making. He indicates domestication of wild animals as an encounter. How has human being have been articulated the plant and animal species with the advancement of technologies? are the main focus of the discussions of the encounter? Encounter reconfigure how we conceptualised the notion of personhood and knowledge. There is an invisible connection or symbiosis relationship between different agents of the environment and they are functioned in a collaborative way.

The encounter also depends upon the spatio-temporal character of the particular space. He classified the encounter into; the encounter of passion and encounter of pain. In the Capitalistic of the Marxist world, all the products are the fruits of the encounter.

Chakraborty (2015) worked out in the field of 'Human and Animal conflict in Terai Dooars region of the North Bengal'. His illustrations reveals the emerging problems related to this issue. He stated that most of the cases the conflict and casualties are projected as animal-centric orientation, emphasizing the deaths and depletions of wildlife, however, in recent years, there has been a huge loss of human life and

properties has been recorded. He further highlights different aspects of Human-Animal Relationship in the Dooars of North Bengal.

1.2.3 North Bengal and Dooars

Xaxa (1985) discusses, how the economy of North Bengal have been influenced by the capitalistic colonialism. Though North Bengal is well endowed with natural resources, the region remains backwards due the colonial regimes. He further specifies that the backwardness of the region is mainly due to uneven development brought by the colonial capitalism in the 19th century.

The trend of opening up of local market near the railways and road tracts can well be traced to the colonial era. He further highlights that the livelihood of inhabitants is strongly influenced by the plantation economy, introduced by colonialists. The class division of the society, the migration of labours from hinterlands, the changes in land use pattern, the indigenous business being subsumed by railways. The dualistic society of the modern capitalistic and backward traditional has been analysed. It was concluded that modernity of the advance sector is the function of backwardness of others. It is in this sense that development generates underdevelopment as by-products. The political economy behind the underdevelopment of such a resourceful region is overwhelmingly debated in this paper.

Bandopadhyaya (1977) examines the relationship between agricultural labour and production system, farmer's right in the post-independence India. There was a sharp rise in the number of agricultural labourers in North Bengal between 1961 and 1971. Apart from the rise in the number of agricultural labourers, the general land use system of North Bengal characterised overwhelmingly by *adhiar* (share-cropper) forms the agricultural economy of the past. The field investigation, on which this paper is based, was carried out during the first half of 1976. It is a thorough study of the

agricultural labourers of the North Bengal basically the six northern district of West Bengal. The major thrust was on sharecropper related issues.

Nagendra et al., (2009) highlighted about the forest change and fragmentation of natural habitats in the Northern West Bengal. The paper evaluates forest change and fragmentation of its habitats between 1990 and 2000 of the nearby area of Mahananda wildlife sanctuary of Darjeeling district.

They argue that though there is a regrowth of forest area due to the proper management of wildlife and forests but the peripheral areas of the sanctuary is still experienced continuous loss of forest cover due to the illegal timber markets by transport networks, as the NH31A is passing through the sanctuary which made it easy to transport. That's why, though the surrounding landscape enjoys regrowth of forests area within less intensively tea plantations, but it is also becoming increasingly fragmented. It may be adversely affected by maintenance of effective wildlife corridors in this ecologically fragile region. So, they are suggested to review the existed management and development policy which has been implied to the forest fringe of this biodiversity hotspot.

Mandal (2012) studies about the land use status of Jalpaiguri district and its compare to West Bengal and India. Jalpaiguri district ranks in the second position in terms of forest cover in West Bengal, but recent developmental activities lead a great threat to the forest cover of the district. The paper portrays an overview of the significant facts of land use status in Jalpaiguri district.

Sarkar (2013) highlights the conditions of tea garden workers of Jalpaiguri district during the colonial periods. Though the tea was introduced by Britishers in Jalpaiguri, it has had a significant influence on the economy of Jalpaiguri district. Manufacturing of tea has become the major industry of the district and it is the second

largest producer of tea in West Bengal. Most of the tea garden workers in Dooars were imported from the tribal belt of uplands of middle India. He further argued that tea garden workers of Jalpaiguri district played an important role in Colonial Indian society. The conditions of workers were not well, they always deprived by their proprietors. Tea garden workers in Jalpaiguri district in general and children and women, in particular, have, long been a disadvantaged, deprived, under-served, exploited and alienated group. The tea garden labourers of Jalpaiguri district were not free from coercive methods of labour control. The paper was the focused on the historical background of the tea industry, the origin of tea workers in Jalpaiguri district.

The historical transition of Dooars of North Bengal has different complexities due to its location and landscape. It the sole door to enter to Bhutan, and North East India and further to South East Asia (Techno-economic survey of Dooars tea industry, 1995). This region is one of the biodiversity hotspots of the country with rich in natural resources like dense forests with flagship species of animals and plants, mineral resources which are yet to be extracted off. The region had experienced different regimes of colonial as well as an indigenous ruler. The peopling of the region is also one of the most diverse in the country, as it is the homeland of several tribes and during the partition of Bengal, the influx of refugees hit their first step to Dooars as it is one of the region shares borders with Bangladesh. During colonial periods it had undergone a destructive change due to the introduction of tea plantation in the region. The region is also very important as it was one of the offshoots of old silk route towards Tibet (Mckay, 2007).

The abrupt of high population growth during the partition of Bengal due to the migration from Bangladesh and unscientific development in an around the forest fringe encroached the natural habitats of this fragile landscape which leads a situation where

Human-Animal Interactions are very common. Therefore, the civil society, as well as different environmental activists, have been raising their voices to stop such so called developmental and other activities which may harm the harmony of animal livings in the region. The strategic location of the region is one of the cause for the difficulties in forests management practitioners. The destructions of the natural migration route animal and trying to isolate them is a small island like landscape surrounded by human habitations called reserve forests, or national parks by developing concrete roads etc. eventually failed to bring a wholesome result for wildlife conservation.

After reviewing numerous literature one can witness that majority of scholars focused on the forest management strategies and approaches through scientific and rationale use of land. The forest conservation policies have been changed, and in the recent years, it has been seen that the human-centric approaches are gradually shifted towards the animal-centric. The main concerns of the conservation practices are co-existence of human and animal, not to isolating animals, but conservation practices have been failed in different parts of the globe.

1.3 Statement of the Problem

Habitat loss and degradation are major contributors to species declines worldwide (Wilcove et al, 1998 and Martinuzzi et al, 2015). Highly specialized species are particularly vulnerable to habitat loss and often show significant population declines in response to changes in land use (Harcourt et al, 2002; Safi and Kerth, 2004). The Dooars was one of the dense forests areas and used to be home of large number of wild species as well as corridor for uninterrupted movements of the wild animals. It was the British who initially expands railways and tea plantations in the region by clearing the forests. Rapid destruction of forests land leads huge changes in land use pattern in the region during the British India (Xaxa, 1985).

In post-independence period, the unprecedented developmental activities like construction of roadways, railways, buildings, growing of township and markets etc. near forest fringe accelerated the destruction of forests land thus obstructing the free movements of wild animals. With increasing development and modernisation, the relationship between human and animal has been constantly deteriorating. Thus, it can be said that forest areas now have become like islands surrounded by human habitations. The forest cover has also changed significantly due to the relocation of the people, extensive deforestation, farm, grazing of cattle and intensification of agriculture and industrial activities near the protected areas caused unprecedented threats to wildlife (Sharma, Deka, and Saikia, 2011). Such situations posed threat to animal habitats which needed to be investigated. The present study will examine the impact of Land use change on Human-Animal Relationship (HAR) in Dooars of North Bengal.

1.4 Objectives and Research Questions of the Study

The main objectives of this study are as follows:

1. To examine the land use pattern in Dooars of North Bengal during British India and Post-Independence period.
2. To analyze the chronology of events and deteriorating the Human-Animal Relationship in Dooars of North Bengal.
3. To evaluate land use change and its impact on Human-Animal Relationship.

The study would make an attempt to answer the following research questions:

a) How has the land use changed in Dooars of North Bengal during British India and the post-Independence period?

b) How has the Human-Animal Relationship deteriorated in Dooars of North Bengal?

1.5 Database and Methodology

1.5.1 Sources of Secondary data and their availability

Data/Reports/Action Plan	Sources
1. Blockwise land use data of Jalpaiguri, Coochbehar and Darjeeling (2000-01, 2004-05 & 2013-14)	1. Directorate of Agriculture (Evaluation), Govt. of West Bengal, Kolkata.
2. Status on Land (2003-04)	2. Department of Land and Land Reforms Government of West Bengal, Kolkata.
3. West Bengal Development Report (2010)	3. Academic Foundation Darya Ganj, New Delhi.
4. State Forest Report (2005-06, 2006-07, 2007-08, 2008-09, 2010-11, 2011-12)	4. Directorate of Forests, Office of the Principal Chief Conservator of Forests, Govt. of West Bengal
5. Annual Wildlife Report (2013-14, 2015-16)	5. Wild Life Wing, Directorate of Forests, Government of West Bengal
6. Detailed list of Elephant killed on Railway Track in North Bengal (1974-2013)	6. North East Frontier Railway, Ministry of Railway, Govt. of India.
7. Annual Report on Forest (2014-15)	7. Ministry of Environment, Forests and Climate Change, Govt. of India
8. West Bengal State Action Plan on Climate Change (2013)	8. Department of Environment, Govt. of West Bengal
9. 150 years of Forestry (1864-2014)	9. Directorate of Forests, Govt. of West Bengal
10. Milestone in Forestry (2010)	10. Directorate of Forests, Govt. of West Bengal
11. Techno-Economic Survey of Dooars Tea Industry (1995)	11. Tea Board of India, Kolkata
12. Report on Forest Resources of Jalpaiguri District of West Bengal (1999)	12. Forest Survey of India, Eastern Zone, Kolkata
13. *Banbithi*, Wildlife Issue (2010-11)	13. Department of Forests, Govt. of West Bengal
14. West Bengal Human Development Report (2004)	14. Development and Planning Department, Govt. of West Bengal
15. Sikkim & Bhutan- 21 Years on the North-East Frontier by J. C. White (1887-1908)	15. London, Edward Arnold, Publisher to the India Office (1909)
16. West Bengal Administrative Atlas (2001)	16. Census of India (2001), Directorate of Census Operations, Govt. of West Bengal
17. Forests and Vegetation Map of Jalpaiguri, Coochbehar and Darjeeling (1972 & 2009-10)	17. Forest Survey of India, Maps are obtained from NATMO, Kolkata
18. Statistical Handbooks of Jalpaiguri, Coochbehar and Darjeeling (1971-2011)	18. Bureau of Statistics and Planning, Joint Administrative Buildings, Kolkata.
19. The Telegraph (an English daily)	19. Kolkata, India.
20. The Uttarbanga Sambad (a Bengali daily)	20. Siliguri, Jalpaiguri, Coochbehar, Malda, India.
21. Forest and Vegetation cover map	21. Survey of India, NATMO, Kolkata

1.5.2 Design of Primary Survey

1.5.2 a) Observation

Personal observation, live-in-experience and people's perception relation to land use changes, Human-Animal Relationship etc. have been captured and analysed.

1.5.2 b) Interviews

In-depth interviews of the Forest Officials, Panchayat Functionaries, and Activist of Civil Society Organisations as well as people involves into different developmental projects have been conducted through structured and open ended questionnaire and the case studies were also carried out in the affected landscape to know their views about the Human-Animal Relationship in the region. The following persons have been interviewed during the field work;

Name of the individuals & designation	Date of interview	Place of interview	Rationale behind the selection of individuals
Mr. Ujjwal Ghosh (Chief Conservator of Forest, North Bengal)	11/11/2017	**Jaldapara National Park** (Salkumarhat)	Since he is the chief conservator of forests in North Bengal and he has extensive experience in the field of wildlife management. His name has been highlighted in several reports on newspapers related to Human-Animal Relationship in Dooars.
Mr. Bhabendra Nath Hrishi (Beat Officer)	12/11/2017	**Buxa Tiger Reserve** (Nimati Range)	According to the institutional data collected from BTR division, Nimati has been reported for the highest frequency of Animal and Human injuries as well as for the crops and hut damages too. At the time of animal depredation or wildlife attacks the beat officer is the person who authorised to take initial steps to tackle the situation. Therefore, of the beat officer of Nimati range Mr. Hrishi was interviewed.
Mr. Dilip Roy (Panchayat Pradhan)	13/11/2017	**Bhutiabasti, BTR**	Bhutiabasti is also reported several times for the Human-Animal interactions in BTR East. The village has been selected for the FGDs to know

		(Jayanti Range)	the perceptions and thoughts of the people. Implementation, planning or any kind of developmental activities in the forest fringe villages has been carried out with the help of Panchayat functionaries. So, the Panchayat Pradhan was interviewed.
Mr. Sambhu Chhetri (A local Resident near to the Banarhat Railway crossing)	14/11/2017	**Banarhat Railway Crossing** (Elephant Corridor)	Banarhat Railway crossing is located on the Elephant corridors and often reported for elephant death due to the accidents with trains. So, this place was selected to know the view of local people and their feedbacks about the matter. His house is located very adjacent to the railway crossing and he has witnessed several cases of elephant deaths on railway tracks at Banarhat.
Mrs. Monica Barla (Teacher)	15/11/2017	**Junas Line, Baradighi Tea Estate** (Gorumara National Park)	The Baradighi Tea Estates has been adversely affected due to the depredations of wild animals in Gorumara National Park. To capture the view of local civilians, the interview was conducted. A teacher in a particular place can give enough information about the ongoing problems of that place. In search of better and authentic information Mrs. Monica Barla was interviewed at Baradighi.
Mr. Bhupen Pradhan (A resident near the Sevoke Railway Crossing)	16/11/2017	**Sevoke** (Mahananda WLS)	Like Banarhat Railway crossing, the Sevoke crossing in Mahananda Wildlife Sanctuary is also the hotspot of Elephant death on Railway tracks. Bhupen Pradhan has been the witness of such incidents in between Gulma and Sevoke railway station in Mahananda Wildlife Sanctuary.

1.5.2 c) Focus Group Discussions (FGDs)

The following six FGDs have been conducted in different locations in the protected areas or nearby areas of Dooars, based on the information of Human-Animal

interactions in the region. The information captured through FGDs are analysed in chapter five. The details of FGDs are as follows:

Location	**Rationale behind the selection**
1. **Bhutiabasti** (Agriculture in Forest Fringe)	On the banks of Jayanti river, Bhutia Basti looks picture-perfect. It is the only village that has ever been relocated from the core area of Buxa Tiger Reserve. These settlement was built by employees of a dolomite mining firm, whose operations were suspended in 1983 after Buxa was declared a tiger reserve. The forest department never bothered about these 29 families while relocating other villagers of Bhutiabasti to Patpara and Hatipota (Times of India, June 23, 2013). There are 33 houses with a population of 112 inhabitants with an average family size of 3.39. The male-female sex ratio is 1: 0.89. Population of this area consists of 99 percent Nepali community and 1 percent local "*Adibasi*" (Bhattacharjee, 2017. p-341). The Bhutiabasti village is often reported for HAI and a maximum number of Human-Animal Interactions have been reported from this part of the Forest Beat in Buxa Tiger Reserve East (Annual report 2013-14 and 2015-16). The maximum number of human death has been reported from Bhutiabasti (Human death/injury, institutional data collected from BTR Division, Alipurduar).
2. Nimati (NH Passes Through)	Nimati is a village in the Alipurduar district. It is about 17 kilometres away from Alipurduar and is a tourist destination. It is part of Buxa Tiger Reserve. The National Highway 31C passes through Rajabhatkhawa near to the Nimati village in the western part of Buxa Tiger Reserve and is well known for Wildlife loss or injury etc. and reported for highest Human-Animal Interaction cases. (Annual Report 2015-16). During the last one and half decades, maximum number of wildlife death cases due to the accident on road has been reported from Rajbhatkhawa area only (*Ibid*).
3. Baradighi (Plantation Village)	Baradighi village is located in Matiali Tehsil of Jalpaiguri district in West Bengal, India. It is situated 5.5km away from sub-district headquarter Chalsa and 40.9km away from district headquarter

	Jalpaiguri. As per 2009 statistics, Matiali, Batabari II is the gram panchayat of Baradighi village. Baradighi village of Matiali block has highest Human-Animal Interactions in the last 10 years report at the adjadcent areas of Gorumara National park. Most of the cases of crop damage have been found in this particular area of Gorumara National Park (Institutional data collected from Gorumara Wildlife Division, Jalpaiguri).
4. Salkumarhat (Forest Livelihood)	The total geographical area of the village is 503 hectares. Salkumarhat Forest has a total population of 334 peoples. There are about 66 houses in Salkumarhat Forest village. Falakata is the nearest town to Salkumarhat Forest which is approximately 20km away (Census of India, 2011). The Salkumarhat village of Jaldapara National Park is also reportedly well known for Human-Animal Interactions. This village is surrounded by Jaldapara national park and most of the population of Salkumarhat are dependent upon the forest area like collecting firewood and other natural resources. The number of wildlife offences is very high in this area (Management-cum-working plan Jaldapara NP, 1998).
5. Sevoke/Gulma (Railway Track Passes Through)	One of the busiest railway track that has been operated through the protected area of North Bengal to North East India has been reported for a maximum number of Elephant death in Mahananda Wildlife Sanctuary. The NH- 31A is also functioned through the sanctuary and make it most vulnerable to the wildlife. The two most important places in the Sanctuary for the movement of large herbivores like Asian Elephant are Sevoke and Gulma. These two places are also well known for the conjuncture of Railway and Roadway crossings (Report on elephant death, 2013).
6. Banarhat (Railway Track Passes Through)	Numbers of Elephants have been killed due to the run over of trains in the Banarhat. Though the region is identified as elephant corridors. The recent death of eight elephants after being hit by a goods train in the Banarhat has once again raised questions over the movement of trains along the elephant corridor in the region.

1.5.3 Matrix of Objectives-Database-Methodology

Objectives	Database and Methodology
1. ***To examine the land use pattern in Dooars of North Bengal during British India and the Post-Independence period.***	In India detailed land use and land cover data available only for the periods of 1960-2016. Though some studies on land use and land cover had been done during British India, there were certain limitations of those inventory datasets (Feddeman et al., 2005; Liu et al., 2008 & Tian et al., 2010). For the study of overall changes in land use during British India, the descriptive method has been used to analyse based on the information collected from district gazetteers of Darjeeling, Jalpaiguri and Coochbehar as well as different colonial writings and governmental documents etc. of British India. Information regarding land use during independent India includes district wise land use data, that has been collected from district statistical handbooks of the three districts for the year of 1960-61, 1965-66, 1972-73, 1985-86, 1994-95, 2005-06 & 2012-13. The statistical methods are used for calculating the percentage, index of changes in land use and the descriptive method with cartographic techniques have also been used for analysing the data. The block-wise land use data has been analysed with mixed methods of qualitative and quantitative techniques for the following years 2000-01, 2004-05, 2011-12 & 2015-16. With the help of tabulating the data, showing changes by graph, chats etc. These data are collected from Directorate of Agriculture (evaluation), Govt. of West Bengal. Since, there is lack of accessibility of block-wise land use data, the district-wise analysis of land use for the time periods of 1960-2000 has been done to fill up the gap of block-wise land use data and try to find the changes and general facts about the land use. District wise forest data are collected from State Forest Report of West Bengal: 1999 (Jalpaiguri), 2005-06, 2006-07, 2007-08, 2008-09, 2009-10, 2010-11, 2011-12 and Forest Survey of India (1991, 1993, 1995, 1999, 2001, 2003, 2005, 2007, 2011 and 2015). These data helped us for the interpretation of forests land, canopy cover and their changes in Dooars of North Bengal. It is also elaborated the types of forest, the present status of the forest with flora and fauna etc.

Forests and Vegetation cover Maps of 1972-73 & 2009-10 of the study area have been collected from NATMO as well as following Satellite imageries

Data Type	Path/Row/Year	Date of Acquisition
Landsat MSS	**(1972-73)**	
Tile 1	149/041	1973/12/25
Tile 2	148/042	1972/12/11
Tile 3	149/042	1972/11/24
IRS LISS III	**(1990-91)**	
Tile 1	149/041	1991/01/08
Tile 2	149/042	1990/12/23
Tile 3	138/042	1990/12/23
IRS LISS III	**(2016-17)**	
Tile 1	139/041	2016/12/30
Tile 2	138/042	2017/03/07
Tile 3	138/041	2017/03/17

have downloaded from LISS III&IV (ISRO Bhuvan), Landsat (USGS Earth Explorer), and Google Imageries (Google Earth Professional). Toposheet Maps of 78/A, 78/F, 78/B (Forest Survey of India) have been analysed to determine the changes in forests and vegetation cover at least two points of time with the help of Arc GIS. The detection of forest cover changes was based on the comparison between the satellite imageries of above said years (1972-73, 1990-91 and 2016-17). The visual interpretation has been done to indicate the locational changes in forests cover over particular space and time of the study area. The changes in forest cover have been calculated by polygons with the help of Arc GIS 10.2.2 and highlighted on choropleth maps in chapter III.

After analysing all the secondary data and information the researcher has carried out FGDs and interviews in the selected places which showed significant changes in land use to investigate the actual situation of land use change as well as drivers of land use change in the study area.

2. ***To analyze the chronology of events and deteriorating the Human-Animal Relationship in Dooars of North Bengal.***	The data related to Human-Animal Relationship of the study area has been obtained from divisional forest offices of Buxa Tiger Reserves (Alipurduar), Gorumara National Park, Neora Valley National Park and Chapramari Wildlife Sanctuary (Jalpaiguri), Jaldapara National Park (Coochbehar) and Mahananda Wildlife Sanctuary (Darjeeling). These data are analysed at block/range level of protected forests areas as well as nearby forest fringe of the Jalpaiguri, Coochbehar and Darjeeling districts. The data of status of flagship species in Dooars have been procured from Annual Census Reports (2014-15 and 2015-16) of Wildlife Wing of West Bengal. Animal Census data (1989, 2012, 2013-14, 2014-15) are also obtained from Census Report (2013-14 and 2014-15) of West Bengal Wildlife Wing. These data have been analysed to identify the places of occurrence of Human-Animal Interactions in the study area and their mapping have been done with the help of Arc GIS 10.2.2. The content analysis method has also been employed to analyse the information gathered from two major Newspapers (The Telegraphs and *Uttarbanga Sambad*) for the period of 2000-01 to 2016-17 which helped the author to analyse and validate the institutional data on Human-Animal Relationship collected from divisional wildlife offices in the study area. The Animal census report's data, institutional data of HAI and information from media reports helped the researcher to locate the hotspot zone/places of Human-Animal interactions in Dooars. The FGDs and interviews were carried out in those hotspot zone/places of HAI to comprehend the existing circumstances and how people has been dealing with such difficulties in the study area.

3. ***To evaluate land use change and its impact on Human-Animal Relationship.***	The changes in spatio-temporal land use pattern in the Dooars region over the space and time has been identified with the help of district-wise and block-wise land use changes, block/range wise events of Human-Animal Interactions and base map interpretation in the study area. Regarding the forest cover and land use change, the Cartographic techniques have been used to show the changes in land use in the study area and superimpose the data of Human-Animal Relationship, such as the occurrence of Human death/injured, Animal death/injured due to Human-Wildlife Interactions, hut damage and crop damages due to the depredations of wild animals. The calculation of frequencies of those events has been done and mapped (with the help of Arc GIS 10.2.2) to understand the impact of land use change on Human-Animal Relationship in the study area. The mapping and identification of Human-Animal interaction events in the Dooars have also done to locate the blocks/regions where the frequency of such events are very high and increasing day by day. The Land use and Human-Animal Interfaces data have been supplemented by the primary surveys FGDs and interviews, through which the author has been authenticated the people's perceptions, ongoing circumstances and existing Government policies related to wildlife protection, which has helped the author to establish a relationship between the impacts of the land use change on Human-Animal Relationship (HAR) in Dooars. Finally, the author came up with a summary of findings and conclusions as well as suggested different measures to minimise deterioration of Human-Animal Relationship or the better ways of wildlife management in Dooars.

1.6 Locational Attributes of the Study Area

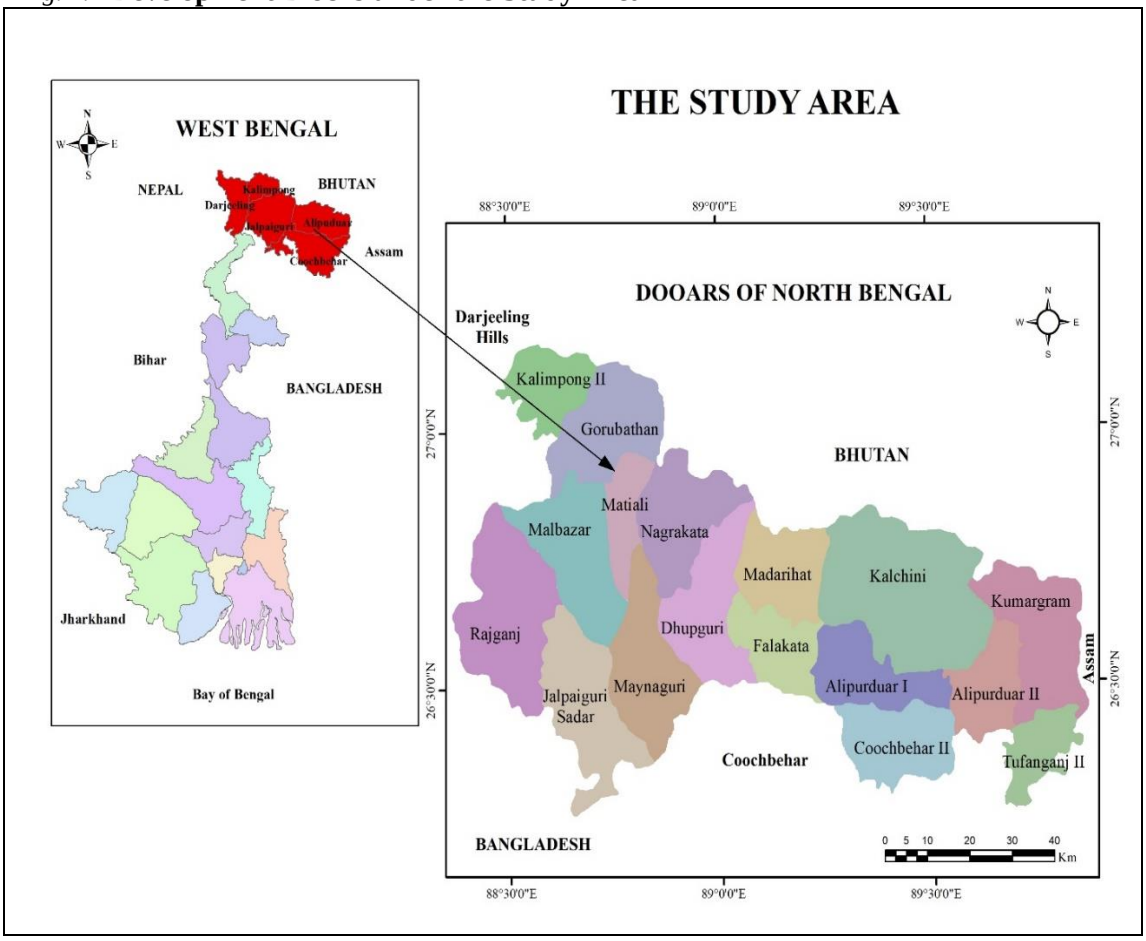
The 'Dooars' was originally a strip land situated at the foot of the Himalaya and to the east of the river Teesta which was annexed from Bhutan to British India in 1865. The word 'Dooars' implies 'Doors' or 'Passes' into Bhutan and there are 18 such passes, through which the Bhutanese people can communicate with the people living in the plains of India. After the annexation of Dooars, it was divided into two parts viz.,

the Eastern Dooars and Western Dooars of which the former now forms a part of Goalpara in Assam while the Western Dooars came to be known as the present day Dooars. Initially, the Western Dooars was divided into three tehsils viz., the Sadar, the Buxa and the Dalinkot. Later, the Dalinkot tehsil was transferred to Darjeeling district while the Titaliya sub-division of Rangpur (now in Bangladesh) was united to the Western Dooars to take shape as Jalpaiguri district in the year 1869 (Techno-economic survey of Dooars tea industry, 1995, p-3)

Table 1.1 **Development blocks under study area**

Name of the Districts	Name of the Blocks under the districts
Jalpaiguri includes newly formed district of Alipurduar	Mal, Matiali, Nagrakata, Maynaguri, Madarihat, Falakata, Kalchini, Kumargram, Alipurduar I, Alipurduar II, Dhupguri and Jalpaiguri Sadar
Coochbehar	Coochbehar II and Tufanganj II
Darjeeling includes newly formed district of Kalimpong	Gorubathan and Kalimpong II

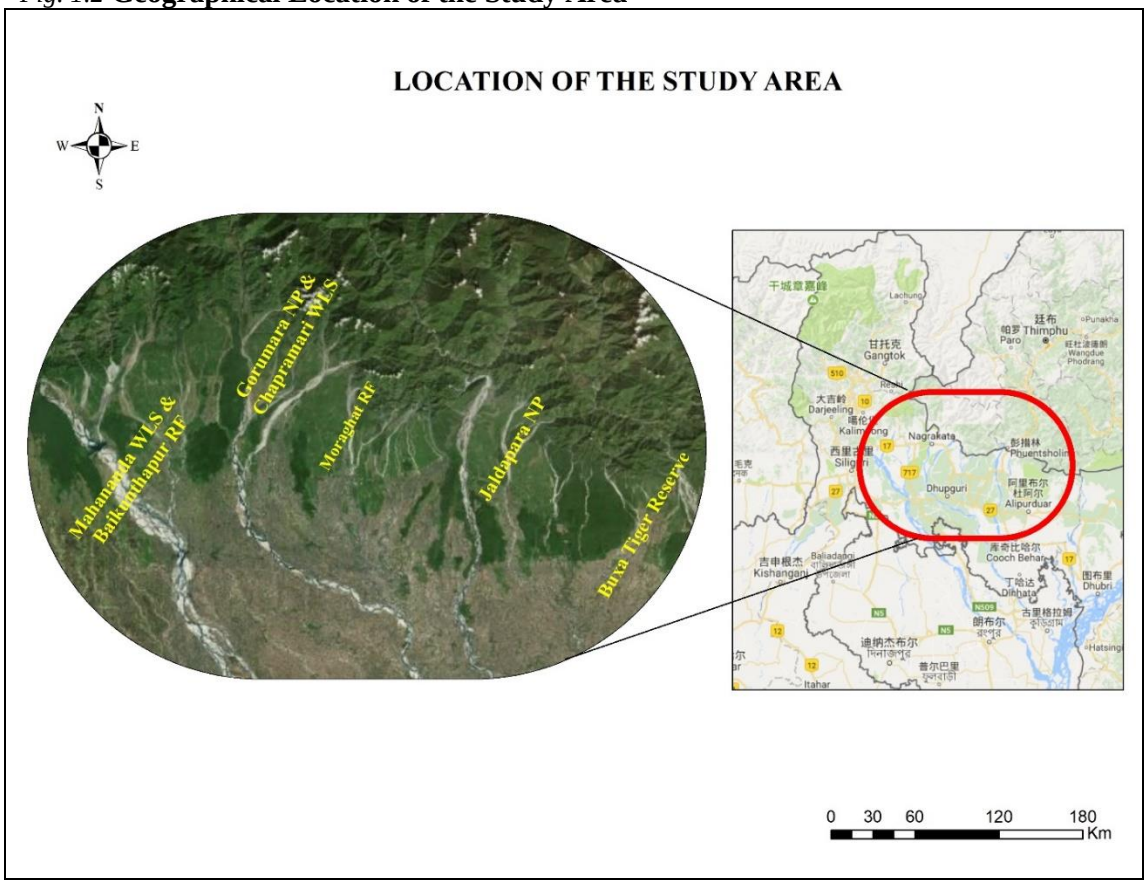
Fig. 1.1 **Development Blocks under the Study Area**



Source: Prepared by Researcher. March, 2017.

The Dooars are the floodplains and foothills of the eastern Himalayas in North-East India around Bhutan. This region is divided by the Sankosh River into the Eastern and the Western Dooars, consisting of an area of 8,800 sq. km. (3,400 sq. mi). The Western Dooars is known as the Bengal Dooars and the Eastern Dooars as the Assam Dooars. Bengal Dooars is a part of the lower Ganga plain, which lies in the northern districts of West Bengal. Dooars is further subdivided into (i) the Western or Siliguri Dooars, (ii) the Central or Jalpaiguri Dooars and (iii) the Eastern or Alipurduar (Singh, 1999).

Fig. 1.2 **Geographical Location of the Study Area**



Source: Prepared by Researcher from Google base map server, Arc GIS 10.2.2. March, 2017.

Unassorted materials and older alluvium (lateritic) constitute the surface of the North Bengal plain. The swiftly flowing Himalayan streams, the Mahananda, the Teesta, the Sankosh and the Jaldhaka drain the region with frequent shifts in their channels, the Teesta and Mahananda being more notorious. The region gets heavy

rainfall throughout the year as its close proximity to Himalaya which results in the growths of dense forest in this region.

Though the interaction of human and nature is relatively older here than any other parts of the Lower Ganga Plain, it could not sustain its supremacy probably owing to its relative isolation and such still exhibits the lowest density of population with overwhelming rural population and the primary sector economic base still dominates (*ibid*).

The entire study has been conducted in the Dooars of North Bengal which covers parts of the districts of Jalpaiguri, Coochbehar and Darjeeling. The newly formed Alipurduar and Kalimpong districts are taken as a part of Jalpaiguri and Darjeeling districts respectively, as separate data are not available. The study area covers 3 wildlife sanctuaries, 4 national parks and 2 reserve forest of the region (See table no.1.2).

Table 1.2 **Protected Forests Areas in Dooars** **(Sq. Km)**

Protected area	District	Biogeographic zone	Area
Wild Life Sanctuaries			
Mahananda WLS	Darjeeling	7B	158.04
Chapramari WLS	Jalpaiguri	7B	9.60
Buxa WLS	Alipurduar	7B	267.92*
National Parks			
Neora Valley NP	Darjeeling	7B	88.00
Buxa NP	Alipurduar	7B	117.10
Gorumara NP	Jalpaiguri	7B	79.45
Jaldapara NP	Alipurduar and Coochbehar	7B	216.5
Reserves			
Buxa Tiger Reserve	Alipurduar	7B	370.29
Eastern Dooars Elephant Reserve	Alipurduar	7B	977.51

Note: NP (National Park), WLS (Wildlife Sanctuaries). (*) indicates old Sanctuary area was 368.99 sq. km. out of which 101.07 Sq. Km. is included in Buxa NP. Biogeographic Zone notified in SFR 2011-12

Source: Computed from State Forest Report of West Bengal (2011-12). Govt. of India.

Table 1.3 **District wise Area under Forests by Legal Status in Dooars (Sq. Km)**

Forest Cover	**Districts**			**West Bengal**	**India**
	Jalpaiguri	Darjeeling	Coochbehar		
Reserve Forest	1483 (23.81%)	1115 (35.54%)	_	7054 (7.94%)	423311 (12.87%)
Protected Forest	217 (3.84%)	_	42 (1.24%)	3772 (4.25%)	217245 (3.89%)
Unclassified State Forest	90 (1.44%)	89 (2.82%)	15 (0.44%)	1053 (1.18%)	127881 (3.89%)
Total Forest Area Recorded	1790 (28.75%)	1204 (38.25%)	57 (1.68%)	11879 (13.38%)	768437 (23.38%)
Total Geographical Area	6227	3149	3387	88752	3287240

Note: Values in brackets are percentage of total forest area in particular districts.
Source: Computed from State Forest Report of West Bengal (2011-12). Govt. of India.

1.7 Organisation of the Study

Chapters	**Descriptions**
Chapter 1	Introduction, Review of Contextual Literature, Statement of the Problem, Objectives, Sources of Data and Methodology, Study Area and Organisation of the study, Limitations of the study.
Chapter 2	**Land use in Dooars**
Chapter 3	**Forest Cover change in Dooars**
Chapter 4	**Chronology of Human-Animal Relationship in Dooars**
Chapter 5	**Land use change and its impact on Human-Animal Relationship**
Chapter 6	**Summary of Findings and Recommendations**

1.8 Limitations of the Study

Some of the information were inaccessible in government departments/agencies because they are either restricted to public use or the data is yet to be published. As such, researcher could not access the land use data during British India as well data related to Human-Animal Relationship in Dooars of North Bengal prior to the period of 1980s. Therefore, the literature-based analysis has been the main source of Land use analysis during British India. However, in the post-independence period, the block wise land use data are available only for the period of 2000-01 to 2015-16. Therefore, the

district wise data (Jalpaiguri, Coochbehar and Darjeeling) has been analysed for the time period of 1960-2000 due to the lack of block-wise land use data of the study area.

The remote sensing data has been used for showing forest cover change in Dooars which has certain limitations. The resolution of LISS-III image is 23.5 m. therefore, the linear strip of forest cover and other low dense forests and young plantations and tree species with low chlorophyll are very difficult to identify. Considerable ground reality has been obscured by clouds and shadows. Such areas are very difficult to classify without the help of extensive field survey. The close proximity of tea plantation area near to the forest causing mixing with signature of forest and tea plantation areas in Dooars and which makes precise forest delineation very difficult.

The strategic location of the study area and strict forest rules and regulations are the other constraints which have been faced by the researcher during the field study as well as during the collection of secondary data.

Chapter- 2

Land use in Dooars

According to Lillesand and Kiefer (1987); the term 'Land use' relates to the human activities associated with a specific piece of land, features present on the earth surface. Land utilization research can be described as leading to problem situations in which people in a given locality are in the process of transformation from activities with the certain land requirement. The study of land use get special attention and flourished after the great works of Stamp L.D of Great Britain and Baker of America. Land use survey was first introduced in Britain by Stamp with his masterpiece work 'The land use of Britain- Its use and Misuse'.

Jainendra Kumar (1986); defined land use as, the surface utilization of all developed and vacant land on a specific point, at a given time and space. In short land use is the use made of the land by man, as surveyed and mapped in series of recognized categories.

Chowdaian (2001) explained that land use and land utilization is not one and the same. Land use is the use actually made of any parcel of land, house, industrial location etc. are land use categories, whereas term residential, industrial, agricultural, refers to land utilization and it mainly deals with the problems related to society and the region as a whole, land utilization is therefore dynamic concept since it undergoes certain changes due to change in socio-economic conditions, needs and with the adoption of innovation. Therefore, the study of land use is a subject of continuous interest.

Land use is any kind of permanent or cyclic human intervention on the environment to satisfy human needs and the land use capability or land suitability is the potential capability of given tract and to support different types of land utilization under

given cultural and socioeconomic conditions (Vink, 1975). Land use of an area is the index of the natural environment. Besides, land utilization pattern of an area indicates efficiency by which scarce natural resources are being utilized (Lal, 2009). The land is a gift given by nature to the mankind hence it is the basic resource of human society. Land use is the surface utilization of all developed and vacant land on a specific point at a given time and space. This leads one back to the village farm and the farmer to the fields, garden pastures, fallow lands and forests and to the isolated farm steam (Freeman, 1968).

The study of land use in its spatial context is essential to understand the area of optimum land use and degraded areas, the comprehensive study of land use is of immense value to ensure better returns from the land to meet future requirements for food, and industrial raw materials and for successful planning of agricultural growth, organized urbanization, regional development and thereby to accelerate the process of development in the country. It is also useful for planners to evolutes the possibilities and limitations of further spatial development to avoid or restrict undesirable trends of land exploitation to adjust the forms of land use to the land capability and to direct the expansion of intensive land utilization into suitable areas (Rao and Vaidyanathan, 1990).

The study of land use is important not only in agriculturally dominated, overpopulated developing regions but throughout the world because of its relationship with different human phenomena. Its importance also increased the population pressure and decreasing man and land ratio, increasing demand for food and raw materials the need for optimum utilization of land in an integrated manner has assumed greater relevance. Therefore, scientific regional, intensive and proper use of every parcel of land has become essential. Lands' planning on a micro level, based on land use surveys

is the first step in putting our lands to the maximum use. The nature and intensity of land use are closely related to the technology adopted by man. Extension of agricultural land with the help of technology may cause considerable changes in land use. Geography deals with the spatial relationship between these aspects and planning. This is because land use changes to meet available demands of the land by the society in its new ways and conditions of life. The demands for new uses of land may be inspired by a technological change or by a change in the size composition and requirements of a community. Some changes are short linked whereas other presents a more constant (Jackson, 1963).

The land is one of the prime natural resources and its management is also a prime concern to sustain the quality environment. Land use change is a major issue of global environmental change. It is believed that the aggressive human activity might have an influence on the land use patterns and result in a possible impact on the environment. Land use change is the modification in the purpose and usage of the land, which is not necessarily the only change in land cover but it also includes changes in intensity and management (Rao, 2014). In India, several geographers, like shaffi, Prakash Rao, Jasbir Singh and Mishra have paid attention to different aspects of land use studies at regional, district and micro level.

The study of land use is one of the complex and dynamic. Classification of land use evolutes through a collaborative venture of scholars of different disciplines. Land use classifications are the systematic arrangement of land on the basis of certain similar characteristics mainly to identify and understand their fundamental utilities intelligently and effectively.

The land use pattern indicates the spatiotemporal sequence of an area under different uses. It also indicates that net available land for cultivation which is an important factor since it is the base for agricultural planning (Arsud, 2000).

There were fivefold categories of Land use during the first half of 19th century of British India. These are (i) Area under forests (ii) Area not available for cultivation (iii) Uncultivated lands excluding current fallows (iv) Area under current fallows and (v) Net sown. This fivefold category of land use was followed in India till 1950 (Tripathi and Prasad, 2009).

The first five-year plan (1951-56) gave thrust on the agricultural planning to strengthen the agriculture sector immediately after the independence as most of the population was depends upon the agricultural sectors (Ibid). Therefore, there was a need to relook the agricultural policy by revising the classification of land use in March of 1950. The new classification of land use has adopted nine-fold classification, which are: (i) Forest area (ii) Area under non-agricultural use (iii) Barren and Uncultivable land (iv) Permanent pastures and other grazing land and (v) Area under miscellaneous trees and groves (vi) Culturable waste land (vii) Fallow and other than current fallow (viii) Current fallow and (ix) Net sown area.

Though the Planning commission and Census of India have classified land utilization in nine different categories, the present study these have been grouped into five major land use categories as the percentage of area under individual categories is relatively insignificant. On the basis of the statistical data abstracted from the sources referred to Dooars may be divided into five major land use categories. These are as follows:

Area under forest

Area Not available for cultivation

Area under non-agricultural use

Barren and Uncultivable land

Other uncultivable land excluding fallow land

Permanent pasture and other grazing land

Area under miscellaneous trees and grooves not included in net sown area

Culturable waste land

Fallow land

Fallow land other than current fallow

Current fallow

Net Sown area

2.1 Land use in Dooars during British India

In India, at the end of the age of the Mughals, there was disintegration in the communal land system. The socio-economic system of agrarian India at that time was the usual farmstead hereditary ownership on land. After the abolition of the patriarchal system, the land used to be managed by the joint families. But for economic inequalities, the family properties were replaced by the private peasant farmstead-hereditary farming and subsequently, it turned into private landed property. Before British conquest, the great Mughals appointed *zamindars* and *jagirdars* as their local agents and they were the Government tax collectors. But instead of collecting tax only, they went far beyond their official powers and managed to exploit the peasant community by increasing and introducing new taxes on the roads, water, marriage, pilgrimage, etc. (Ulyanovsky, 1985). Being a Government tax collector, the *zamindars* gradually became the possessor of various types of land viz., uncultivated land, agricultural land, pasture land, forest land etc. and finally became the landowners of a particular area. So, the state land ownership of the great Mughals began to be replaced by the feudal property of the *zamindars.*

After the establishment of colonial rule in India, the idea of landlords was adapted. The British policies were revolved around getting maximum revenue from the land without any consideration to the indegenious farmers. During the colonial era, the different land revenue system was implemented under the regime of different viceroys. The prime motive of the British to invade India was to exploits its resources under the mask of trade. The establishment of East India Company worked as the tool of colonial loot which operated through the monopoly of trade and implementation of land revenue. To replace the traditional Asiatic mode of production, the colonial land system of

British converted India into its landed estates and enhanced the process of commercial revolution in India (Marx, 1960).

To consolidate political power, the British East India Company inherited the institutional form of the agrarian land system from the Mughals. They superimposed a system over the existing land settlement pattern in tune with British customs and laws relating to land. Accordingly, government-sponsored cooperative movement through different land revenue experiments brought several changes in land tenure, property relation, agrarian productivity, food supply, marketing, agriculture indebtedness and cultivated land in British-India (Desai, 1948).

The auction-based land system which was prevailed in the early years of British had converted into three types of land system in India, i.e. *zamindari* system in Bengal, *rayatwari* system in Madras and Bombay and *mahalwari* system in the North-Western Provinces of India. The z*amindari* system prevailed in most of the parts of the undivided Bengal. The *mahalwari* tenure was introduced in a major portion of Uttar Pradesh, the Central Provinces, and Punjab (with some reformation) (Bandopadhaya, 2004, p-83).

2.1.1 Land System in Bengal during British India

The *Diwani* Right Acquisition in the year 1765 was one of the important incidents in India's history. After gaining full control over Bengal in 1765, the East India Company follows traditional land assessment system in the initial year but gradually reformed the existing land settlement from time to time to collect maximum possible land revenue which was the aim of colonial administration (Bandopadhayay, 2004).

As an experiment, the auction-based farming system was initially introduced in Bengal in the year 1772, where rights of the land revenue collection were allotted on a

contract basis to the local *zamindars.* Eventually, this farming system was developed into three major land settlements in India and the *zamindari* system in Bengal. The basic characteristic of the system was the attempt to integrate fundamentals of the former agrarian structure. The existing systems under the colonial policy produced widely different native results and hybrid forms (Dutt, 1963).

In British India, the Bengal (undivided Bengal) had an area of 82,277 Sq. miles. It was a densely populated province and according to 1931 census, it had a population of five million. Its population density was 646 per sq. mile, which was the highest in India. Due to the reign of feudal landlordism in the rural areas of Bengal, the subsistence farming was converted into commercial farming which was speeded by the industrial revolution in Britain. There was an unprecedented need of raw materials in Britain. Consequently, due to the investment of British industrial capital, subsistence farming of Bengal was transformed into commercial farming and act as a supplier of raw materials to Britain. Eventually, the mission of British to invade India was fulfilled. The poverty of Indian farmers started to aggravate due to the systematic overexploitation by the colonial ruler. The tenants were forced to introduce the cultivation of jute and indigo in their lands instead of the food crops. The farmers in Bengal forcefully started for the cultivation of cash crops instead of food crops. Due to the overexploitation socio-economic mistreatment and physical abuse, the peasant and agrarian movements started in Bengal. The *Neel Bidroha*, (Indigo movement) was the result of it (Powell, 1990).

Some legal measures were adopted by the colonial Government to weakening the agrarian movements in Bengal as well as to ensuring the smooth flow of raw materials to meet the needs of the newly setup industries in Britain. In 1769, some supervisors were appointed to land survey and review the existing policies as well as to

inquire the real limits of estates held by the *'zamindars',* the quantity of land ought to have revenue-free, and the real rents which the actual cultivators ought to make against each estate. Many a time, the company officials were unable to find out the real reason, due to their limited knowledge base about Indian agriculture system. For sorting out the problems and removing difficulties, the Regulating Act, 1773 was passed in the British Parliament. The Act established the Governor-General and Council in Bengal. As a result, for the first time in Bengal, the 'collectors' were appointed instead of supervisors and their functions were to receive land revenue. But by this process, the existing *zamindars* were not displaced because revenue was collected through them only. To create burden over the native *zamindars* of Bengal some new regulations were passed by the British Parliament. The 'Decennial Settlement' or 'Ten years settlement' was one of them. As the Ten years Settlement with *zamindars, jaigirdars,* and *talukdars* etc. did not yield the desired outcome which was expected by the British, therefore, some commissions were appointed by the Colonial government for reformation the 'Land system of British India'. Finally by the proclamation of Lord Cornwallis the decennial settlement transformed into a 'Permanent Settlement' on 22nd March 1793 (*Ibid*).

The year 1793 was very significant in the history of Bengal's land system. The provision under 'Permanent Settlement' provides special powers to the *zamindars* in Bengal and they become the supreme authority of the British government to act as a tax collector directly from the farmers. The salient features of the Permanent Settlement in Bengal are as follows:

That the *zamindars* were settled with and as they were declared proprietors of the areas over which their revenue collection extended. That proprietary right, however, was a limited one; it was subject, on the one hand, to the payment of revenue to government and to liability to have the estate sold at once a failure to pay; and it was subject on the

other hand, to the just rights of the old and original cultivators of the soil, the *raiyats* (farmers), dependent, *talukdars* and others. The *zamindars* was accepted as the person to be settled with not as a matter of chance, but as one of deliberate policy, and on administrative grounds

The assessments fixed in the manner presently to be described were declared to be unalterable forever (Powell, 1990).

Under the Permanent Settlement, the *zamindars* were recognized as proprietors of the soil with rights of free hereditary succession, sale and mortgage, but subject to the loss of their property on failure to the revenue on a fixed date.

System restricted that the *zamindar* should safeguard the rights of their tenants by granting those parts or documents stating the area and rent of their respective holdings. The *talukdars* of Bengal were raised to the position of *zamindars* and allowed to pay fixed revenue directly to the government.

In Bengal, there was no survey and no record-of-rights, and no local native revenue establishment and the settlement was always with someone landlord or *zamindar*, never with a body of village sharers (village communities being unknown) (Powell, 1990. p-8).

The most disastrous land system was the *zamindari* system in Bengal than the others land system in India. The *zamindars* in Bengal gradually became aristocrat class as they were miss used the stipulated power given to them. The *zamindars* become the sole power to collect revenue from farmers under the British. They were the middlemen for collecting land revenue, taxes etc. but subsequently they became the owner of a large estate by dispossessing the ownership of marginal or poor farmers. Consequently, the *zamindars* become the owners of different types of land i.e. waste land, forest land and wetland etc.

The Permanently settled district of Bengal in 1793 was as follows:

In Burdwan Division: Burdwan, Bankura, Birbhum, Midnapore (Medinipur), Hughli and Howrah. In Presidency Division: 24-Pergunnahas, Calcutta, Nadia, Jessore, Khulna, Murshidabad. In Rajshahi Division: Dinajpur, Rajshahi, Rangpur, Bogra (Bagura). Dacca Division: Dacca, Faridpur, Bakiganj, Maimansing. Chittagong Division: Chittagong, Noacolly (Nawakhali), Tipperah (Tipra). The Districts which were temporarily settled- Darjeeling and parts of Jalpaiguri (Powell, 1990. p-54).

Though almost all classes of land in Bengal were settled under the act of Permanent Settlement, two classes of land were out of the coverage of the rule of Permanent Settlement and those were:-

Lands held by persons recognized as proprietors, but not under the Permanent Settlement law;

Lands which do not belong to proprietors i.e. in which no proprietary right other than that of government exist (Powell 1990, p-443).

According to the Report of 1882-83 on the 'Land system in Bengal, Bihar and Orissa', the waste land, *thanadari* land and conquered land were out of the regulation of Permanent Settlement and were temporarily settled with local *zamindars* by British to collect revenue from it. The interesting fact that there was no identical types settlement for such lands in Bengal, it varies in different parts of the Bengal. An example of such settlement is as follows:

Table 2.1 **Division and no. of estates fall under Permanent Settlement in colonial Bengal**

Division	District	Permanent Settlement	Temporary Settlement	Govt. estates
Burdwan	Burdwan	4838	30	141
	Bankura	890	-	19
	Birbhum	1001	1	1
	Mednapur	2696	29	224
	Howrah & Hooghly	3615	72	246

Source: Cited from B. H. Baden Powell, 'Land System of British India' p-470.

It can be easily observed from the above table that though most of the area under the different district of Bengal was permanently settled, some parts (especially the waste lands including the forest, barren and unculturable land) were not settled permanently. Some cases the government (colonial) was the owner of such lands.

Most of the waste lands were owned by the government and some of being settled with the *zamindars*. According to the preamble of the Regulation III of the 1828 Act- "commissioners have likewise from time to time been appointed under the orders of the government, to maintain and enforce the public rights in different districts in which extensive tracts of country, unowned and unoccupied at the time of the Permanent Settlement, are now liable to assessment or being still waste, belong to the state" (Powel, 1990. p-431)

In the Regulation III of 1828 mentioned about the waste land for the first time. On the other hand, the Regulation II of 1819 specially mentioned about the Sundarbans and nearby irregularly cultivated area as '*patitabadi taluks'* (barren land). Besides Sundarban, there were some waste lands in the northern parts of colonial Bengal. Waste Land Rules were found applicable in Jalpaiguri, Darjeeling and also in Chittagong (now in Bangladesh). Therefore, it can be easily said that the forests and waste lands in Dooars were under the supervision of colonial government and those lands were regulated under waste land rules. The waste land and scrub lands were cleared by the *zamindars* in Dooars to increase their revenue and size of the actually settled estate.

2.1.2 Land System in Dooars during British India

Prior to the British, the Dooars was inhabited by different tribes. The *Bodo, Mech, Garo, Koch, Toto, Rabha, Lepcha* etc. The demographic pattern of the Dooars began to experience a drastic change since the annexation of the area into British India after the second Anglo-Bhutan war in 1865. The Treaty of Sinchula forced Bhutanese

to leave the Dooars (Bengal Dooars including some parts of Bangladesh) and Kalimpong to British. The Assam Dooars had already been occupied by British in 1842. The Coochbehar and Baikanthapur were also conquered by the British and had subsidiary relations with them. The new areas having been annexed assisted the British to articulate their imperial economy in the Dooars leading to the introduction of commercialisation of agriculture (tea plantation) in the newly occupied fertile and marshy land covered by dense forests and scattered human habitations (De et al. 1981, p-204-205).

The British government wanted to exploit the rich natural resources (mostly forest) of the Dooars. Along with the commercial agricultural gains, revenue from forests and the opportunity to collect taxes from newly habitat people, who migrated and settled in Dooars as tea workers. The forests were owned by the government (under the regulation act of 1819 and 1828) and it was thought better to handover the tea estates to entrepreneurs or persons ready to cultivate tea in the Dooars and agricultural lands were given on rent to leaseholders (*zamindars* with medium size of estate) who were also became *jotedars* in course of time and some area of land were distributed revenue-free to persons who had rendered admirable service (who works as sepoy), especially military service, to the British government. But agricultural land which had already been under the hereditary occupation of the farmers were called as *raiyat* land and the occupants of such lands were given permanent right of occupancy, sale and transfer. Thus the land in Dooars may be subdivided into four categories, viz. a) Reserve forests, b) Tea estates on lease land, c) Lease land outside the tea gardens (mostly agricultural land) and d) *Raiyati* land under the hereditary right of the *raiyats* (Debnath, 2010, p-46).

There was different cadastral and general survey done in Dooars to have a clear perception of the available resources as large parts of the Dooars was covered by forest land. All the survey were done to assess the amount of the land could be kept reserved for forests, for tea estates, and for agricultural purposes. As most of the lands were declared as lease land, the volume of *jot* or *raiyati* lands got reduced. Some of the newly declared lease lands were again redistributed and those who received huge area of land become big *raiyats*. By the way, they become rich and powerful and they again sub-divided their lands into small plots to give away to intermediary landholders on deed called '*Pattani'* or '*Patta'*. Thus there was a new mini feudal type of land system was developed in Dooars (*ibid*, p-46).

B.C. Basu, Assistant Director of the Department of Land Records and Agriculture, Government of Bengal (Colonial), advised to the Director of the Department- "in its physical aspects, the Western Dooars, exclusively the hilly tract, may be distinguished into two belts of the country, running east and west parallel to the hills. The first of this stretch along the base of the hills and is popularly known as the Terai. It may be described as Sal forest, interspersed with a few Sisu, Khayer, Magnolias, Palas and various other fewer characteristics jungle trees.[1]"

He further stated that; "it is the lower belt of the country that we are agriculturally concerned. A quarter of a century ago, when the Dooars was annexed there must have been very little of regular cultivation, since, however a steady tide of immigration from the neighbouring districts of Rangpur and Coochbehar has set in…….The Western portion of the subdivision (Alipurduar) seems to be better cultivated, but, as we proceed eastward the quantity of cultivated land gets smaller and

[1] Revenue Department, P.V. Nov. 1895, No. 124 dated Calcutta the 28th September, 1889, West Bengal Achieves, Kolkata.

villages fewer and smaller in size. The census 1881 returned the density of the population of the Western Dooars at only 69 persons per square mile which were about one-tenth of the average density of population of the district of the Presidency Division"(*ibid*).

The Dooars of North Bengal falls under five district i.e. Jalpaiguri, Alipurduar, Coochbehar and some parts of Darjeeling and Kalimpong district. The Jalpaiguri (includes the newly form Alipurduar district) and Darjeeling district (includes newly form Kalimpong district) were temporarily settled during 1793 under the Permanent Settlement regime. In the second half of 18th century (1874), the revision of the waste land lease rules was published. The revised rule did not bring the probable returns, the waste land rule was wiped out in 1879 and the only rules prevails in Bengal to sales or lease the waste lands:

"Waste lands capable of being leased exist in the Sundarbans, the Western Dwars (present-day Dooars) of Jalpaiguri, Chittagong, the Hill Tracts of Chittagong in Palamau, in Lohardagga. and to a very small extent in Shahabad. The tea lease-rules for the Dwars of 1875 were at first extended to Palamau but were found inapplicable, and application for waste land there require to be dealt with on their own merits. For the other districts, there are different sets of rules. It may be observed that in the Sundarbans and Chittagong that the lease (waste land) was sold by auction. The Jalpaiguri district is rapidly increasing in prosperity; owing to the abundant rainfall and fertile soil, famines are unknown; there is great demand for labour, wages are high, and the people are well to do. In the two large *zamindari* estates rents are low, and though the *jots* have passed into the hands of middlemen, such as Marwari merchants and traders living in the Jalpaiguri town, the cultivators are not badly off. The demand for labour and the waste land still remaining in the district prevent the oppression of the

adhiar (sharecropper), for, if his employer does not treat him well, he can always take service under another employer or migrate into the Western Duars; between 1891 and 1901 the increase amounted to 38.5 percent. The rise of the tea industry has led to the introduction of numbers of coolies from Chotnagpur, the Santhal Parganas and Nepal, many of whom, after working for some years on the tea gardens, take up land and settle in the district. The fertile waste lands have attracted the people from neighbouring districts of Rangpur and Dinajpur and from the Coochbehar state. It is difficult to estimate to what extent the moneylender is succeeding in getting a hold on the land, but he has probably been more successful in the permanently settled portion of the district than in the government estates. In the Baikanthapur estates, many of the *jots* are held by middlemen, while in the Coochbehar *zamindari* nearly all the land were divided into *tehsils* for auction purpose. At the last settlement of the Western Duars, it was remarked the number of the resident *jotdars* was 21724 and non-resident *jotdars* was 1615 or less than 8 percent; it would be more interesting to know how many *jots* and how much land are held by absentees" (Grunning, 1911. p-127-128).

Table. 2.2 ***Jots* are passing into the hands of outsiders in Falakata Tehsil (1905) (in Acres)**

Class of People	Numbers of Jots	Area
Rajbansi	1638	58665.23
Muhammadan	1092	40739.47
Mech	381	7599.52
Jaldha	19	577.16
Garo	17	302.28
Santhal	2	24.52
Oraon	263	6182.99
Nepali	140	4990.49
Marwari	115	6551.13
Up-Countrymen	272	14097.20
Kabuli	14	381.41
Assamese	18	1132.65
European	7	1036.19
All others	136	5074.22
Total	4114	173523.46

Source**:** Cited from J.F. Grunning, the Gazetteer of Jalpaiguri District, 2008, p- 128.

There were two classes of lease-rules in Dooars:-

(a) Those for large capitalists wishing to grow special crops, like tea or cinchona.

(b) Those for small capitalists for ordinary cultivation (Powell, 1990. p-488).

The main characteristics of the first class as applicable for Jalpaiguri and Darjeeling published on 1878 are as follows:

"Declared forest-reserves and land having valuable timber in a compact block, lands in which other rights exist, lands lying within sixty feet from the centre of any public road, and lands expressly exempted by the government, are not to be granted. Each lot must be compact, and not contain more than 800 acres. Inquiry and survey at the expense of the applicant must ordinarily precede the grant of a lease. A preliminary five years' lease is granted rent-free for the first year, and at progressive rents for the rest of term. The rights conveyed are heritably transferable, provided that the whole lot is transferred, that clearance conditions are observed, that the transfer is registered, and a registration fee paid. The right of government to minerals and quarries, and to pay for valuable trees on the grant, and the right of the public to fisheries, and a right of way along the banks of navigable streams, are reserved, while provision is made for the construction and maintenance of proper boundary-marks, the presence of the Jesses himself or of a resident manager on the grant, and for acquisition by government of any land required for public purposes free of cost, expect by proportionate reduction in the rent and by the payment of the value of any improvements on the land taken up. If, after inspection during the term of the preliminary lease, 15 percent of the total area shall have been brought under cultivation and actually bears tea-plants, the laesses entitled to renewal for a ten of years, and to similar renewals in perpetuity, provided that government may fix the rent on certain specified conditions on each renewal; that the renewed lease be heritable and transferable in so far that only the whole may be

transferred, and that only with the consent of government; and that all the other conditions of the preliminary leasehold good. Failure to comply with any of the conditions renders the lessee liable to forfeit his lease; and failure to apply for a renewal before the expiration of his preliminary lease reduces him if he is allowed to continue, to the status of a tenant-at-will till other arrangements are made. Grantees can club or amalgamate their grants by transfers, duly registered, on payment of the prescribed fee" (Powell, 1991, p-484-488).

"The second class of rules for small capitalists, as applicable to the Dwars (Dooars), published on the 23rd June 1879, correspond in the main with the rules for the grant of leases for tea-cultivation. The differences are briefly these: Ordinarily, the lot must not be less than ten acres or contain more than 200 acres. The survey fee is to be three annas an acre, and no further sum will be demanded nor any refund made, while in the case of tea leases the fee is fixed at one rupee an acre and the applicant is entitled to a refund of any surplus, or, if the expenses exceed the deposit, has to make good the deficiency. Renewal of the preliminary lease is conditional on one-half of the total area held been occupied by homesteads, or cultivated or left fallow, according to good husbandry, or otherwise fairly turned to account for agricultural purposes. The periods of renewals are to be conterminous with the period of Settlement of the district, current at the time of renewal. Sub-infeudation in the first degree only is allowable. The sub-tenant is, however, to have from the lessee the same promise of renewal as the lessee himself has from the government, and the sub-tenants rent is to be determined by the Deputy Commissioner. Rates of rent on the renewal of lease have been fixed both in the case of tea-leases and of leases of arable lands. Where half the area of the grant of the arable land has not been brought under cultivation, the renewed lease shall ordinarily include an area of waste land equal to the extent of land brought under

cultivation during the currency of the preliminary lease, but in such cases the Deputy Commissioner has the power, under certain restrictions, of refusing renewal altogether, or of allowing it on special conditions. Each description of land-tea, bastoo, rupit, etc. is charged at the rate fixed in the pergunnah where in it is situated. In the case of tea-leases in the hills of the Darjeeling district, an all round rate of one rupee an acre will be imposed on the renewal of the lease, subsequent to the expiration of the preliminary lease" (*Ibid*).

Mr W.O.A Bescket, Deputy Commissioner of Jalpaiguri carried out the first settlement under the British government in 1871. On a detailed measurement, classification of all cultivated and waste land in the possession of the *jotdars*, rates of revenues were fixed as follows:

Table 2.3 **Rent of different categories of land in Dooars**

Categories of Land	Rent per acre in Maynaguri			Rent per acre in rest of the Dooars		
	Rupee	Anna	Paisa	Rupee	Anna	Paisa
Homestead and *Rupit*	1	8	0	1	0	0
Faringati	0	12	0	0	8	0
Waste	0	1	6	0	1	6

Source**:** Cited from D.H.E. Sunder, Survey and Settlement of the Western Dooars in the District of Jalpaiguri, 1889-95, Calcutta, 1895, p-2.

There was an increase in the revenue rate of the land in Dooars and the newly settled amount in every case was more than the previous amount. Which was negetively impacted on the *raiyats* in Dooars. Therefore, the government ultimately decided to make a substitute settlement or resettlement of the most of the areas in Dooars, which includes Ambari-Falakata, Chengmari, North Maynaguri, Moraghat, Lakhipur, West Madari, Chakowakheti, Buxa Dooar, Bhatbari and Bhalka Dooar. Lord Ulick Brown, the Commissioner of the Rajshahi division was assigned with the task of the resettlement in Dooars. In order to come up with a solution of the revenue of different categories of land in Dooars, Brown recommended the South Maynaguri rates to introduced in Ambari-Falakata and Chengmari; and North Maynaguri rates of the

revenue to be introduced in Lakhipur and West Madari. The rest of the Dooars new rates of revenues as per different categories of land were reassessed and reintroduced (Grunning, 1911. p-115-117).

Table 2.4 **Rates of Land Revenue introduced by Ulick Brown**

Categories of Land	South maynaguri Rates			North Maynaguri Rates			Rest of the Dooars Rates		
	Rupee	Anna	Paisa	Rupee	Anna	Paisa	Rupee	Anna	Paisa
Basti	2	0	0	1	8	0	1	0	0
Bamboo	2	0	0	1	8	0	1	0	0
Rupit	1	8	0	1	8	0	1	0	0
Doba	1	8	0	1	8	0	1	0	0
Faringati	1	2	0	0	12	0	0	8	0
Waste	0	3	0	0	1	6	0	1	6

Note: Basti (Village), Rupit and Faringati (Low land), Doba (Pond).
Source**:** Cited from D.H.E. Sunder, Survey and Settlement of the Western Dooars in the District of Jalpaiguri, 1889-95, Calcutta, 1895, p-42.

Though the Revenue Board of the government of Bengal seemingly accepted the recommendation of Brown (1878-79), the Board again sought some changes in revenue, by which they can earn more revenue. The modified rates of Brown's settlement were as follows:

Table 2.5 **Modified rates of U. Brown's revenue settlement**

Categories of Land	Ambari-Falakata, Chengmari, N. Maynaguri and Moraghat			Lakhipur and West Madari			East Madari, Chokowakheti and Bhalka Dooar		
	Rupee	Anna	Paisa	Rupee	Anna	Paisa	Rupee	Anna	Paisa
Basti	2	0	0	1	12	0	1	8	0
Bamboo	2	0	0	1	12	0	1	8	0
Garden	2	0		1	12	0	1	8	0
Rupit	1	8	0	1	12	0	1	2	0
Doba	1	0	0	1	4	0	1	8	0
Faringati	1	2	0	0	12	0	0	9	0
Waste	0	3	0	0	3	6	0	3	6

Note: Basti (Village), Doba (Pond), Rupit and Faringati (low land or wet land).
Source**:** Cited from D.H.E. Sunder, Survey and Settlement of the Western Dooars in the District of Jalpaiguri, 1889-95, Calcutta, 1895, p-42.

With the new land settlement, the Brown's settlement was dismissed in 1890. The new settlement was known as Sunder's settlement. The Sunder's settlement was accomplished in 1889-95 in four tehsils namely Maynaguri, Falakata, Alpurduar and Bhalka of Western Dooars and in Ambari-Falakata in eastern Dooars. The Sunder's

settlement expired in 1908. The report of the Commissioner of Rajshahi division had revealed different land tenant in Dooars, which are as follows:

Table 2.6 **Tenants in Dooars (in Acres)**

Tenants	Number	Land
Jotdars	3440	217294
Chukanidars	4027	67673
Dar-Chukanidars	901	6661
Dar-dar chukanidars	44	291

Source**:** Cited from Sailen Debnath, The Dooars in Historical Transition, p-122.

To remove the loopholes and errors in the Brown's and Sunder's settlement, the new (the fourth settlement) settlement was enacted in 1907 under the supervision of Milligan. Milligan's settlement of land was carried out in Western Dooars, where the current leases were about to expire and it further stepped in the creation of new *jots* by way of further devolution of the previous *jots* and reclaiming waste land as arable land. As to the question of the classification of land an alteration was made from that of Sunder's. Sunder classified land into such categories as (1) Basti (homestead, garden, orchard and bamboo grooves), (2) *Rupit* or *Doba* (low land, Wetland), (3) *Faringati* (High land, waste land and market etc.). On the other hand, Milligan classified land as (see table 2.7). This was the first attempt of a detailed classification of land use in Dooars.

Table 2.7 **Classification of Land by Milligan**

Basti	*Dohla*		*Danga*		*Shohuri*		*Doba*	*Potit*	Unclassed land
	Dohla I	*Dohla II*	*Danga I*	*Danga II*	*Shohuri I*	*Shohuri II*			

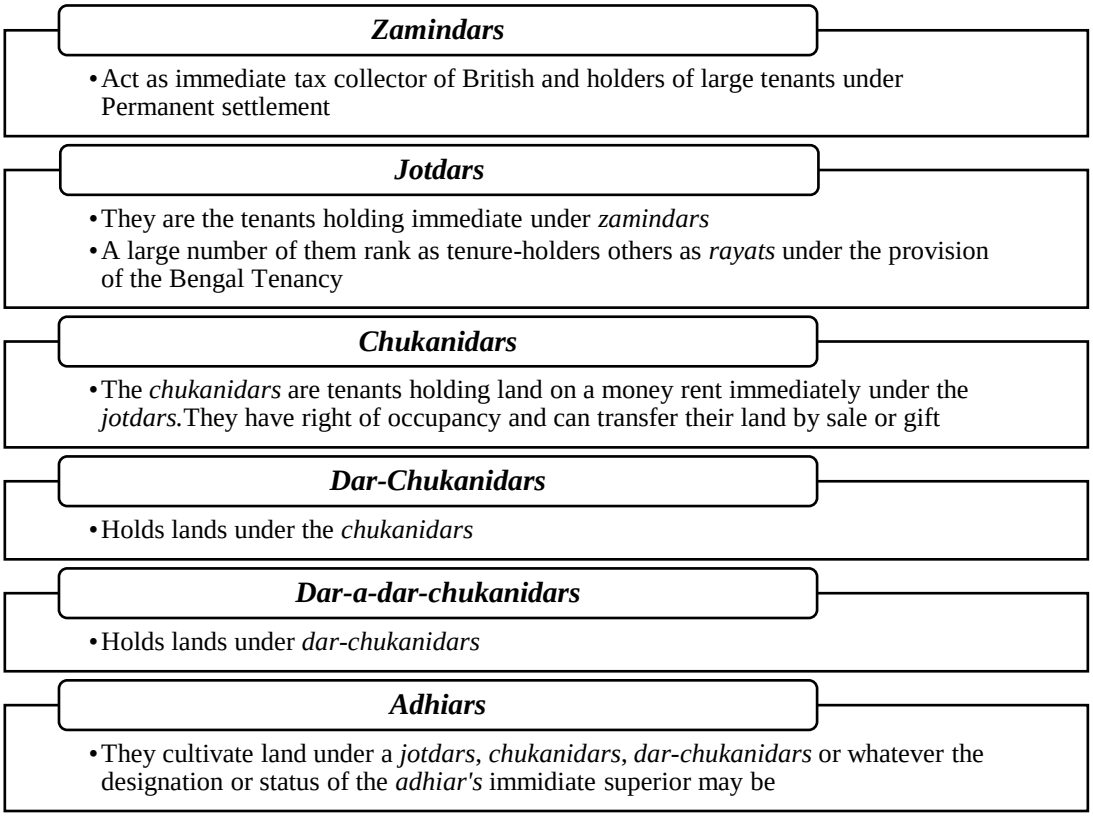
Note: *Dohla* (Wet land), *Danga* (Dry high land), *Shohuri* (Semi urban land), *Doba* (Pond) and *Potit* (Waste land)

Source**:** Cited from Sailen Debnath, The Dooars in Historical Transition, p-126.

From the above discussions, it can be clearly said that there was no uniform land settlement in Dooars during the initial periods of British. The two landmarks in the land system of Dooars were the waste land regulation of 1828 and introduction of plantation agriculture. It was the Milligan and Sunder who propounded a scientific land categorisation in Dooars for the first time. The land settlement in Dooars was very

complex in nature and most of the time the British ruler tried to exploit the natural resources by implementing different land settlement and regulation for revenue collection. The destruction process of the forest land and scrub land in Dooars were started in the early days of Permanent Settlement and under the waste land regulation, it diversified in numerous ways. The hierarchy of land system in Dooars summarized as follows:

Fig 2.1 **Hierarchy of Land system in Dooars during British India**



Source**:** Prepared by Researcher from J. F. Grunning. Eastern Bengal and Assam district gazetteers, Jalpaiguri. 1911, p-109-110.

2.1.2 a) The growth of Tea Plantation Area in Dooars

Most parts of the Dooars (Jalpaiguri and Darjeeling district) were sparsely populated, especially the northern part that shares boundary with Bhutan was covered with forests, jungles, bushes, and scrubs. These areas had been converted into plantation agriculture of tea estates by the British. On the other hand, the southern part of it was relatively dense populated (Xaxa, 1985). Warren Hastings was first to envisage in 1774

that the company would make enough money if tea could be cultivated in this area. Sir Joseph Banks, a renowned botanist had carried out series of plans in 1778 to introduce new crops in India including tea. Followed by Joseph, Robert Kyd was tried to plant tea in India, though it was unsuccessful, it showed a new light in Indian agriculture. The tea was planted in Calcutta in 1780, the tea bushes brought from China but the tea was not survived in Calcutta due to heat and unsuitable soil. By the time the Governor General of Bengal Lord William Bentinck had appointed a 'Tea Committee' in 1834 to explore the prospects of tea cultivation in India as a result 'The Tea Association of Bengal' came into existence in 1839 and it was followed by 'Assam Tea Company' in London (Ghosh, 1987. p-1).

Finally, Dooars was found suitable for tea cultivation and the reason behind the unprecedented success of tea cultivation in Dooars is suitable climate, soil and the availability of land since the government declared such jungle land as non-regulated in Dooars which were very easy to occupy for the tea cultivation. A huge amount of waste land and scrub land near the forest fringes in the Dooars was converted into the plantation. The rate of the lease was very low due to the plenty of lands and therefore, tea industry had been expanded with time (Grunning, 2008. p-103).

As a result of different incentives and attractive land tenure policies offered by the Britishers, the number of tea garden started to increase in Dooars. Grunning writes, "By 1881 the number of gardens had increased to 55 and the acreage under tea to 6230 or, in other words, the number of tea gardens had more than quadrupled and the area under tea cultivation had increased seven times in five years" (Grunning, 1911. p-108).

The land in Dooars was subdivided into three categories viz. a) Land for agricultural purposes which could be given on lease to willing *jotdars* and *chukanidars,* b) Land for reserve forest and c) Land for tea cultivation. According to the Calcutta

Gazette (2nd May 1894), tea garden entrepreneurs had to follow some procedures to get a lease of land. Under the lease rules, the land was granted on lease to any capable entrepreneurs. The main motives of the colonial government were to encourage people to invest more and more to accelerate the revenue collection and use of waste lands. (Roy, 2002. p-76).

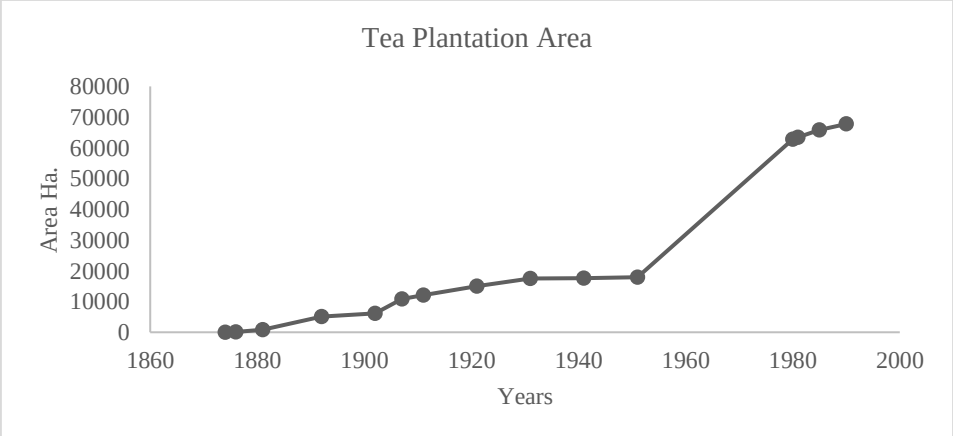
Table. 2.8 **Number of tea gardens in Dooars (1874-1990) (in Ha.)**

Years	Number of Gardens	Area under Tea	Percentage change in land under Tea
1874	1	-	-
1876	13	109	-
1881	55	831	662.39
1892	182	5144	519.01
1902	235	6187	20.28
1907	180	10845	75.29
1911	191	12114	11.70
1921	131	15025	24.03
1931	151	17476	16.31
1941	189	17569	0.53
1951*	158	17929	2.05
1980	-	62782	250.17
1981	-	63418	1.01
1982	-	65047	2.57
1983	-	65265	0.34
1984	-	65475	0.32
1985	-	65816	0.52
1986	-	66209	0.60
1987	-	66422	0.32
1988	-	67295	1.31
1989	-	67620	0.48
1990	-	67760	0.21

Note: Till the year 1951, the unit of the area was Acre. The Acres into Hectares by using 1 hectare = 2.5 Acres. Percentage change is calculated by Value in (Time2-Time1)/Time1)*100.

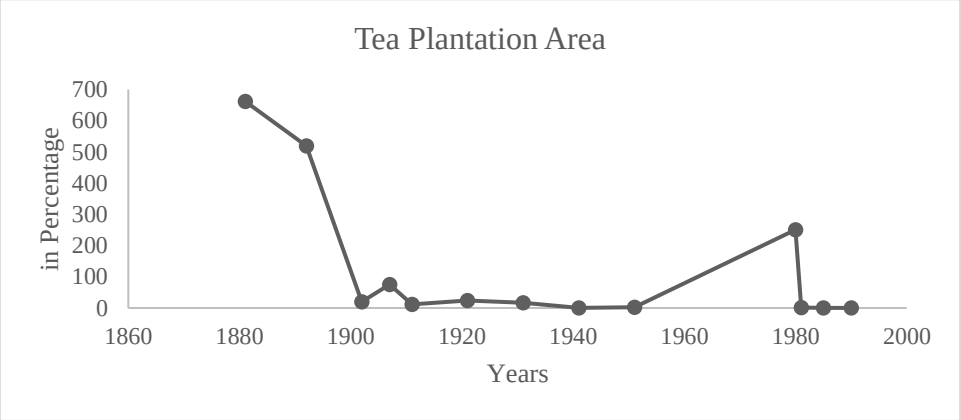
Source**:** Computed from J. F. Grunning, Gazetteer of the Jalpaiguri District, p-135 and Techno-Economic Survey of Dooars Tea Industry, p-4.

Fig 2.2 **Tea plantation area in Dooars (1870-1990)**



The fast pace of growth in tea cultivation recorded in the 1890s, 1901s and in 1980s. The number of tea gardens increased to 191 (15025 hectares) in 1911, which was only 55 in 1881. Though the number of tea gardens had decreased in subsequent years after 1911 (this was maybe for the partition of Bengal in 1911), in the post-independence period the number of tea garden and area under tea cultivation have been growing (see table no. 2.8).

Fig 2.3 **Growth Rate of Tea plantation area in Dooars (1870-1990)**



It is noted that after the 1990s, the small tea growers play a vital role in Dooars. Most of the marginal farmers converted their agricultural land into the small tea plantation in Dooars. The influence of British to the Indian planters has a long term impact as the Indians learnt a lot from the colonial planters in terms of management. In the expansion of tea gardens in the Dooars both the Europeans and the Indians contributed in their own ways, and consequently, an increasing trend in the tea plantation had found in Dooars.

Table 2.9 **Tea estates under Foreign and Indigenous control in Bengal**

Types of Owners	1921		1911	
	No	Percent	No	Percent
Companies with European Director	158	65.8	184	54.1
Companies with Indian Director	18	7.5	82	24.1
Companies with Mixed Board	-	-	11	3.3
Privately owned by Europeans	46	19.2	36	10.6
Privately owned by Indians	18	7.5	27	7.9
Total	240	100.0	340	100.0

Source**:** Cited from Xaxa, 'Colonialism capitalism and under development in North Bengal. p-1660.

As the number of tea gardens increased in the Dooars, the size of the tea estates becomes larger and larger. Due to the sparse habitation and lack of the labours, fast expansion of the tea gardens had not possible in the early years of tea cultivation in Dooars by the British. The forced migrated labourers from middle India by colonial ruler and in the post-independence periods, with the partition of Bengal, a huge influx of refugee settled in the particular region and accelerated the process of the tea expansion by clearing the forest land and waste land in the area. The most of the tea estates fall under the group of above 400 hectares which is more than 75 percent of the total tea estates in Dooars (table no 2.10).

Table 2.10 **Size wise distribution of tea estates in Dooars (1990) (in Ha.)**

Size Group	No. of Tea Estates	Area under Tea	Percentage
Upto 8.09	5	15	0.02
Above 8.09 to 50	5	96	0.15
Above 50 to 100	4	330	0.51
Above 100 to 200	13	2117	3.28
Above 200 to 400	47	13254	20.53
Above 400	83	48757	75.51
Total in all groups	157	64569	100.00

Source**:** Computed from Techno-Economic Survey of Dooars Tea Industry, p-5.

Considering the above discussion in can be said that the introduction and expansion of tea plantation leads a paradigm shift of land use in Dooars and it has further diversified with the following processes.

2.1.2 b) The Expansion and Land use under Railways in Dooars

The year 1873, railway tracks touched Siliguri from Sealdah via Haldibari. In the year 1990, Bengal Dooars Railway further connected line from the northern section of Sartahar to Siliguri passed through Haldibari. Bengal Dooars Railway train service from Lalmonirhat Junction to Madarihat in Dooars via Changrabandha. The Eastern Bengal railway extended the line from Lalmonirhat Junction (now in Bangladesh) to Amingaon via Gitaldaha Junction and Banarhat in Dooars.

The region has been well served by railway; the Eastern Bengal State Railway, the Bengal Dooars Railway, and the Coochbehar State Railway all pass through it (Grunning, 1911. p-147). The northern part of the Eastern Bengal Railway was called as Northern Bengal Railway and opened to traffic till Jalpaiguri and Siliguri in the year 1878.

A Brief History of Coochbehar State Railway (1870-1910)

1870: The idea of Railway in Coochbehar was envisaged by Maharaja Nipendra Narayan in his boyhood.

1883: Maharaja Sir Nependra Narayan took the initiative to lay rail line in his kingdom.

1891: Maharaja Nipendra Narayan passed an order for construction of railway lines from *Maharanee's* road to Gitaldaha.

1893: Two and a half feet narrow gauge line was commissioned for goods transportation.

1894: The passenger train services started. The main stations were Torsa, Dewanhat, Chowra hat, Gitaldaha and Gitaldaha hat, Fakirtakitya and Bhetaguri (added on the route in 1895-96)

1993: Railway track extended to Kholta.

1901: The Railway track extended to Jaintia Hills (Meghalaya). The total length of Coochbehar State Railway was 86km from Gitaldaha to Jaintia Hills.

1910: The Narrow gauge line was converted into Meter gauge. The total capital investment till 1900 was Rs. 1321638.

Source**:** J. F. Grunning, Gazetteer of the Jalpaiguri District, p-102 and *Biswa* Dooars *Utsab*, held in parade ground, Alipurduar, December, 2017.

The main aim of the construction of Bengal Dooars Railway was to assist in opening up the Western Dooars and the developing the tea industry as well as extraction of forest resources. The offshoots of this railway were Jalpaiguri to Dam-Dim, with a branch from Lataguri to Ramsaihat and it was proposed to extend later on eastwards across the Jaldhaka. The other branches of the Bengal Dooars Railway were Barnes Junction to Lalmonirhat (Now in Bangladesh); Dam-Dim to Bagrakot; *Mal to* Madarihat, and with a junction in Dhubri it was connected towards Lalmonirhat (*Ibid*, p-148).

The rapid destruction of forests in Dooars started with the construction of the Bengal Dooars Railway in the year 1878. The demand for transportation of the tea and timber was the main motives of the colonial government. Shubhajit Roy[2] stated that, "the railway demand would be large enough to exhaust the forest…….the North Bengal Railway will require large quantities from Darjeeling, Jalpaiguri and at present, the demand is much greater than that can be satisfied from forests". The forest in Dooars was destructed rapidly and out of the two divisions in Jalpaiguri district, in a division 108.4 miles of railroads were built.

The pace of railway expansion from 1349 km of track in 1860 to 51,658 km in 1910, resulted in a massive decline of the forests in India. The Governor-General in 1862 thus called for the establishment of a department that could ensure the sustained availability of wood (Gadgil and Guha, 1999).

Some idea can be obtained from the above table how forest destruction had taken place in Dooars. In 1878, 2776 green trees and 1932 dry trees chopped in a division to meet the division of sleepers of North Bengal State Railway. A massive area of forest cleared and brunt in the name of Railway construction. For example, 5900 acres of forests were burnt in Jalpaiguri district only in 1876-77 (Roy, 1997. p-74).

Table. 2.11 **Numbers of sleepers supplied from Buxa Division (1879 to 1882)**

Years	No of sleepers
1879	18449
1880	22683
1881	29865
1882	21602
Total	99599

Source**:** Computed from Shubhajit Roy 'Transformations on the Bengal Frontier: Jalpaiguri 1765-1948'. p-73.

Almost all the reserve and protected forests have had a history of destruction in the name of railway construction in Dooars. The destruction of virgin and dense forest

[2] Transformations on the Bengal Frontier: Jalpaiguri 1765-1948, p-73

land started during the early days of expansion of railway under the British colonial rule and it has not been stopped after the independence too. The meter gauge railway track has been renovated into broad gauge in the contemporary periods lead another destruction forest land and cut downed of biological corridors for the movement of wild animals in Dooars. The 74 km of NFR railway track has been identified as a killer tracks which leads deaths of several wildlife.

Table 2.12 **Railway Tracks Passage through protected areas in Dooars (in Km.)**

Railway track	Length
Buxa Tiger Reserve	18
Jaldapara NP	12
Jalpaiguri Division	6
Chapramari WLS	12
Kalimpong Division	8
Baikunthapur Division	6
Mahananda WLS	12
Total	74

Source: Computed from North East Frontier Railway, Alipurduar Division. July, 2017.

2.1.2 c) The Expansion and Land use under Roadways in Dooars

The main mode of transport in the area is roadways. Most of the places are well connected by roads. NH-31 is the main highway of the area. Asian Highway (AH-02) is also being constructed through the Dooars region.

Table 2.13 **Length of Forest Roads in different protected areas of Dooars (in Km)**

District	Division	Water bound Macadam	Blacktop Motorable	Others	Total
Alipurduar	BTR(E)	0	55	574	629
Alipurduar	BTR(W)	0	63	570	633
Coochbehar	Coochbehar	36	1	62.5	99.5
Coochbehar	Jaldapara NP	65	0	435	500
Kalimpong	Kalimpong	35	201	145	381
Darjeeling	Darjeeling WL	30	13.3	332	375.3
Jalpaiguri	Baikunthapur RF	0	0	205.03	205.03
Jalpaiguri	Gorumara NP	14	0	187.97	201.97
Jalpaiguri	Jalpaiguri	180	0	239.09	419.09
Dooars Total		360	333.3	2750.59	3443.89

Source: Computed from Annual Administrative Report- 2015-2016, Department of Forests, Govt. of West Bengal, p-297.

The major branches of road that pass through the different forest (protected and state forest) areas are; Lataguri-Matiali road, Ramsai-Sulkapara road, Sulkapara-

Thaijhora road, Nagrakata-Banarhat-Chamurchi road, Ramsai-Gairkata-Birpara-Dhupguri-Jalpaiguri road, Jalpaiguri-Ambari-Falakata-Siliguri road.

The traffic density is growing at a high pace annually. Some of this road network is being expanded through protected areas (table 2.13). Apart from fragmentation, roads are becoming a serious threat to wildlife, as several wild animals are killed on a daily basis by speeding vehicles. Vehicles today travel at high speeds and this combined with poor eyesight and slow response time of animals results in the death of innumerable wildlife in Dooars.

Commonly killed species includes nocturnal animals such as deer, snake. There have been several instances of elephant and other large mammals killed due to road accidents. Different types of reptiles, birds and amphibians are killed due to vehicular traffic in protected areas. In North Bengal, the NH31A and 37C are considered one of the killer roads in the region as it is a passage through the heartland of the protected areas like Jaldapara, Buxa and Chapramari.

2.1.2 d) The Growth of Township in Dooars and Land use

The introduction of tea cultivation creates a huge demand for labour in Dooars. The colonial ruler brought people from middle India (from tribal belt i.e. Jharkhand, Chhattisgarh and Madhya Pradesh is formerly known as Chhotanagpur and Santhal Parganas) to work as a tea labourer. The development of railways and roads with the tea market economy speeded up the growth of small-township and markets (*bazar*) in Dooars. These new small townships and markets were the nodal points to meeting the population of peasant and tea plantation sectors. Xaxa[3] said, 'The practice of settling down as cultivators/sharecroppers in the neighbouring subsistence sector by plantation labourers after completion of some length of service in the estate was a normal

[3] Virginious xaxa (1985). 'Colonial Capitalism and Underdevelopment in North Bengal'. p-1662

phenomenon in the tea districts of North Bengal. Once settled, they did not restrict their activity and mobility- exclusively to that sector'.

All these developmental activities led a kind of interactions in the sectors of plantation and subsistence economy and growing urban sectors in Dooars. The growth of small-township, local markets, subsistence agriculture within the plantation fringes had an ultimate pressure on the existing forest land in Dooars.

2.2 Land use in Dooars during the Post-Independence Period

After a long period of being colonised and ruined economic situation at the time of independence, India was looked for a universal land policy in the early years of the independent. The land use of any area is always influenced by the land-policy of that region. It has already been stated that the British land-policy were revolved around to the generation of maximum revenue from land. The British land policy was aimed at constructing the British industries economically sustainable. Though India got freedom, it was very difficult to assess the land resources in the initial years of independence. It was a very difficult task for India to frame or structure a uniform land policy for the nation (Powell, 1990).

In the year 1950, the constitution of India was finalised and enforced. According to the new constitution, India become a federal country. Three lists were prepared to vest the federal powers between centre and state viz. the central list (list-I), the state list (list-II) and the concurrent list (list-III). Due to the complexity and diversity of land resources, it was listed under concurrent list and the state governments were empowered to formulate land policies (Roy, 1997).

The year 1953 was the landmark year for the West Bengal government. In this year the Estate Acquisition Act was enacted by the legislative assembly of West Bengal. The main objective of this act was to abolish the permanent settlement regulation that

prevails during the colonial periods in West Bengal. The preamble of the Land Acquisition Act 1953, clearly stated that "An Act to provide for the state acquisition of estates of rights of intermediaries therein and certain rights of *raiyats* (peasants) and under *raiyats* and of the rights of certain other persons in lands comprised in estates". The act was enacted in all over the West Bengal, except the Calcutta municipal corporation.

The West Bengal Estate Acquisition Act 1953, clearly defined the rural land in two ways; a) Agricultural land and b) Non-Agricultural land. 'Agricultural land means land ordinarily used for purposes of agriculture or horticulture and includes such land, nonetheless that it may be lying fallow for the time being.' and 'non-agricultural land means land other than agricultural land or other than land comprised in a forest'.

The first two decades of left front government which came into power in the year 1977 were the worst for the agriculture sector in West Bengal. West Bengal adopted very complex land policies which were widely recognized to be the hindrances to the development of agriculture. The West Bengal continues to be a poor performing state in terms of agricultural outputs, until the end of the 1970s. The existing land system and land use policies had created a class of parasitic, non-cultivators landlords who seized rent from the real farmers who cultivated their lands. In particular, the system was associated with a high prevalence of sub-infeudation, with many layers of intermediaries between the actual cultivator and the landlords. Therefore, the needs of reformation of land use policies were utmost necessary (Bagchi, 2010).

To meet the need of a huge population, the government of West Bengal was thought of a new policy for land distribution. The influences of colonial *zamindari* system were created lots of socio-economic problems in the rural economy. Therefore, the government wanted to adopt a land policy where, a new system of land allocation

will be promulgated not with *Zamindars*, but with the farmers directly. As a result, the West Bengal Land Reform Act, 1955 came into existence.

The two main components of land reforms carried out in West Bengal by the left front government in West Bengal were tenancy reforms and the redistribution of land. The Govt. implemented *'Operation Barga'* by 1990, the names of 1.4 million sharecroppers were registered in the land records. The registration ensures tenure, prevented the eviction of tenants by non-cultivated landlords and made tenured contracts more transparent. By the process, the new production culture which was mostly influenced by the Marxism was taken place in the land use of the West Bengal (Bandopadhyaya, 1977). A large area of waste land and cultivable fallows were distributed to the landless people in the Dooars. The new land policy might bring good results for agriculture in West Bengal, it had several adverse effects on the environment.

2.2.1 Temporal Pattern of Land use in Dooars

The following categories of land use i.e. 1) Forest Area 2) Area Not Available for Cultivation (Area under non-agriculture, Barren and uncultivable land) 3) Other uncultivated land excluding fallow land (Permanent pasture & other grazing land, Area under miscellaneous trees & grooves, Culturable waste land) 4) Fallow land (Fallow land other than current fallow, Current fallow) and 5) Net area sown are discussed in below:

2.2.1 a) Land use in Jalpaiguri district (1960-2016)

The forest land includes the lands under forest as classed or administered by the legal enactment dealing with the forest at any administrative level. The forest area in Jalpaiguri district in 1960-61 was 27.20 percent (176300 hectares), with a significant decrease in 1965-66, it becomes 26.72 percent (164300 hectares). Though it was increased in 1970-71 and 1975-76 to 28.27 percent (174200 hectares) and 28.01 percent

(172560 hectares) respectively, it again decreased in 1981-82 to 27.92 percent (172050 hectares). The forest cover increased to 29.35 percent (179070 hectares) in the year 1990-91. After the year 1990-91, there has been a significant decrease in the forest area and it became 28.74 percent (179990 hectares) in 2001-02 and it remains almost same in the following years till 2015-16 (table no. 2.14).

There is a decreasing trend of land under not available for cultivation in Jalpaiguri district until the year 2004-05. Land under this category in Jalpaiguri district was 15.96 percent (98100 hectares) in the year 1960-61, it decreased to 15.69 percent (96500 hectares), 14.72 percent (90700 hectares), 13.26 percent (817100 hectares), 10.75 percent (669600 hectares) and 12.54 percent (806500 hectares) in the year 1965-66, 1970-71, 2001-02 and 2004-05 respectively. There was a significant increase in the land under not available for cultivation after the year 2004-05. The land under this category become 15.05 percent (936900 hectares) in 2015-16. There was very insignificant land under barren and uncultivated land in Jalpaiguri district and it is showing a decreasing trend. The information regarding the barren and uncultivable land is available only for the period of 2001-02 to 2015-16. In the year, 2001-02, the area under this category of land use was 0.77 percent (4800 hectares) which become only 0.41 percent in (2570 hectares) in 2004-05. With a slight increase in 2011-12, it becomes 0.50 percent (3120 hectares) which further decreased to 0.20 percent (1230 hectares) only. The steady decrease of barren and uncultivable land in Jalpaiguri district may help to the decrease in an area not available for cultivation and increase the land under agricultural uses.

The other uncultivated land excluding fallow land constitutes a very meagre percentage of land. The other uncultivated land excluding fallow land in Jalpaiguri district was 1.68 percent (10340 hectares) in 1970-71. It decreased in the following

years and become 0.96 percent (5950 hectares) in 2001-02, 0.79 percent (4900 hectares), 0.83 (5150 hectares) and 0.72 percent (4.480 hectares) in 2005-06, 2011-12 and 2015-16 respectively. In Jalpaiguri, among three different classes of land under this category, the miscellaneous trees and grooves shares 1.68 percent (9980 hectares) in 1970-71, which decreased in 2001-02 to 0.73 percent (4560 hectares) and further decreased in 2015-16 to 0.66 percent (4090 hectares). On the other hand, the Culturable waste land shares a very scanty percentage of land.

The fallow land in Jalpaiguri district was 1.80 percent, which was only (11100 hectares) to the total reporting area in 1960-61. It becomes 0.63 percent (3880 hectares) in the year 1970-71, 0.56 (34800 hectares) in 1980-81, 0.34 percent (2100 hectares) in 1990-91, 0.62 percent (38300 hectares) in 2001-02. After the year 2001-02, there was a significant increase in the fallow land. In 2004-05, it becomes 2.96 percent (18240 hectares), 1.56 percent (9700 hectares) in 2011-12 and 1.36 percent (84580 hectares) in 2015-16.

The net sown area in the Jalpaiguri district shows an uneven growth. In 1960-61 it was 47.07 percent (289500 hectares), it increased in the year 1975-76 and it becomes 49.33 percent (303400 hectares) in 1965-66, 53.87 percent (331900 hectares) in 1970-71 and 52.56 percent (3238600 hectares) in 1975-76. Whereas, in 1981-82 it decreased to 47.43 percent (2922100 hectares) and the decreasing trend remains same until the year 1990-91. With a significant increase in 2001-02, it becomes 58.92 percent (3669200 hectares) which the highest growth in net sown area. The growing trends remain the same and in the year 2011-12, it was 53. 80 percent (3449900 hectares) and in 2015-16 it was 54.13 percent (3370400 hectares).

Table 2.14 **Temporal Land use Pattern in Jalpaiguri (1960-61 to 2015-16)** **(Area in '000 hectares)**

Categories/Year	1960-61	1965-66	1970-71	1975-76	1981-82	1985-86	1990-91	1994-95	2001-02	2004-05	2011-12	2015-16
1. Forest Area	167.3	164.3	174.2	172.56	172.05	179	179.07	173.95	178.99	179	179	179
2. Area Not Available for Cultivation	98.1	96.5	90.7	81.71	-	-	-	-	66.96	80.65	93.83	93.69
a) Area under non-agriculture	98.1	96.5	90.7	81.71	-	-	-	-	62.16	78.08	90.71	92.46
b) Barren and uncultivable land	-	-	-	-	-	-	-	-	4.8	2.57	3.12	1.23
3. Other uncultivated land excluding fallow land	-	-	10.34	-	-	-	-	-	5.954	4.9	5.15	4.48
a) Permanent pasture & other grazing land	-	-	0.36	-	-	-	-	-	0.004	-	-	-
b) Area under miscellaneous trees & grooves	-	-	9.98	-	-	-	-	-	4.56	4.53	5.03	4.09
c) Culturable waste land	-	-	-	-	-	-	-	-	1.39	0.37	0.12	0.39
4. Fallow land	11.1	4.1	3.88	4.73	3.48	2.1	2.1	3.99	3.83	18.424	9.7	8.458
a) Fallow land other than current fallow	-	-	2.28	2.41	1.57	0.89	0.89	-	0.27	0.044	0.13	0.038
b) Current fallow	11.1	4.1	1.6	2.32	1.91	1.21	1.21	3.99	3.56	18.38	9.57	8.42
5. Net area sown	289.5	303.4	331.9	323.86	292.21	291.12	289.83	321.53	366.92	339.69	334.99	337.04
Total reporting area	615	615	616.1	616.12	616.12	610.02	610.02	610.02	622.7	622.7	622.7	622.7

Note: (-) indicates nil or insignificant value

Source: Compiled from District Statistical Handbook of Jalpaiguri and Institutional data collected from Directorate of Agriculture (Evaluation), Govt. of West Bengal. March, 2017.

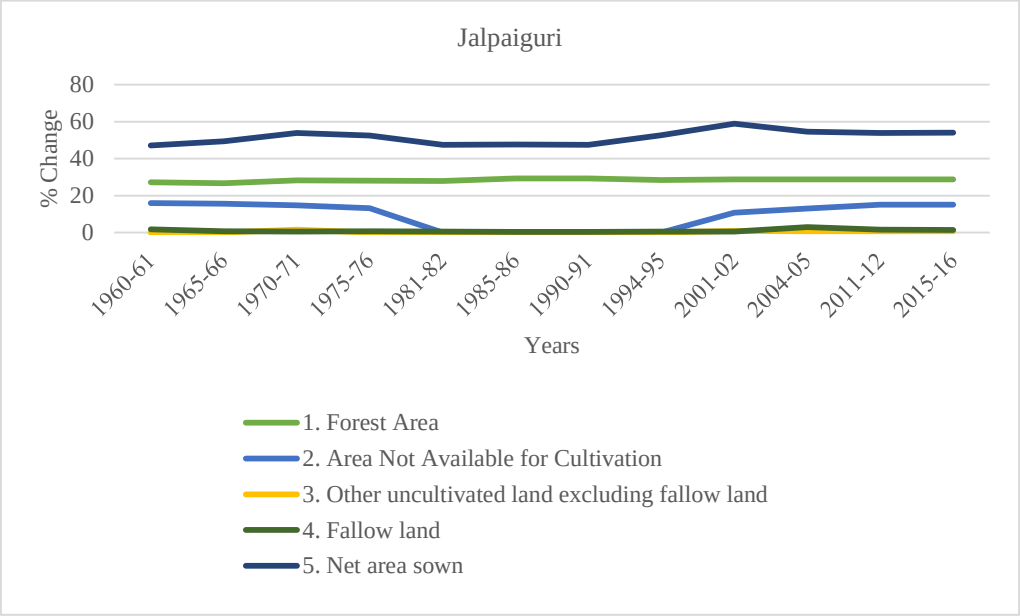
Table 2.15 **Temporal Variation of Land use Pattern in Jalpaiguri District (1960-61 to 2015-16)** **(Area in percentage)**

Categories/Year	1960-61	1965-66	1970-71	1975-76	1981-82	1985-86	1990-91	1994-95	2001-02	2004-05	2011-12	2015-16
1. Forest Area	27.20	26.72	28.27	28.01	27.92	29.34	29.35	28.52	28.74	28.75	28.75	28.75
2. Area Not Available for Cultivation	15.95	15.69	14.72	13.26	-	-	-	-	10.75	12.95	15.07	15.05
(a) Area under non-agriculture	15.95	15.69	14.72	13.26	-	-	-	-	9.98	12.54	14.57	14.85
(b) Barren and uncultivable land	-	-	-	-	-	-	-	-	0.77	0.41	0.50	0.20
3. Other uncultivated land excluding fallow land	-	-	1.68	-	-	-	-	-	0.96	0.79	0.83	0.72
(a) Permanent pasture & other grazing land	-	-	-	-	-	-	-	-	-	-	-	-
(b) Area under miscellaneous trees & grooves	-	-	1.62	-	-	-	-	-	0.73	0.73	0.81	0.66
(c) Culturable waste land	-	-	-	-	-	-	-	-	0.22	0.06	0.02	0.06
4. Fallow land	1.80	0.67	0.63	0.77	0.56	0.34	0.34	0.65	0.62	2.96	1.56	1.36
(a) Fallow land other than current fallow	0.00	0.00	0.37	0.39	0.25	0.15	0.15	0.00	0.04	0.01	0.02	0.01
(b) Current fallow	1.80	0.67	0.26	0.38	0.31	0.20	0.20	0.65	0.57	2.95	1.54	1.35
5. Net area sown	47.07	49.33	53.87	52.56	47.43	47.72	47.51	52.71	58.92	54.55	53.80	54.13
Total reporting area	**615.00**	**615.00**	**616.10**	**616.12**	**616.12**	**610.02**	**610.02**	**610.02**	**622.70**	**622.70**	**622.70**	**622.70**

Note: (-) indicates nil or insignificant value

Source: Calculated from table 2.14 and the Percentage figure of each category is calculated on total reporting area in the respective year.

Fig. 2.3 **Temporal Variations of Land use Pattern in Jalpaiguri district (1961-2016)**



2.2.1 b) Land use in Coochbehar district (1960-2016)

The area under forest in 1960-61 was 1.20 percent (4000 hectares) in Coochbehar district. There was a gradual but significant increase in forest area in Coochbehar district till the year 1994-95. After that, the area under forest has significantly decreased in Coochbehar district. From 1.20 percent (4000 hectares) in 1960-61 it has increased to 1.71 percent (5700 hectares) in 1970-71, but it was decreased to 0.95 percent (3150 hectares) in 2001-02. Again with a significant increase in forest area from 0.95 percent to 1.28 percent (4250 hectares) in 2004-05 and it remains same in the Coochbehar district until the year 2015-16.

In Coochbehar district, the land under non-agriculture use in 1960-61 was 13.72 percent (45700 hectares), which decreased to 11.19 percent (37300 hectares) and 11.22 percent (37400 hectares) in 1965-66 and 1970-71 respectively. The highest growth rate found in the year 1975-76 and the area under this category become 15.86 percent (541400 hectares). It decreased in the year 195-86 to 14.14 percent (48300 hectares). In the year 1990-91 and 2001-02, the area under not available for cultivation was 14.14 percent (47100 hectares), 13.89 percent (471900 hectares). In 2004-05, 2011-12 and

2015-16 it becomes 18.80 percent (623200 hectares), 18.81 percent (623600 hectares) and 19.34 percent (641100 hectares) respectively. There was very insignificant land under barren and uncultivable land in Coochbehar district. Only the year 2004-05 had 0.46 percent land under this category. Whereas, the land under barren and uncultivable land shows a very uneven growth in Coochbehar district. In 2001-02 the land under this category in Coochbehar was only 0.14 percent (460 hectares) which increased in 2004-05 to 0.46 percent (1540 hectares), but it becomes almost nil in the year 2015-16.

In Coochbehar district, the land under this category was only 0.29 percent (950 hectares), which has increased to 3.02 percent (1005 hectares) in 1970-71, 5.53 percent (18870 hectares) in 1975-76. After the year 1975-76, the land under this category was started to decrease significantly and they become 2.07 percent (6850 hectares) in 2001-02, 2.58 percent (8560 hectares) in 2005-06, 2.97 percent (9840 hectares) in 2011-12 and 2 percent (6635 hectares) in 2015-16. Though there was a meagre percent of land under permanent pastures and grazing land in Coochbehar during 1960-61 to 1975-76, it becomes nil due to the land reform or conversion of pastures to agricultural land in the later period. The district shares a good percentage of area under miscellaneous trees and grooves, which accounts 2.83 percent (9440 hectares) in 1970-71, 3.03 percent (10340 hectares) in 1975-76. It was decreased to 1.94 percent (6440 hectares) in 2001-02. It was again increased to 2.43 percent (8070 hectares) and 2.34 percent (7750 hectares) in 2004-05 and 2011-12 respectively, it becomes 1.94 percent (6940 hectares) by decreasing thereafter in 2015-16. The Culturable waste land has shown a distinct decrease in Coochbehar. The Culturable waste lad might have been converted into agricultural land due to the population growth and suitable climate which prevails in the district.

In Coochbehar district, the fallow land was 5.19 percent (17300 hectares) in 1960-61. It becomes only 0.83 percent (2750 hectares) in 1970-71 which was further decreased in 1980-81 to 0.27 percent (930 hectares), 0.13 percent (460 hectares). But in the year 2001-02, it increased to 1.25 percent (4130 hectares). It was again decreased in the year 2011-12 to 0.26 percent (847 hectares) and 0.24 percent (800 hectares) in 2015-16. The land under current fallow in the district is very insignificant. The highest percentages of current fallow found in the year 2001-02, i.e. 2.95 percent (3540 hectares) in 2015-16.

The Coochbehar district is also showing the same fashion growth in net sown area like the Jalpaiguri district. The net sown area in Coochbehar district was 72.96 percent (243100 hectares) and it was increased to 82.41 percent (247600 hectares) and 76.21 percent (276000 hectares) in 1965-66 and 1970-71 respectively. Again there was a decrease until the year of 1994-95. In 1994-95 it becomes 72.88 percent (248900 hectares). After this year, the net sown area has been increased. In 2001-02, 2004-05, 2011-12 and 2015-16 it was 81.55 percent (2700300 hectares), 76.57 percent (2538600 hectares), 76.66 percent (2541800 hectares) and 77.13 percent (2557400 hectares) respectively (see table no. 2.16)

Table 2.16 **Temporal Land use Pattern in Coochbehar (1960-61 to 2015-16)** **(Area in '000 hectares)**

Categories/Year	1960-61	1965-66	1970-71	1975-76	1981-82	1985-86	1990-91	1994-95	2001-02	2004-05	2011-12	2015-16
1. Forest Area	4	4.1	5.7	5.7	-	-	-	-	3.15	4.25	4.25	4.25
2. Area Not Available for Cultivation	45.7	37.3	37.4	54.14	-	48.3	47.1	-	47.19	62.32	62.36	64.11
a) Area under non-agriculture	45.7	37.3	37.4	54.14	-	48.3	47.1	-	46.73	60.78	62.16	64.11
b) Barren and uncultivable land	-	-	-	-	-	-	-	-	0.46	1.54	0.2	0
3. Other uncultivated land excluding fallow land	0.95	0.86	10.05	18.87	-	-	10.53	-	6.85	8.566	9.843	6.635
a) Permanent pasture & other grazing land	0.95	0.86	0.61	0.09	-	-	-	-	0.02	0.016	0.003	0.005
b) Area under miscellaneous trees & grooves	-	-	9.44	10.34	-	-	8.22	-	6.44	8.07	7.75	6.43
c) Culturable waste land	-	-	-	8.44	-	-	2.31	-	0.39	0.48	2.09	0.2
4. Fallow land	17.3	1.6	2.75	1.47	0.93	0.39	0.46	3.91	4.13	2.53	0.847	0.8
a) Fallow land other than current fallow	-	-	0.75	0.24	0.26	0.39	0.46	0.51	0.59	0.34	0.007	-
b) Current fallow	17.3	1.6	2	1.23	0.67	-	-	3.4	3.54	2.19	0.84	0.8
5. Net area sown	243.1	274.6	276	260.14	-	253.12	-	248.9	270.03	253.86	254.18	255.74
Total reporting area	333.2	333.2	333.2	341.35	0	341.5	-	341.5	331.13	331.56	331.56	331.56

Note: (-) indicates nil or insignificant value.

Source: Compiled from District Statistical Handbook of Coochbehar and Institutional data collected from Directorate of Agriculture (Evaluation), Govt. of West Bengal. March, 2017.

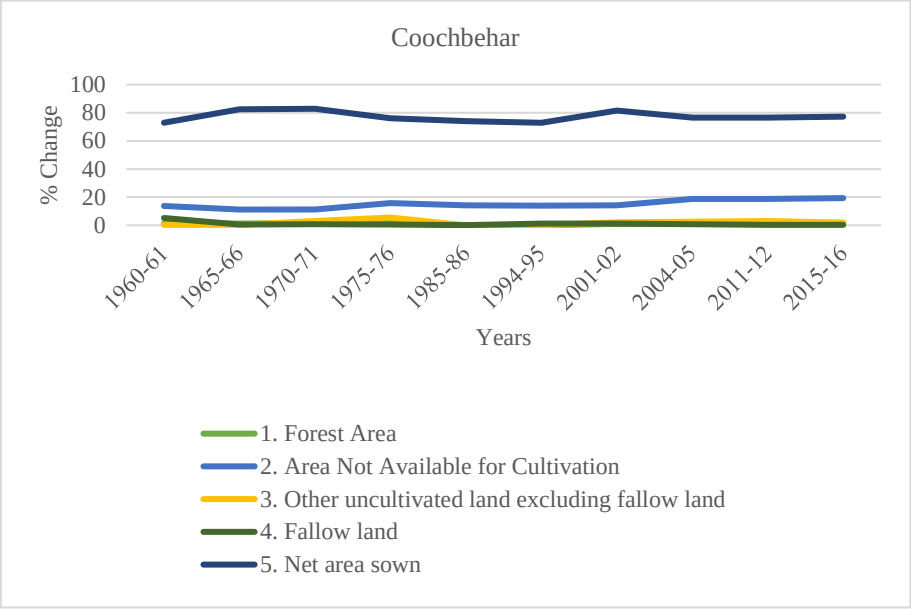
Table 2.17 **Temporal Variation of Land use Pattern in Coochbehar District (1960-61 to 2015-16)** **(Area in percentage)**

Categories/Year	1960-61	1965-66	1970-71	1975-76	1981-82	1985-86	1990-91	1994-95	2001-02	2004-05	2011-12	2015-16
1. Forest Area	1.20	1.23	1.71	1.67	-	-	2.12	2.58	0.95	1.28	1.28	1.28
2. Area Not Available for Cultivation	13.72	11.19	11.22	15.86	-	14.14	13.79	14.02	14.25	18.80	18.81	19.34
(a) Area under non-agriculture	13.72	11.19	11.22	15.86	-	14.14	13.79	-	14.11	18.33	18.75	19.34
(b) Barren and uncultivable land	-	-	-	-	-	-	-	-	0.14	0.46	0.06	-
3. Other uncultivated land excluding fallow land	0.29	0.26	3.02	5.53	-	-	3.08	-	2.07	2.58	2.97	2.00
(a) Permanent pasture & other grazing land	0.29	0.26	0.18	0.03	-	-	-	-	0.01	-	-	-
(b) Area under miscellaneous trees & grooves	-	-	2.83	3.03	-	-	2.41	-	1.94	2.43	2.34	1.94
(c) Culturable waste land	-	-	-	2.47	-	-	0.68	-	0.12	0.14	0.63	0.06
4. Fallow land	5.19	0.48	0.83	0.43	0.27	0.11	0.13	1.14	1.25	0.76	0.26	0.24
(a) Fallow land other than current fallow	-	-	0.23	0.07	0.08	0.11	0.13	0.15	0.18	0.10	-	-
(b) Current fallow	5.19	0.48	0.60	0.36	0.20	-	-	1.00	1.07	0.66	0.25	0.24
5. Net area sown	72.96	82.41	82.83	76.21	-	74.12	-	72.88	81.55	76.57	76.66	77.13
Total reporting area	333.2	333.2	333.2	341.35	-	341.35	341.35	341.5	331.56	331.56	331.56	331.56

Note: (-) indicates nil or insignificant value.

Source: Calculated from table 2.15 and the Percentage figure of each category is calculated on total reporting area in the respective year.

Fig. 2.4 **Temporal Variations of Land use Pattern in Coochbehar district (1961-2016)**



2.2.1 c) Land use in Darjeeling district (1960-2016)

There were no such significant changes in forest areas in Darjeeling district. The forest area in Darjeeling district in 1960-61 was 38.01 percent (118300 hectares), which was increased in 1965-66 to 38.11 percent (118400 hectares). The total reporting area of Darjeeling for the time periods of 1970-71 to 1985-86 was only 83.91 thousand hectares. There was no such survey during the period because of some political turmoil in Darjeeling. The forest area in 1988-89 was 38.55 percent (1245700 hectares) in Darjeeling district and the figure remains almost same as 38.28 percent (1245700 hectares) in the year 1994-95, 2001-02, 2004-05, 2011-12 and 2015-16.

The Darjeeling district is also showing a decreasing trend in land under not available for cultivation. The land not available for cultivation accounts for 23.46percent (72900 hectares) in 1960-61 which becomes 23.43 percent (72600 hectares) in 1965-66, 72.8 percent (72800 hectares) in 1970-71, 33.83 percent (338300 hectares) in 2001-02, 35.43 percent (354300 hectares) in 2005-06, 41.18 percent (411800 hectares) in 2011-12 and 43.56 (435600 hectares) in 2015-16. The growth of population and implementation of land reform policy may be the main reason behind

the decrease in the area under not available for cultivation in Darjeeling and Jalpaiguri district. A clear decrease in barren and uncultivable land found in Darjeeling district. In 2001-02 it was 1.57 percent (6670 hectares) which decreased in 2005-06 to 0.81 percent (2650 hectares) and in 2011-12 and 2015-16, it becomes only 0.79 percent (2570 hectares) and 0.77 percent (2550 hectares).

Whereas, the Darjeeling district is showing a decreasing trend. In Darjeeling the other uncultivated land excluding fallow land in 2001-02 was 2.05 percent (6670 hectares), it becomes 1.26 percent (4110 hectares) in 2004-05, 1.38 percent (4490 hectares) in 2011-12 and 1.55 percent (5030 hectares) in 2015-16. The area under permanent pastures and other grazing land in Darjeeling district were 0.37 percent (1990 hectares) in 2001-02 and decreased thereafter. In 2005-06 it decreased to 0.26 (860 hectares) and continuously decreased in the following years, and in 2015-16 it becomes only 016 percent (510 hectares). Darjeeling is well known for its livestock products and to sustain the industry, there is need to protect the pasture and grazing land in the district. On the other hand, land under miscellaneous trees and grooves, as well as culturable waste land, have sown a clear decline in their percentage share in the district. The area under miscellaneous trees and grooves in Darjeeling district was 1.15 percent (3740 hectares), which reached 0.81 percent (2630 hectares) in 2011-12 and 0.99 percent (3220 hectares) in 2015-16.

In Darjeeling district, the fallow land was only 1.48 percent (4600 hectares) in the year 1960-61 and it has been increased with the time. In 1970-71 it was increased to 1.54 percent (9700 hectares). Though there was a slight decrease in 1981-82 i.e. 0.88 percent (1290 hectares), in the year 1988-89 it increased to 4.90 percent (15430 hectares), 4.27 percent (13900 hectares) in 2001-02, 6.31 percent (205300 hectares) in 2011-12 and 5.35 percent (174200 hectares) in 2015-16.

On the other hand, Darjeeling district reveals a continuous increasing in the net sown area. In 1960-61 it was only 31.12 percent (98000 hectares), it increased to 54.33 percent (103200 hectares) in 1971-72 and was the highest growth in the net sown area (the reporting area in 1971-72 was only 96700 hectares). In the year 1988-89 the net sown area in Darjeeling district was increased to 41.62 percent (1310600 hectares) and it becomes 45 percent (1464500 hectares) following the same fashion of growth. With a little decrease in the year 2011-12 and 2015-16, it becomes 41.37 percent (1346500 hectares) and 41.43 percent (1348500 hectares) respectively (table no. 2.18).

Table 2.18 **Temporal Land use Pattern in Darjeeling (1960-61 to 2015-16)** **(Area in '000 hectares)**

Categories/Year	1960-61	1965-66	1970-71	1981-82	1985-86	1988-89	1994-95	2001-02	2004-05	2011-12	2015-16
1. Forest Area	118.3	118.4	118.4	22.6	22.66	124.57	124.57	124.57	124.57	124.57	124.57
2. Area Not Available for Cultivation	72.9	72.6	72.8	-	-	-	-	33.83	35.43	41.18	43.56
a) Area under non-agriculture	72.9	72.6	72.8	-	-	-	-	28.71	32.78	38.61	41.04
b) Barren and uncultivable land	-	-	-	-	-	-	-	5.12	2.65	2.57	2.52
3. Other uncultivated land excluding fallow land	-	-	-	-	-	-	-	6.67	4.11	4.49	5.03
a) Permanent pasture & other grazing land	-	-	-	-	-	-	-	1.19	0.86	0.56	0.51
b) Area under miscellaneous trees & grooves	-	-	-	-	-	-	-	3.74	1.85	2.63	3.22
c) Culturable waste land	-	-	-	-	-	-	-	1.74	1.4	1.3	1.3
4. Fallow land	4.6	2.61	9.7	1.29	0.74	15.43	13.97	13.9	17.47	20.53	17.42
a) Fallow land other than current fallow	0	0.91	1.7	0.91	0.6	5.38	4.2	4.43	3.48	3.17	2.52
b) Current fallow	4.6	1.7	8	0.38	0.14	10.05	9.77	9.47	13.99	17.36	14.9
5. Net area sown	98	103.2	96.7	45.59	37.88	131.06	145.83	146.45	143.86	134.65	134.85
Total reporting area	310.7	310.7	310.7	83.91	83.91	314.9	325.46	325.47	325.46	325.46	325.46

Note: (-) indicates nil or insignificant value

Source: Compiled from District Statistical Handbook of Darjeeling and Institutional data collected from Directorate of Agriculture (Evaluation), Govt. of West Bengal. March, 2017.

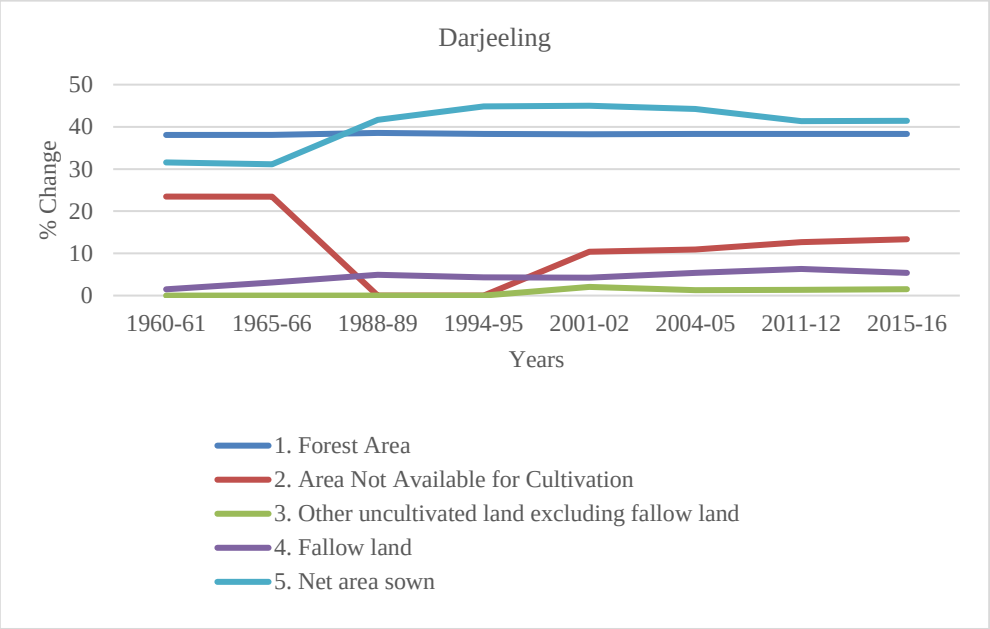
Table 2.19 **Temporal Variation of Land use Pattern in Darjeeling (1960-61 to 2015-16)** **(Area in percentage)**

Categories/Year	1960-61	1965-66	1970-71	1975-76	1981-82	1985-86	1988-89	1994-95	2001-02	2004-05	2011-12	2015-16
1. Forest Area	38.08	38.11	26.93	27.01	27.01	27.01	38.55	38.28	38.27	38.28	38.28	38.28
2. Area Not Available for Cultivation	23.46	23.43	-	-	-	-	-	-	10.39	10.89	12.65	13.38
a) Area under non-agriculture	23.46	23.43	-	-	-	-	-	-	8.82	10.07	11.86	12.61
b) Barren and uncultivable land	-	-	-	-	-	-	-	-	1.57	0.81	0.79	0.77
3. Other uncultivated land excluding fallow land	-	-	-	-	-	-	-	-	2.05	1.26	1.38	1.55
a) Permanent pasture & other grazing land	-	-	-	-	-	-	-	-	0.37	0.26	0.17	0.16
b) Area under miscellaneous trees & grooves	-	-	-	-	-	-	-	-	1.15	0.57	0.81	0.99
c) Culturable waste land	-	-	-	-	-	-	-	-	0.53	0.43	0.40	0.40
4. Fallow land	1.48	3.12	1.54	0.88	0.88	0.88	4.90	4.29	4.27	5.37	6.31	5.35
a) Fallow land other than current fallow	0.00	0.55	1.08	0.72	0.72	0.72	1.71	1.29	1.36	1.07	0.97	0.77
b) Current fallow	1.48	2.57	0.45	0.17	0.17	0.17	3.19	3.00	2.91	4.30	5.33	4.58
5. Net area sown	31.54	31.12	54.33	45.14	45.14	45.14	41.62	44.81	45.00	44.20	41.37	41.43
Total reporting area	310.7	310.7	83.91	83.91	83.91	83.91	314.9	325.46	325.47	325.46	325.46	325.46

Note: (-) indicates nil or insignificant value

Source: Calculated from table 2.16 and the Percentage figure of each category is calculated on total reporting area in the respective year.

Fig. 2.5 **Temporal Variations of Land use Pattern in Darjeeling district (1960-2016)**



2.2.2 Spatial Pattern of Land use in Dooars

It is observed that the Dooars under study area has shown a remarkable change in forest area. The forest area in 2001-02 was 29.35 percent but it was declined in 2004-05 by 0.49 percent and become 28.96 percent. There is a slight growth of forest area in the second half of the decade, in 2011-12 it was 29.45 percent and it remained same in the year 2015-16 as in 2011-12. Among 17 blocks of the study area, Kalchini block of Alipurduar district with 70.85 percent of land under forest area of the total reporting area was the highest in 2015-16. The other block which has more than 40 percent of land under forest area are Gorubathan (65.74%) of Darjeeling district, Kumargram (47.37%) and Alipurduar I (40.65%) blocks of Alipurduar district, and Kalimpong II (43.08%) of Kalimpong district. The least forest area have been reported from the following blocks Coochbehar II (1.81%), Tufanganj II (8.04%) of Coochbehar district, Jalpaiguri (2.57%), Dhupguri (10.33%), Mal (10.45%), Matiali (19.11%) blocks of Jalpaiguri district and Falakata (8.76%) block of Alipurduar district (table no. 2.19 and 2.21)

Every block under the study area shows same fashion of growing trends in the area under non-agricultural use. The blocks which have larger urban area have a greater area under non-agricultural use, like the Jalpaiguri block is exposed faster growth of area under non-agricultural use, as it the Sadar block of the district which possesses the Jalpaiguri town. In 2001-02 the Jalpaiguri block had only 10.88 percent area under non-agricultural use but, it was increased by double in 2005-06 i.e., 26.00 percent and 31.46 percent in 2011-12. Though there was a slight decrease in the year 2015-16, it was 31.38 percent.

The highest growth of area under non-agricultural use is observed from Jalpaiguri block and lowest growth is observed from Kalchini, Matiali, Madarihat-Birpara, Nagrakata, Kumargram and Grubatahan blocks. In 2001-02 Jalpaiguri and Kalchini blocks had 10.88 percent and 3.54 percent area under non-agricultural use, but in the year 2015-16, they become 31.38 percent and 2.90 percent respectively. It is observed that blocks with more forest area, shown steady growth or decrease in the area under non-agricultural use and vis-à-vis.

Like the districts in the study area, the region (Dooars) also experience the same fashion of growth in area under non-agricultural use. In 2001-02 it was 10.48 percent of the area under non-agricultural use which has been increased to 14.90 percent in 2015-16. There may be the following reasons which lead the growth of area in the category. The unprecedented developmental activities like development of railways, roadways, buildings etc. and above all the population growth with multifarious needs.

The Dooars also shows the same fashion of decreasing trends of land under permanent pastures and other grazing land. In 2001-02 it was 748,000 hectare (0.10%) in Dooars, while it has decreased in the following years and in 2015-16 it reached only (0.06%).

Most of the blocks do not have any pastures or grazing lands, barring the Kalimpong II and Gorubathan blocks of Darjeeling Hills. In the year 2001-02 Kalimpong II, Gorubathan, and Tufanganj II block have 2.58 percent, 0.09 percent and 0.03 percent of land under this category respectively. The area under this category has reduced in the following years like Kalimpong II and Gorubathan blocks have lost a significant area of this category during 2004-05, 2011-12 and 2015-16.

The blocks close to the foothill of the Himalaya have a significant percentage of land under this category. Mal block (4.33%) shows the highest percentage of land under this category in 2001-02 and Jalpaiguri block had only 0.04 percent of land under this category. The major factors that have been transforming the barren and unculturable land are the pressure of population growth, advancement of technology etc.

There were 6041,000 hectares (0.80%) of land was under the miscellaneous trees and crops in Dooars of North Bengal during 2001-02. It revealed decreasing trends in 2004-05 but it increased in 2011-12. Eventually, there was an increase of area under this category during 2015-16, that was 0.87 percent.

In 2001-02 the Alipurduar II block has 2.97 percent of land under this category, where it has been decreased to 0.06 percent in the year 2015-16. The others blocks which have experienced a significant loss of the land under this category are Coochbehar II, Tufanganj II, Kalimpong II, Falakata, Maynaguri, and Nagrakata.

The Dooars shows the same fashion of growth and decrease in area under Culturable waste land. The Dooars is accounted for a very little portion of land under this category. There is very less portion of land is falling into this category. As the region is a part of the Great Plains of Northern India and is highly fertile in nature. Only

Coochbehar II and Gorubathan blocks hold more than one percent of land under this category.

The Dooars is also experienced decreasing trends in the land under this category, like different districts in Dooars. In 2001-02 there was 0.35 percent of land under this category, but it decreased to 0.19 percent in 2015-16. In the year 2001-02, the land under this category in different blocks of the study area was as follows- Kalimpong II (8.35%), Gorubathan (1.74%), and Jalpaiguri (0.42%). The other blocks are very insignificant in terms of the area under fallow lands other than current fallows. There was a drastic decrease in the fallow land other than current fallows in 2004-05, 2011-12 and 2015-16. In 2015-16 the Kalimpong, Gorubathan blocks hold 4.36 percent, 0.57 percent respectively and there was no land under this category in Jalpaiguri block.

The Dooars shows an uneven growth of area under current fallows. In 2001-02, there was only 0.61 percent (159,000 hectares) land under current fallows, while it was increased in 2004-05 and reached 2.66 percent. The main factors may be sudden floods in Jalpaiguri and lower parts of Darjeeling district. In 2011-12 and 2015-16, there was significantly decreased in current fallows in Dooars of North Bengal. The highest increase has been found in Jalpaiguri block during 2001-02 to 204-05. In 2001-02 it was only 1.78 percent but it increased to 8.39 percent in 2004-05. The other blocks which have shown a drastic increase of land under this category in 2001-02 to 2004-05 are Mal, Kalimpong II, Madarihat-Birpara, and maynaguri. There was a sudden decrease of land under current follows after the year 2004-05. Though, the Kalimpong II block has been experiencing growing trends of current fallows, but some of the blocks have been experiencing a decline in current fallows. The highest decrease has been

found in the following blocks- Jalpaiguri, Mal, Madarihat-Birpara, Gorubathan, and Dhupguri.

The Dooars is also showing the same trends in net sown area like the districts. In 2001-02 the net sown area in Dooars was 57.06 percent (432692 thousand hectares) while it decreased in 2015-16 and accounted for 52.65 percent (399256 thousand hectares). In 2001-02 most of the blocks have more than 50 percent of the area under net area sown. Among different blocks, Jalpaiguri (82.89%) is the highest. The other illustratable blocks are Dhupguri (81.66%), Alipurduar II (81.11%), Coochbehar II (81.36%) and Falakata (79.22%). Alipuurduar II block with 83.70 percent of land under net sown area is the highest among different blocks of the study area in 2004-05. The others blocks above 50 percent area under the net sown area in 2004-05 are- Falakata (78.12%), Coochbehar II (73.36%), Dhupguri (73.64%), Tufanganj II (67.70%), Madarihat-Birpara (69.22%), Nagrakata (65.42%) and Jalpaiguri (62.54%). The major changes that have been observed in the time periods of 2001-2006 are changes in current fallows always have an impact on the net sown area. In other words, when there is an increase in current fallows it always results in a decrease of the net sown area.

Table 2.20 **Spatial Pattern of Land use in Dooars (2001-02)** **(Area in Hectares)**

Name of the District/ Block/Region	Reporting Area	Forests	Area under non-Agricultural uses	Barren and Unculturable land	Permanent Pastures and other grazing land	Land under miscellaneous tree, crops etc.	Culturable waste land	Fallow lands other than current fallows	Current fallows	Net Sown Area
Jalpaiguri	50316	1292 (2.57)	5475 (10.88)	22 (0.04)	-	714 (1.42)	-	209 (0.42)	897 (1.78)	41707 (82.89)
Rajganj	63543	23595 (37.13)	8804 (13.86)	-	-	592 (0.93)	-	-	197 (0.31)	30355 (47.77)
Maynaguri	65163	17013 (26.11)	8730 (13.4)	606 (0.93)	-	711 (1.09)	267 (0.41)	30 (0.05)	530 (0.81)	37276 (57.2)
Dhupguri	56586	5845 (10.33)	3394 (6.0)	29 (0.05)	3 (0.01)	168 (0.3)	528 (0.93)	-	412 (0.73)	46207 (81.66)
Mal	54870	5733 (10.45)	9998 (18.22)	2374 (4.33)	-	990 (1.8)	307 (0.56)	25 (0.05)	317 (0.58)	35126 (64.02)
Matiali	20620	3940 (19.11)	1056 (5.12)	11 (0.05)	-	100 (0.48)	-	-	58 (0.28)	15455 (74.95)
Nagrakata	28400	6975 (24.56)	2373 (8.36)	411 (1.45)	-	14 (0.05)	12 (0.04)	-	61 (0.21)	18554 (65.33)
Falakata	35487	3110 (8.76)	3576 (10.08)	-	-	223 (0.63)	42 (0.12)	-	422 (1.19)	28114 (79.22)
Madarihat-Birpara	38086	8774 (23.04)	1576 (4.14)	123 (0.32)	-	243 (0.64)	-	-	192 (0.5)	27178 (71.36)
Kalchini	89274	63253 (70.85)	3156 (3.54)	87 (0.1)	1	58 (0.06)	132 (0.15)	1	16 (0.02)	22570 (25.28)
Alipurduar - I	38311	15575 (40.65)	5115 (13.35)	-	-	259 (0.68)	-	-	114 (0.3)	17248 (45.02)
Alipurduar - II	31603	-	4881 (15.44)	329 (1.04)	-	395 (1.25)	94 (0.3)	7 (0.02)	264 (0.84)	25633 (81.11)
Kumargram	50441	23893 (47.37)	4035 (8.0)	813 (1.61)	-	102 (0.2)	15 (0.03)	-	86 (0.17)	21497 (42.62)
Jalpaiguri Dist.	622700	178998 (28.75)	62169 (9.98)	4805 (0.77)	4	4569 (0.73)	1397 (0.22)	272 (0.04)	3566 (0.57)	366920 (58.92)
Coochbehar –II	38198	691 (1.81)	5506 (14.41)	168 (0.44)	-	581 (1.52)	117 (0.31)	41 (0.11)	18 (0.05)	31076 (81.36)
Tufanganj-II	26021	2092 (8.04)	6499 (24.98)	-	9 (0.03)	171 (0.66)	-	-	159 (0.61)	17091 (65.68)
Coochbehar Dist.	64219	2783 (4.33)	12005 (18.69)	168 (0.26)	9 (0.01)	752 (1.17)	117 (0.18)	41 (0.06)	177 (0.28)	48167 (75.0)
Kalimpong – II	26986	11626 (43.08)	1729 (6.41)	264 (0.98)	696 (2.58)	508 (1.88)	-	2254 (8.35)	690 (2.56)	9219 (34.16)
Gorubathan	44372	29169 (65.74)	3554 (8.01)	938 (2.11)	39 (0.09)	212 (0.48)	1157 (2.61)	770 (1.74)	147 (0.33)	8386 (18.9)
Darjeeling Dist.	71358	40795 (57.17)	5283 (7.4)	1202 (1.68)	735 (1.03)	720 (1.01)	1157 (1.62)	3024 (4.24)	837 (1.17)	17605 (24.67)
Dooars Total	**758277**	**222576 (29.35)**	**79457 (10.48)**	**6175 (0.81)**	**748 (0.1)**	**6041 (0.8)**	**2671 (0.35)**	**3337 (0.44)**	**4580 (0.6)**	**432692 (57.06)**

Note: (1) Figures in bracket indicate percentage to the total reporting area. (2) -- indicates nil or insignificant value.

Source: Compiled from the institutional data collected from Directorate of Agriculture (Evaluation), Govt. of West Bengal, Kolkata. March, 2017.

Table 2.21 **Spatial Pattern of Land use in Dooars (2004-05)** **(Area in Hectares)**

Name of the District/ Block/Region	Reporting Area	Forests	Area under non-Agricultural uses	Barren and Unculturable land	Permanent Pastures and other grazing land	Land under miscellaneous tree, crops etc.	Culturable waste land	Fallow lands other than current fallows	Current fallows	Net Sown Area
Jalpaiguri	50316	1292 (2.57)	13081 (26.00)	-	-	244 (0.48)	10 (0.020)	-	4221 (8.39)	31468 (62.54)
Rajganj	63543	23595 (37.13)	8774 (13.81)	141 (0.22)	-	471 (0.74)	-	8 (0.01)	1539 (2.42)	29015 (45.66)
Maynaguri	65163	17013 (26.11)	10599 (16.27)	247 (0.38)	-	1648 (2.53)	-	-	2829 (4.34)	32827 (50.38)
Dhupguri	56586	5845 (10.33)	7220 (12.76)	-	-	503 (0.89)	-	-	1349 (2.38)	41669 (73.64)
Mal	54870	5733 (10.45)	12469 (22.72)	985 (1.80)	-	210 (0.38)	20 (0.036)	6 (0.01)	4162 (7.59)	31285 (57.02)
Matiali	20620	3940 (19.11)	1268 (6.15)	8 (0.04)	-	60 (0.29)	-	1	492 (2.39)	14851 (72.02)
Nagrakata	28400	6975 (24.56)	1817 (6.40)	452 (1.59)	-	29 (0.10)	12 (0.042)	-	535 (1.88)	18580 (65.42)
Falakata	35487	3110 (8.76)	3874 (10.92)	-	-	256 (0.72)	-	13 (0.04)	510 (1.44)	27724 (78.12)
Birpara-Madarihat	38086	8774 (23.04)	1874 (4.92)	123 (0.32)	-	79 (0.21)	-	-	871 (2.29)	26365 (69.22)
Kalchini	89273	63254 (70.85)	2845 (3.19)	81 (0.09)	-	101 (0.11)	4 (0.004)	16 (0.02)	744 (0.83)	22228 (24.90)
Alipurduar - I	38311	15576 (40.66)	4626 (12.07)	12 (0.03)	-	167 (0.44)	-	-	322 (0.84)	17608 (45.96)
Alipurduar - II	31604	-	3981 (12.60)	272 (0.86)	-	468 (1.48)	7 (0.022)	-	423 (1.34)	26453 (83.70)
Kumargram	50441	23893 (47.37)	5654 (11.21)	256 (0.51)	-	302 (0.60)	321 (0.636)	-	391 (0.78)	19624 (38.90)
Jalpaiguri Dist.	622700	179000 (28.75)	78082 (12.54)	2577 (0.41)	-	4538 (0.73)	374 (0.06)	44 (0.01)	18388 (2.95)	339697 (54.55)
Coochbehar-II	38198	1427 (3.74)	8105 (21.22)	-	-	214 (0.56)	-	-	412 (1.08)	28021 (73.36)
Tufanganj-II	31618	-	5702 (18.03)	19 (0.03)	-	666 (2.11)	-	-	14 (0.04)	25236 (79.82)
Coochbehar Dist.	69816	1427 (2.04)	13807 (19.78)	19 (0.03)	-	880 (1.26)	-	-	426 (0.61)	53257 (76.28)
Kalimpong – II	26986	11626 (43.08)	2946 (10.92)	231 (0.86)	579 (2.15)	316 (1.17)	-	2073 (7.68)	814 (3.02)	8401 (31.13)
Gorubathan	44372	29169 (65.74)	4175 (9.41)	872 (1.97)	6 (0.01)	176 (0.40)	960 (2.16)	489 (1.10)	697 (1.57)	7828 (17.64)
Darjeeling Dist.	71358	40795 (57.17)	7121 (9.98)	1103 (1.55)	585 (0.82)	492 (0.69)	960 (1.35)	2562 (3.59)	1511 (2.12)	16229 (22.74)
Dooars Total	**763874**	**221222 (28.96)**	**99010 (12.96)**	**3699 (0.48)**	**585 (0.08)**	**5910 (0.77)**	**1334 (0.17)**	**2606 (0.34)**	**20325 (2.66)**	**409183 (53.57)**

Note: (1) Figures in bracket indicate percentage to the total reporting area. (2) -- indicates nil or insignificant value.

Source: Compiled from the institutional data collected from Directorate of Agriculture (Evaluation), Govt. of West Bengal, Kolkata. March, 2017.

Table 2.22 **Spatial Pattern of Land use in Dooars (2011-12)** **(Area in Hectares)**

Name of the District/ Block/Region	Reporting Area	Forests	Area under non-Agricultural uses	Barren and Unculturable land	Permanent Pastures and other grazing land	Land under miscellaneous tree, crops etc.	Culturable waste land	Fallow lands other than current fallows	Current fallows	Net Sown Area
Jalpaiguri	50316	1292 (2.57)	15829 (31.46)	-	-	198 (0.39)	23 (0.05)	3 (0.01)	340 (0.68)	32631 (64.85)
Rajganj	63543	23595 (37.13)	8823 (13.89)	6 (0.01)	-	320 (0.50)	-	8 (0.01)	2417 (3.80)	28374 (44.65)
Maynaguri	65163	17013 (26.11)	13273 (20.37)	601 (0.92)	-	1409 (2.16)	13 (0.02)	11 (0.02)	2150 (3.30)	30693 (47.10)
Dhupguri	56586	5845 (10.33)	8849 (15.64)	-	-	294 (0.52)	-	-	244 (0.43)	41354 (73.08)
Mal	54870	5733 (10.45)	13046 (23.78)	1123 (2.05)	-	244 (0.44)	27 (0.05)	-	431 (0.79)	34266 (62.45)
Matiali	20620	3940 (19.11)	1632 (7.91)	18 (0.09)	-	85 (0.41)	4 (0.02)	14 (0.07)	216 (1.05)	14711 (71.34)
Nagrakata	28400	6975 (24.56)	2939 (10.35)	411 (1.45)	-	696 (2.45)	17 (0.06)	-	186 (0.65)	17176 (60.48)
Falakata	35487	3110 (8.76)	4605 (12.98)	321 (0.90)	-	388 (1.09)	-	48 (0.14)	658 (1.85)	26357 (74.27)
Madarihat-Birpara	38086	8774 (23.04)	3213 (8.44)	153 (0.40)	-	85 (0.22)	-	-	485 (1.27)	25376 (66.63)
Kalchini	89273	63254 (70.85)	3049 (3.42)	62 (0.07)	-	2	10 (0.01)	42 (0.05)	534 (0.60)	22320 (25.00)
Alipurduar - I	38311	15576 (40.66)	4815 (12.57)	-	-	161 (0.42)	2 (0.01)	5 (0.01)	627 (1.64)	17125 (44.70)
Alipurduar - II	31604	-	5790 (18.32)	100 (0.32)	-	940 (2.97)	8 (0.03)	-	998 (3.16)	23768 (75.21)
Kumargram	50441	23893 (47.37)	4852 (9.62)	332 (0.66)	-	208 (0.41)	16 (0.03)	3 (0.01)	291 (0.58)	20846 (41.33
Jalpaiguri Dist.	622700	179000 (28.75)	90715 (14.57)	3127 (0.50)	-	5030 (0.81)	120 (0.02)	134 (0.02)	9577 (1.54)	334997 (53.80)
Cooch Behar–II	38198	1427 (3.74)	6835 (17.89)	42 (0.11)	3 (0.01)	642 (1.68)	1961 (5.13)	-	-	27288 (71.44)
Tufanganj-II	26020	2092 (8.04)	3887 (14.94)	-	-	364 (1.40)	-	22 (0.08)	118 (0.45)	19537 (75.08)
Coochbehar Dist.	64218	3519 (5.48)	10722 (16.70)	42 (0.07)	3	1006 (1.57)	1961 (3.05)	22 (0.03)	118 (0.18)	46825 (72.92)
Kalimpong – II	26986	11625 (43.08)	2950 (10.93)	120 (0.44)	459 (1.70)	387 (1.43)	218 (0.81)	1493 (5.53)	2623 (9.72)	7111 (26.35)
Gorubathan	44372	29169 (65.74)	4814 (10.85)	908 (2.05)	19 (0.04)	203 (0.46)	442 (1.00)	240 (0.54)	2161 (4.87)	6416 (14.46)
Darjeeling Dist.	71358	40794 (57.17)	7764 (10.88)	1028 (1.44)	478 (0.67)	590 (0.83)	660 (0.92)	1733 (2.43)	4784 (6.70)	13527 (18.96)
Dooars Total	**758276**	**223313 (29.45)**	**109201 (14.40)**	**4197 (0.55)**	**481 (0.06)**	**6626 (0.87)**	**2741 (0.36)**	**1889 (0.25)**	**14479 (1.91)**	**395349 (52.14)**

Note: (1) Figures in bracket indicate percentage to the total reporting area. (2) -- indicates nil or insignificant value.

Source: Compiled from the institutional data collected from Directorate of Agriculture (Evaluation), Govt. of West Bengal, Kolkata. March, 2017.

Table 2.23 **Spatial Pattern of Land use in Dooars (2015-16)** **(Area in Hectares)**

Name of the District/ Block/Region	Reporting Area	Forests	Area under non-Agricultural uses	Barren and Unculturable land	Permanent Pastures and other grazing land	Land under miscellaneous tree, crops etc.	Culturable waste land	Fallow lands other than current fallows	Current fallows	Net Sown Area
Jalpaiguri	50316	1292 (2.57)	15790 (31.38)	8 (0.02)	-	194 (0.39)	-	-	505 (1.00)	32527 (64.65)
Rajganj	63543	23595 (37.13)	8845 (13.92)		-	323 (0.51)	-	4 (0.01)	1926 (3.03)	28850 (45.40)
Maynaguri	65163	17013 (26.11)	13576 (20.83)	70 (0.11)	-	824 (1.26)	-	-	2032 (3.12)	31648 (48.57)
Dhupguri	56586	5845 (10.33)	8094 (14.30)		-	205 (0.36)	36 (0.06)	-	299 (0.53)	42107 (74.41)
Mal	54870	5733 (10.45)	13215 (24.08)	433 (0.79)	-	265 (0.48)	100 (0.18)	-	384 (0.70)	34740 (63.31)
Matiali	20620	3940 (19.11)	1370 (6.64)	8 (0.04)	-	56 (0.27)	34 (0.16)	-	234 (1.13)	14978 (72.64)
Nagrakata	28400	6975 (24.56)	3318 (11.68)	211 (0.74)	-	244 (0.86)	35 (0.12)	-	40 (0.14)	17577 (61.89)
Falakata	35487	3110 (8.76)	5282 (14.88)	79 (0.22)	-	392 (1.10)	112 (0.32)	4 (0.01)	501 (1.41)	26007 (73.29)
Madarihat-Birpara	38086	8774 (23.04)	2420 (6.35)	134 (0.35)	-	106 (0.28)	-	-	353 (0.93)	26299 (69.05)
Kalchini	89273	63254 (70.85)	2586 (2.90)	67 (0.08)	-	65 (0.07)	50 (0.06)	10 (0.01)	405 (0.45)	22836 (25.58)
Alipurduar - I	38311	15576 (40.66)	5339 (13.94)	10 (0.03)	-	332 (0.87)		-	481 (1.26)	16573 (43.26)
Alipurduar - II	31604	-	6826 (21.60)	130 (0.41)	-	891 (2.82)	20 (0.06)	20 (0.06)	1108 (3.51)	22609 (71.54)
Kumargram	50441	23893 (47.37)	5803 (11.50)	88 (0.17)	-	194 (0.38)	12 (0.02)	-	156 (0.31)	20295 (40.24)
Jalpaiguri Dist.	622700	179000 (28.75)	92464 (14.85)	1238 (0.20)	-	4091 (0.66)	399 (0.06)	38 (0.01)	8424 (1.35)	337046 (54.13)
Coochbehar– II	38198	1427 (3.74)	6610 (17.30)	-	-	461 (1.21)	209 (0.55)	-	181 (0.47)	29310 (76.73)
Tufanganj-II	26020	2092 (8.04)	4815 (18.50)	-	-	369 (1.42)	-	-	78 (0.30)	18666 (71.74)
Coochbehar Dist.	64218	3519 (5.48)	11425 (17.79)	-	-	830 (1.29)	209 (0.33)	-	259 (0.40)	47976 (74.71)
Kalimpong – II	26986	11625 (43.08)	3893 (14.43)	219 (0.81)	400 (1.48)	463 (1.72)	337 (1.25)	1177 (4.36)	1249 (4.63)	7623 (28.25)
Gorubathan	44372	29169 (65.74)	5217 (11.76)	889 (2.00)	19 (0.04)	358 (0.81)	344 (0.78)	251 (0.57)	1514 (3.41)	6611 (14.90)
Darjeeling Dist.	71358	40794 (57.17)	9110 (12.77)	1108 (1.55)	419 (0.59)	821 (1.15)	681 (0.95)	1428 (2.00)	2763 (3.87)	14234 (19.95)
Dooars Total	**758276**	**223313 (29.45)**	**112999 (14.90)**	**2346 (0.31)**	**419 (0.06)**	**5742 (0.76)**	**1289 (0.17)**	**1466 (0.19)**	**11446 (1.51)**	**399256 (52.65)**

Note: (1) Figures in bracket indicate percentage to the total reporting area. (2) -- indicates nil or insignificant value.
Source: Compiled from the institutional data collected from Directorate of Agriculture (Evaluation), Govt. of West Bengal, Kolkata. March, 2017

2.3 Concluding Remarks

The history of land use transformation in Dooars is very complex in nature. The Dooars was covered by dense forests with very less density of population. The region was ruled by different kingdoms and it was the British who annexed the region in India. The Britishers found the region as plantation suitable and started tea cultivation.

During the colonial period, the forest resources were degraded under the different land settlement in Dooars, viz. the 'Permanent Settlement' which was introduced with a semi-feudal system of land use in the region. The *zamindars* allocated their land to the *talukdars* and *chukanidars* in Dooars. The *zamindars* enlarged their estate by clearing the forests and wastelands to increase the revenue. In India, the forest land was not regularised under any of the settlement of land allocation by the British. The British showed very less interest in wildlife conservation, rather they killed wildlife in the name of '*shikar'* (Hunting). The thoughtlessness of hunting led to habitat destruction and the total number of some flagship species of wildlife were found to be endangered and near to extinction.

The introduction of tea plantation has changed the socio-economic structure of the Dooars. There was an influx of people who came in Dooars a tea labourers from Central India and others parts of the country. Gradually, the infrastructures like roads and railways also started to develop. As it was mentioned earlier, the main motive of the colonial ruler was to generate maximum possible revenue from land, therefore, they come up with different land settlement policies. There were several surveys carried out during the colonial time to assess the forest and other resources in Dooars.

The construction of Bengal Dooars Railway and Coochbehar Railway were the main agents of destruction of forest land during the colonial era. The total number of sleepers supplied from the Buxa region during 1879-1882 was 99599. The Sal forest across the Dooars degraded due to the felling of trees for construction purposes. The destruction of forest land that started during the colonial period because of the construction of Railway networks have not been checked or stopped even in the post-independence period too. The NFR Railway track passes through all the protected areas in Dooars i.e. 18 km into the BTR, 12 km in Jaldapara National Park, 12 km in Chapramari Wildlife Sanctuary, 12 km in Mahananda Wildlife Sanctuary and 6 km in Baikunthapur Reserve. The track in Chapramari and Jaldapara region are highly prone to wildlife deaths due to the collision with trains as both the regions constitute an important elephant corridor.

The peopling in the Dooars has also greatly been influenced by plantation agriculture. Therefore, it can be said that tea plantation has brought a paradigm shift in land use pattern of Dooars. The forced emigration of tea labourers by British from the tribal belt of central India led to demographic changes in Dooars, which was augmented by the emergence of small-township and local markets. The subsistence agriculture in the fringe areas of the forest has also been carried out by the tea labourers in Dooars. Thus the pressure of increasing population has affected the existing natural resources.

After independence, under the new land policy (estate acquisition act of West Bengal), huge forest and wastelands have been converted into agricultural land in Dooars. There was no rules and regulations for the forest management in the early years of independence. The population pressure diversified the land use in Dooars.

During the 1970s, the land use pattern of West Bengal was characterised with different hierarchical system which was the results of colonial land system. The influence of *zamindari* system created various socio-economic problems in the rural economy of West Bengal. Therefore, Govt. wanted to adopt and implement such a land policy where, a new land allocation system promulgated not with the *zamindars* but with the farmers. Eventually, the West Bengal Land Reform Act 1955 came into existence.

The main aspects of land reforms carried out in West Bengal were the tenancy reforms and redistribution of land. With the implementation of '*Operation Barga'* in 1990s, 1.4 millions of sharecroppers have been registered with land records. The seized lands from big *zamindari* estates have been distributed among the sharecroppers or landless farmers. A large area of waste and scrub lands has been converted into agricultural land in Dooars and distributed to the farmers. The new land policies in West Bengal have been very effective for agricultural sectors but they have several adverse effects on forest and environment like the encroachments of forest lands across the protected areas in Dooars.

The temporal pattern of land use in Darjeeling, Jalpaiguri and Coochbehar districts during 1960-2016 shows very uneven growth. The forest land in Jalpaiguri revealed significant loss. Though there was a slight increase in forest land in Coochbehar district, it was very insignificant as proportioned to the total geographical area of the district. There was very minor change in temporal forest land in Darjeeling district. The net sown areas have been increasing in three districts. The main reason behind the increase in net sown area may be the decrease in land under miscellaneous trees and grooves and cultivable waste land.

The spatial pattern of land use in the blocks of the study area show remarkable changes in land under different categories. Every blocks shows increasing trend of land area under non-agricultural use.

Among the three districts (Darjeeling, Jalpaiguri and Coochbehar), the change in land use is the highest in Jalpaiguri followed by Coochbehar. The Coochbehar district shows the highest loss of forest cover. The land under miscellaneous trees and grooves is at the verge of extinction in almost all of the blocks of Dooars. The decrease in the net sown area and increase in the area under non-agricultural use indicates the continuing changes in land use. Due to the changes in land use, the forest cover has been affected adversely. The land use change followed by forest cover change has brought several impacts like fragmentation in the natural habitat of the rich biodiversity in Dooars which further augmented by several socio-economic problems in the region.

Chapter- 3

Forest Cover change in Dooars

The Dooars of North Bengal is known for its natural beauty and rich biodiversity. The area was once well endowed with the dense forest cover. The forests resources have been exploited since the colonisation of the region by the British. The West Bengal Forestry has a celebrated past and now has completed 150 years of scientific forestry. The history of West Bengal's forestry dates back to British India and in the post-independence period, it has been flourishing under the suitable forest protection regulations (150 Years of Forestry, West Bengal, 2014).

The major types of forest in Dooars includes tropical wet evergreen forest, moist deciduous forest and subtropical evergreen forest. The tropical evergreen forest is dominated in Khutimari areas of Jalpaiguri district. The moist deciduous forest is the most important forest in Dooars and it covers almost all the sub-montane belts of it. Parts of Buxa Dooars is occupied by subtropical evergreen forest (State Forest Report, 2012-13, p-16).

The process of deforestation in India by the British rule was very intense in the early years of the building of the railway network, especially after the year of 1853. The sub-Himalayan forests of Garhwal and Kumaon, for example, were all 'felled even to desolation' and 'thousands of trees were felled which were never removed, nor was this removal possible'. Before the coal mines of Raniganj became fully operative, the railway company drew upon the forests for fuel as well (Gadgil and Guha, 1999). There was a massive destruction of forest in Dooars due to the construction of Bengal Dooars and Coochbehar State railways.

The total Recorded Forest land in West Bengal is 11879 Sq. km. out of which 7054 sq. km. is Reserved Forest, 3772 sq. km. is Protected Forest and 1053 sq. km. is

Unclassed State Forest, accordingly it constitute 13.38 percent of the total geographical area of West Bengal. The forest cover including the forests formed outside the recorded forest area is 15.52 percent of the total geographical area as assessed by the GIS Cell of the West Bengal (NRSA, Hyderabad, 2004).

The change detection of forest cover is the process of identifying differences in the state of an object or phenomenon by observing multi-temporal variations (Shing, 1989). The basic principle of change detection through remote sensing is that the changes in spectral signatures proportionate to the change in land cover. The detailed procedure is to superimpose two-period maps to find the change (Jessica et. al, 2001).

3.1 Forests and Protected Areas in Dooars

The Dooars of North Bengal comprises part of the districts viz., Jalpaiguri, Darjeeling and Coochbehar. Jalpaiguri district has the largest geographical area of 6227 sq. km (the newly formed Alipurduar district is included in Jalpaiguri, as no separate data was found) followed by Coochbehar 3387 sq. km and Darjeeling 3149 sq. km (the newly formed Kalimpong district is included in Darjeeling).

Table. 3.1 **Distribution of Recorded Forest land in Dar. Jal. and Cob. (2006-07) (sq. km.)**

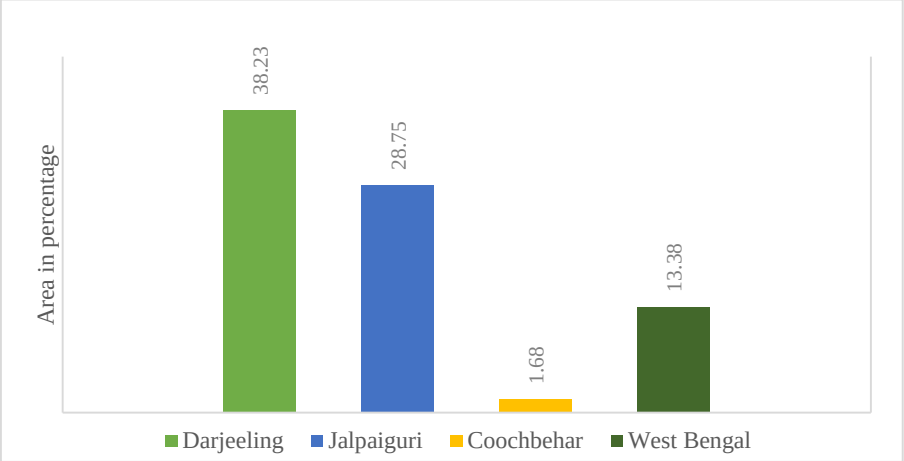
Forest Cover	District			West Bengal
	Jalpaiguri	Darjeeling	Coochbehar	
Total geographical area	6227	3149	3387	88752
Reserve forests	1483	1115	-	7054
Protected forests	217	-	42	3772
Unclassed state forests etc.	90	89	15	1053
Total forests area recorded	1790	1204	57	11879
Total forests area (in %)	28.75	38.23	1.68	13.38

Source: Computed from State Forest Report 2008-09, 2009-10 and 2012-13. Govt. of India.

The Recorded forest areas, however, do not follow the same fashion of the geographical area, Coochbehar has the least area under forest, (only 57 sq. km which is only 1.68 percent of the geographical area of the district). Although Jalpaiguri has more recorded forest area (1790 sq. km) than Darjeeling (1204 sq. km) in respect to their geographical areas, Darjeeling district is more forested (38.23%), compared to

Jalpaiguri (28.75%) in terms of total forest cover. the Most surprising fact is observed is that Coochbehar district which is almost comparable in terms of total geographical area to Darjeeling in but contains less area to the area under forest (Das, 2014).

Fig. 3.1 **Forest Land in Jalpaiguri, Darjeeling, Coochbehar and West Bengal (2007-08)**



The important protected forest areas in Dooars includes the following;

1) The Buxa Tiger Reserve which is situated in the newly formed district of Alipurduar (which is the northernmost part of West Bengal, curved out as the district of Alipurduar from Jalpaiguri in 2014) is known for Leopard, Asian Elephant, Clouded Leopard, Himalayan Black Bear, Gaur, Pangolin and Python. The forest can be further categorised into Buxa National Park, Buxa Wildlife Sanctuary and the Buxa Tiger Reserve. It shares an international boundary with the Phipsu Wildlife Sanctuary of the neighbouring country of Bhutan and thus serves as an international migratory zone and biological corridor for the Asian Elephants between Buxa (West Bengal), Manas National Park (Assam, India) and the forests of Bhutan (Management-cum working Plan, BTR, 2000).

2) The Jaldapara National Park is situated in Alipurduar and Coochbehar district of West Bengal. It is a natural habitat with a great diversity of flora and fauna. It is the home to the great Indian one-horned Rhinoceros. The Chilapata region of Jaldapara National Park forms as an important Asian Elephant corridor between Buxa Tiger

Reserve and Jaldapara National Park, located in Coochbehar district connecting both Alipurduar and Jalpaiguri district as a natural corridor in Dooars. The forest cover in Jaldapara National Park is characterised by savannah types, covered with tall elephant grasses. The National Park holds the maximum number of Rhinoceros population in India after Kaziranga National Park in Assam. The other important animals in Jaldapara National Park are Asian Elephants, Sambhar, Barking deer, spotted deer and Hog deer, Wild pig and Bison. It is one of the very rare places in India, where the Bengal Florican is sighted. The National Park is also well known for its variety of birds like Crested Eagle, Pallas's Fishing Eagle, Junglefowl, Peafowl, partridges, Bengal Florican and lesser Pied Hornbill. Python, monitor lizards, krates, cobras, geckos and about 8 species of freshwater turtles have also been found here (Annual Report, Wildlife Wing, 2014-15).

3) The Gorumara National Park is located in the Terai-Dooars region of the Himalayan foothills in Jalpaiguri district (Malbazar subdivision), it is a medium-sized park with grasslands and forests. It is primarily known for its population of Indian Rhinoceros. Gorumara was a reserve forest since 1895. The park was declared a Wildlife Sanctuary in 1949, on account of its increasing population of Indian Rhinoceros. It was declared an Indian National Park in the year 1994. Initially, the total area of the National Park was as small as 7 sq. km, Gorumara has enlarged it area by incorporating neighbouring lands to about 80 sq. km. The park has recorded 50 species of mammals, 193 species of birds, 22 species of reptiles, 7 species of turtles, 27species of fishes and other macro and micro-fauna. The National Park is rich in large herbivores including Indian Rhinoceros, Gaur, Asian Elephant, Sloth bear, Chital, and Sambar Deer. Small herbivores include Barking deer, Hog deer and Wild boar.

There National Park is also suffering due to the lack of large carnivores, only carnivores are the Leopard. There is no Bengal Tigers, Indian Wild Dogs or Indian Wolf in the Park. Tigers are, however, occasionally sighted here. It does have numerous small carnivores including various civets, mongooses and small cats. The park has a large population of Wild boar and the critically endangered Pygmy Hog has also been reported from the park. It also has numerous rodents, including Giant Squirrels. The rare Hispid Hare has also been reported from the park. Gorumara National Park is famous for its bird population, which includes wonderful submontane forest birds like the Scarlet Minivet, Sunbird, Asian Paradise Flycatcher, Spangled Drongo and Great Indian Hornbill. Numerous woodpeckers and pheasants inhabit the park. Peafowls are very common in Gorumara. The park is home to a large number of snakes, venomous and non-venomous, including the Indian Python, one of the largest snakes in the world, and the King Cobra, the world's deadly venomous snake (Management-cum working plan, Gorumara NP, 2004. p-110).

4) The Chapramari forest is located near the NH31 connecting North-East with the rest of India. It is located on the other side of river Teesta on the way into Dooars. The River Murti flows along the western boundary. A huge variety of flora and fauna covers the forests. Chapramari is famous for its Asian Elephant population. Gaur (commonly known as Indian Bison) is quite common around this region. The other varieties animals include deer, reptiles etc. Chapramari WLS shares a natural boundary with the Gorumara National Park and both protected forests have been treated as same biological zone under Jalpaiguri Forest division (*ibid.* p-111).

5) The Neora Valley National Park is situated in the newly formed Kalimpong district of West Bengal and covers an area of 88 sq. km. It was established in 1986 as one of the richest biological zones in the nearby areas of entire Northeast region. The

land of famous Red Panda in the virgin undisturbed natural habitat with rugged inaccessible hilly terrain and rich diversity of flora and fauna altogether make the park an important biodiversity zone. Neora Valley National Park is one of the rare biodiversity zones in the country that sustains a unique eco-system where tropical, subtropical, sub-temperate, and the temperate prevails with an affluence of flora and fauna. The Neora Valley also has numerous species of orchids. The fauna consists of endangered species as the Clouded Leopard, Red panda, and Musk deer. Other species are Leopard, five species of Civet, Black bear, Sloth bear, Golden cat, Wild boar, Leopard cat, Goral, Barking deer, Samba, Himalayan flying squirrel and Thar and several species of birds (*ibid*. p-112).

6) The Mahananda Wildlife Sanctuary is located in Darjeeling district of West Bengal. It stretches between the between the Teesta and Mahananda river with an area of 159 sq. km and shares an international boundary with Nepal through the Mechi river. The main aim to upgrade the game sanctuary into the full-fledged sanctuary was to protect two flagship species i.e. Bison and Tiger. This sanctuary has given more importance because the sanctuary provides biological corridors with Nepal for the migration of wild animals. The sanctuary is bounded to the south by a less intensively protected area, the Baikunthapur Reserve Forest in Jalpaiguri (Nagendra et al, 2009).

All the National Parks, Wildlife Sanctuaries and Reserve Forests makes the Dooars region biological rich and viable. The wide variety of natural resources and rich wildlife population are under threat due to several reasons which have been discussed in the following.

3.2 Distribution of Forest Cover in different Canopy density

The forest cover in the Jalpaiguri, Coochbehar and Darjeeling district is analysed based on the satellite data interpretation of 2001, 2011 and 2015 of Forest

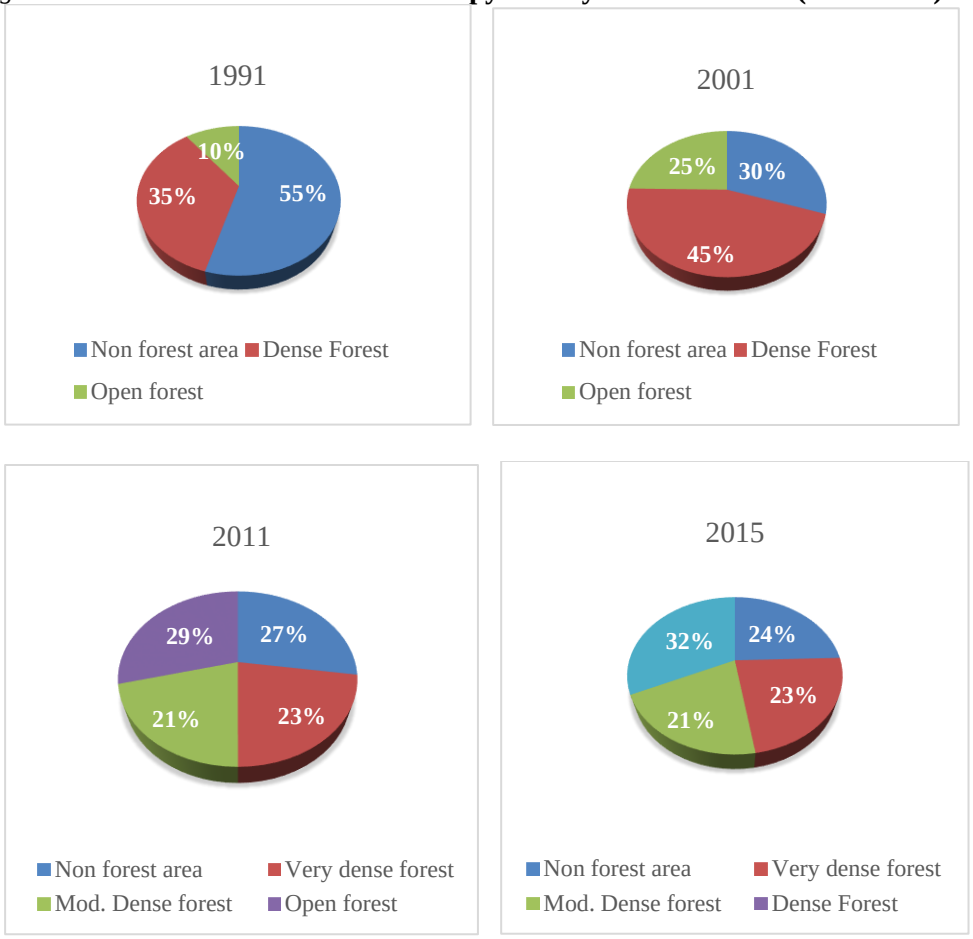
Survey of India. On the other hand, the forest cover data of 1991 is analysed based on the different reports of Forest Survey of India (the real ground survey report). The most important fact that found from the data (table no. 3.2) is the forest cover has been increased significantly after the year 2001. In the year 2001, the non-forest area in Darjeeling was 30 percent which shows an increase in the forest area comparison to the 1991 data. The present data (2001) is also shown a gain of ten percent of forest area from the previous assessment (1991). The following decades after 2001, 2011 and 2015 also show positive trends in the forest area in Darjeeling. The main factors of the increase in the forest in tea garden areas. There is an uncertainty of such an increase in forest cover in Darjeeling which could be because of the low-quality image data interpretation or obstruction from clouds as noise. In Darjeeling it is very difficult to distinguish the forest and tea plantation areas from satellite images as the signature of forests and tea plantations overlaps each other (Annual Report FSI, 2003).

Table. 3.2 **Forest Cover in different Canopy density and Scrub in Dar. district. (Sq. km.)**

Year/types of forest	1991	1993	1995	1999	2001	2003	2005	2007	2011	2015
Geographical Area	3149	3149	3149	3149	3149	3149	3149	3149	3149	3149
Very dense forest	-	-	-	-	-	472	472	714	714	724
Mod. Dense forest	-	-	-	-	-	893	893	663	663	650
Dense Forest	1109	1093	1091	1096	1417	-	-	-	-	-
Open forest	326	362	357	359	779	856	856	912	912	1004
Total forest	1435	1455	1448	1455	2196	2221	2221	2289	2289	2378
Change*	-	-	-	-	-	25	-	-1	-	89
Percent of G.A	45.57	46.21	45.98	46.21	69.74	70.53	70.53	72.69	72.69	75.52
Scrub	-	-	1	-	-	-	-	-	-	5

Notes: (*) denotes change of total area compared to previous year assessments. G.A (Geographical Area)
Source: Computed from State Forest Reports 1991, p-62; 1993, p-75; 1995, p-67-68; 1999, p-105; 2001, p-101; 2003, p-151; 2005, p-145; 2007, 165; 2011, p-243 & 2015, p-214.

Fig. 3.2 **Forest cover and different Canopy density in Dar. district (1991-2015)**



The most important factors that have been found from the above data are; though there was an increase in the actual area under forest, the density of different forest has been decreasing. The dense forest cover was 45 percentage in 2001, which decreased to 44 percent (included 21 percent mod. and 23 very dense forests) and it remained same in the year 2015 in Darjeeling.

Like the Darjeeling district, Jalpaiguri district also shows an increasing trend in forest areas under different canopy cover. The assessment of forests cover in Jalpaiguri district has been carried out based on the satellite data of 2001, 2011 and 2015. As it was said earlier, the differentiation of the forest cover and the tea estates is very difficult by analysing the satellite imageries, which eventually results in the increase of forest area in Jalpaiguri district too. An increase of two percent and six percent in the open

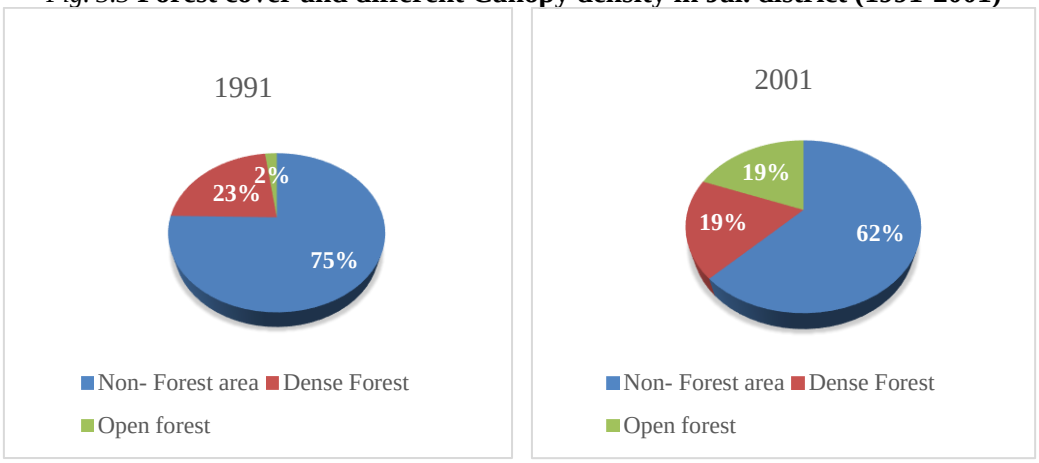
forest has been assessed during the time periods of 2001 to 2015. On the other hand, loss of canopy density under different forest cover have been assessed in the dense and very dense forest cover during the same time periods. The changes in the forest canopy density of moderate dense forest and dense forest in Jalpaiguri is high (see table 3.3).

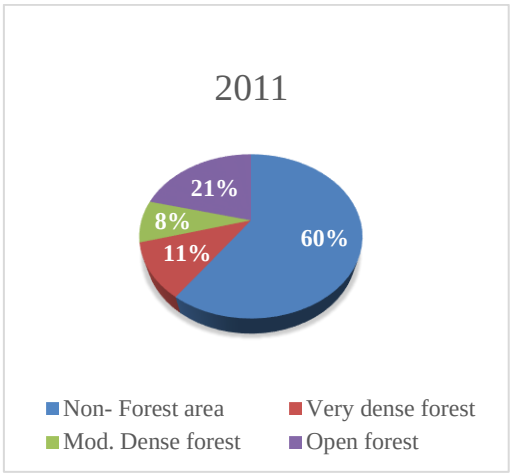
Table. 3.3 **Forest Cover in different Canopy density and Scrub in Jal. dist. (Sq. km)**

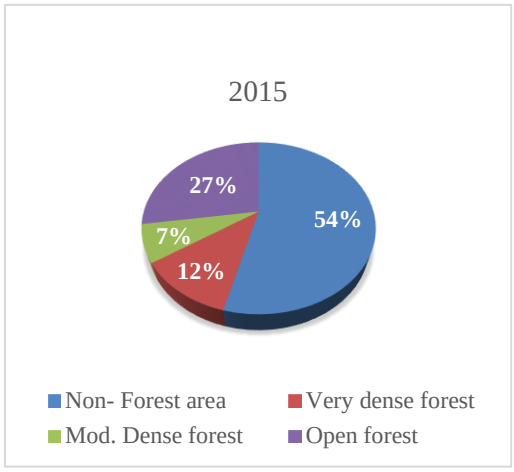
Year/types of forest	1991	1993	1995	1999	2001	2003	2005	2007	2011	2015
Geographical Area	6227	6227	6227	6227	6227	6227	6227	6227	6227	6227
Very dense forest	-	-	-	-	-	607	607	681	681	720
Mod. Dense forest	-	-	-	-	-	566	573	514	514	440
Dense Forest	1405	1396	1414	1445	1156	-	-	-	-	-
Open forest	132	175	164	137	1188	1220	1233	1311	1309	1703
Total forest	1537	1571	1578	1582	2344	2393	2413	2506	2504	2863
Change	-	-	-	-	-	49	14	6	-2	359
Percent of G.A	24.68	25.23	25.34	25.41	37.64	38.43	38.75	40.24	40.21	45.98
Scrub	-	-	4	-	12	-	13	8	8	31

Note: (*) denotes change of total area compared to previous year assessments. G.A (total geographical area).
Source: Computed from State Forest Reports 1991, p-62; 1993, p-75; 1995, p-67-68; 1999, p-105; 2001, p-101; 2003, p-151; 2005, p-145; 2007, 165; 2011, p-243 & 2015, p-214.

Fig. 3.3 **Forest cover and different Canopy density in Jal. district (1991-2001)**







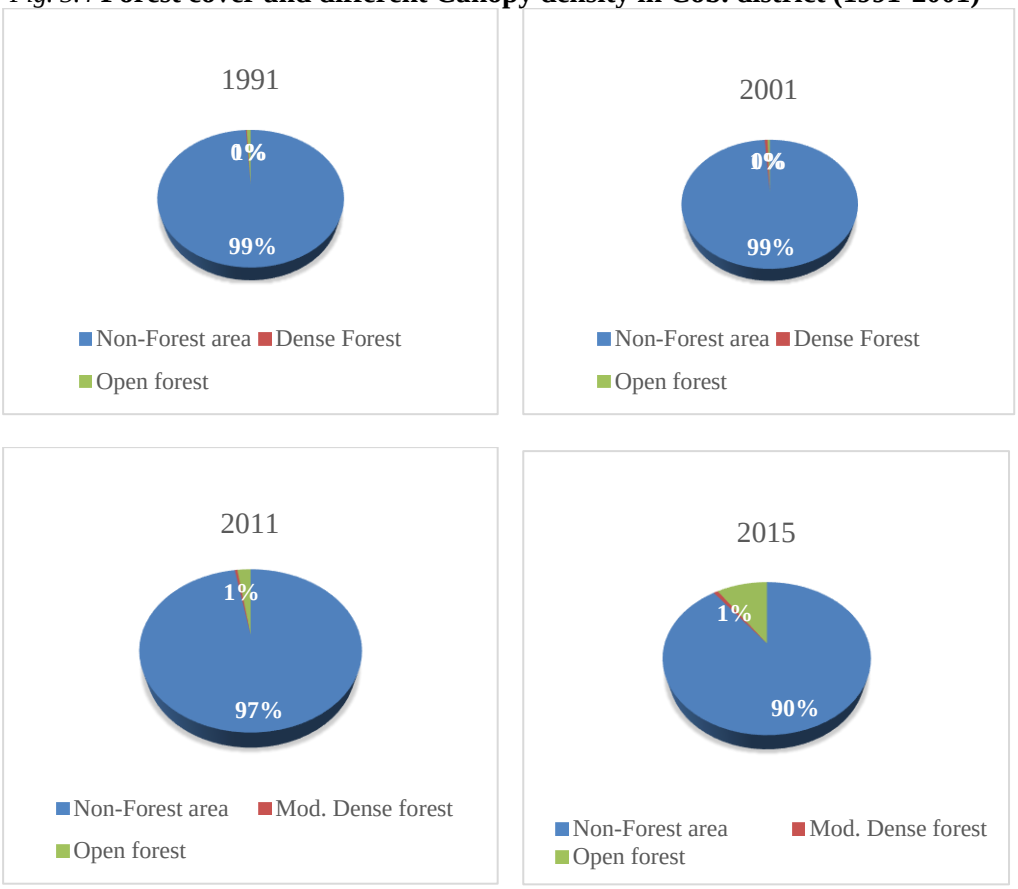
Comparing with the other two districts, the Coochbehar district has very less area of land under forest cover. More than 98 percent area of the district is under the non-forest cover. Though there was a slight gain in open forest area in the year 2015 (eight percent), which is very insignificant to its total geographical area of the district. There was a gain of 254 sq. km of forest land during 2003 to 2015 in Coochbehar district.

Table. 3.4 **Forest Cover in different Canopy density & Scrub in Cob. district. (Sq. km)**

Year/types of forest	1991	1993	1995	1999	2001	2003	2005	2007	2011	2015
Geographical Area	3387	3387	3387	3387	3387	3387	3387	3387	3387	3387
Very dense forest	-	-	-	-	-	-	-	-	-	-
Mod. Dense forest	-	-	-	-	-	25	25	15	15	27
Dense Forest	6	7	8	12	22	-	-	-	-	-
Open forest	27	24	24	20	16	62	62	79	79	321
Total	33	31	32	32	38	87	87	94	94	348
Percent of G.A	0.97	0.92	0.94	0.94	1.12	2.57	2.57	2.78	2.78	10.27
Change	-	-	-	-	-	49	-	-	-	254
Scrub	-	-	1	1	1	-	-	1	1	-

Note: (*) denotes change of total area compared to previous year assessments. G.A (Geographical Area).
Source: Computed from State Forest Reports 1991, p-62; 1993, p-75; 1995, p-67-68; 1999, p-105; 2001, p-101; 2003, p-151; 2005, p-145; 2007, 165; 2011, p-243 & 2015, p-214.

Fig. 3.4 **Forest cover and different Canopy density in Cob. district (1991-2001)**



3.3 Comparative Assessment of Forest Cover in Dooars

The comparative assessment of forest cover of the three districts in North Bengal have been done to understand the changes in the actual area of the forest (see table 3.5 & fig 3.5). The Forest cover in three districts of North Bengal show an uneven trends of growth. An important fact about Darjeeling district is that it has the highest loss of forest cover during the time period of 1988-2008. In the year 1988, the total percentage of forest cover in Darjeeling was 51.11 (1609 sq. km.), which increased in the following years of 1991, 1994 and in 2000 to 53.05 percent, 53.31 percent, 53.38 percent respectively. But, forest cover decreased significantly since the year 2000. In the year 2004 and 2006, it decreased to 52.46 percent and 44.68 percent respectively.

The Jalpaiguri district shows an increasing trend of forest cover, though there was a loss assessed in the year 2000 (23.69 percent). The following years since 2000 have shown a positive growth in forest cover in the district. The forest cover in Coochbehar district shows same fashion of growth like the Jalpaiguri district. The forest cover of the district is very scanty in terms of the geographical area. The total forest cover in Coochbehar district was 1.03 percent in the year 1988, which increased to 1.30 percent in 2006.

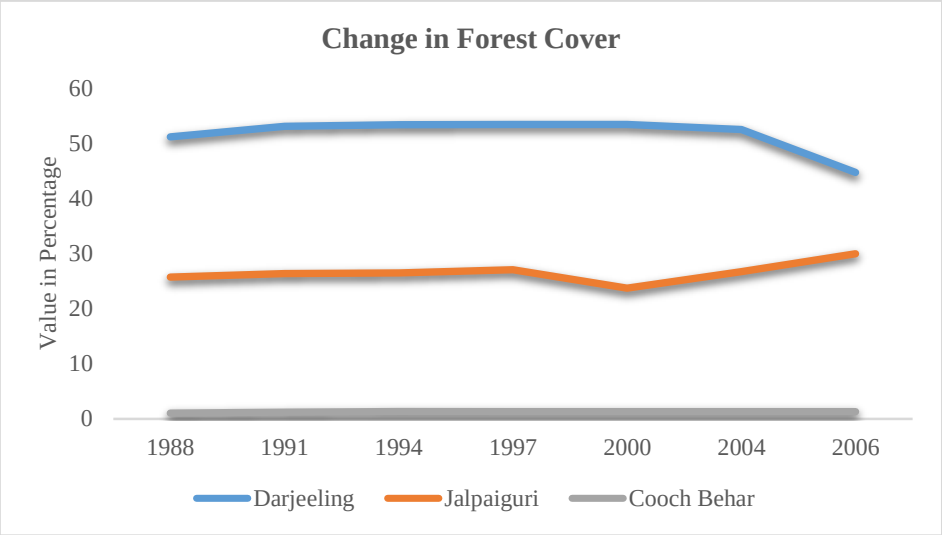
Almost all the forest reports show increasing trends of forest cover in the three districts. There are instances where wastelands and tea estates are being converted to forests. But, the question whether the forest quality remains original if the forest cover increases yearly and whether the canopy density of forest remains the same, remains unaddressed.

Table. 3.5 **Comparative Assessment of Forest cover Dar, Jal and Cob (1988-2006) (Sq. km)**

Years	Darjeeling	Jalpaiguri	Cooch Behar
1988	1609 (51.11)	1602 (25.72)	35 (1.03)
1991	1670 (53.05)	1640 (26.34)	42 (1.23)
1994	1679 (53.31)	1646 (26.44)	44 (1.29)
1997	1681 (53.38)	1682 (27.01)	44 (1.3)
2000	1681 (53.38)	1475 (23.69)	44 (1.3)
2004	1652 (52.46)	1661 (26.67)	44 (1.3)
2006	1407 (44.68)	1864 (29.93)	44 (1.3)

Note: Values in bracket shows the percentage of forest cover of respective districts.
Source: Computed from Wastelands Atlas of India, 2005. Published by Ministry of Rural Development, Dept. of Land Resources. Govt. of India and NRSA, Dept. of Space.

Fig. 3.5 **Forest cover and different Canopy density in Dar, Jal & Cob dist. (1988-06)**



3.4 Degradation of Forest Land in Dooars

The term 'degraded forest land' implies, formerly forested lands severely impacted by intensive or repeated disturbance (such as mining, repeated fires or overgrazing or felling of large numbers of trees) with consequently inhibited or delayed forest regrowth. These include barrens areas, grasslands, and scrublands (Chokkalingam, and Jong, 2001).

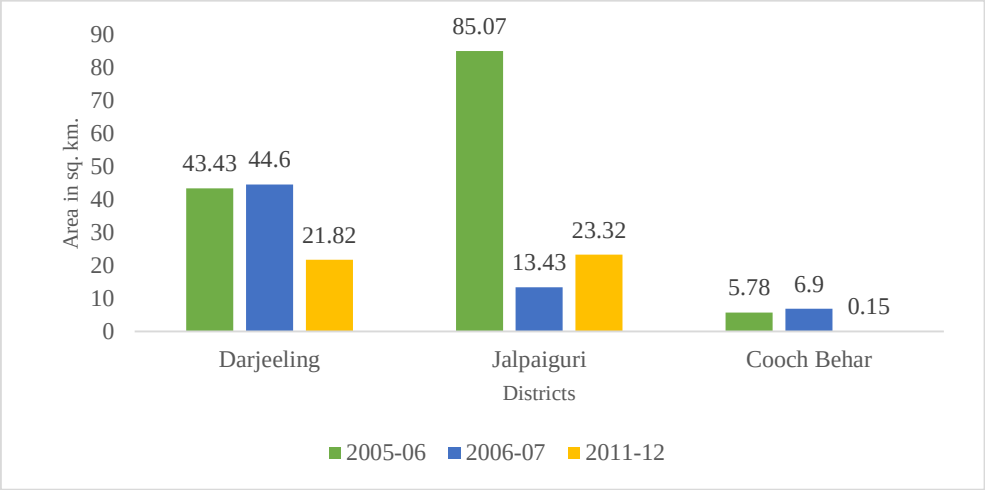
Most of the forests land in Dooars has been affected by degradation which is largely led by human-induced activities. The natural agents like, floods of different rivers also lead the processes of forest degradation in Dooars.

Table 3.6 **Degraded Notified Forest Land in Dar., Jal. and Cob. Dist. (2005-2012) (sq. km)**

District	2005-06	2006-07	2011-12
Darjeeling	43.43	44.6	21.82
Jalpaiguri	85.07	13.43	23.32
Cooch Behar	5.78	6.9	0.15

Source: Computed from Wastelands Atlas of India, 2005. Ministry of Rural Development, Dept. of Land Resources. Govt. of India and NRSA, Dept. of Space.

Fig 3.6 **Degraded Forest Land in Darjeeling, Jalpaiguri & Coochbehar dist. (2005-2012)**



The Dooars is constituted with the parts of the three districts (Darjeeling, Jalpaiguri and Coochbehar) and degradation of the forest land has been one of the major threats in this region. The greater part of the Dooars is under Jalpaiguri district which shares the highest percentage of land under degradation. Jalpaiguri district is followed by Darjeeling and Coochbehar in terms of degraded forest land. Most of the protected areas in Dooars are affected by the degradation and which has been adversely influenced the natural stability of the ecosystem.

The increase in human population exerts continuous pressure on the forest land for agriculture and other purposes. Therefore, the forest land has been experiencing a constant threat like encroachments and related issues during the sixties and seventies.

After the Forest (Conservation) Act, 1980 came into force the problem was, however, not been checked. For diversion of forest land for any developmental purpose, compulsory afforestation on the land made available in lieu has been made binding but in reality, it never happened (SFR, 2006-07. p-56).

The encroachment of forest land in Coochbehar district was very high compared to the other two district. Almost thousand hectares of forest land has encroached in the year 2008 and 2010. Jalpaiguri district is also accounted for encroachment of forest

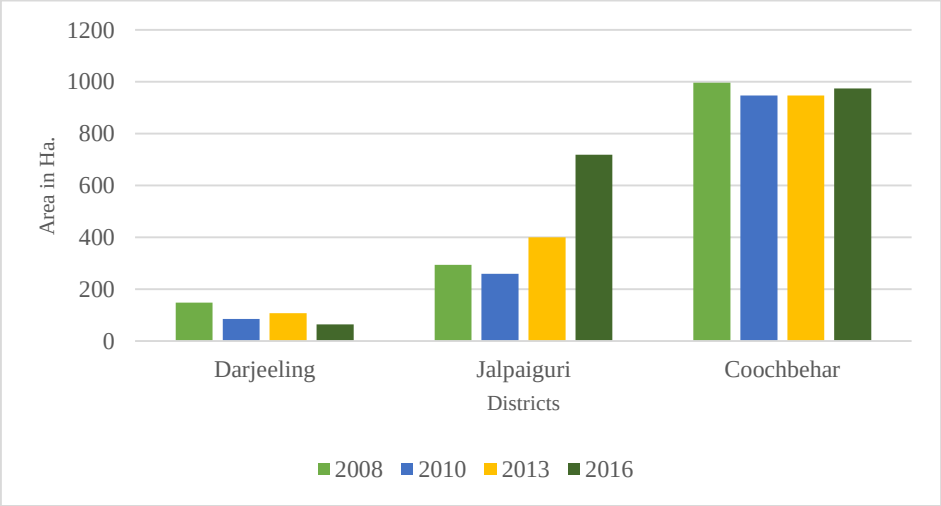
land. In the year 2008, it was 293 hectares of forest land under encroachment, which is further going up to 400 hectares in 2013 and 718 hectares in 2016. In Darjeeling district, the encroachment of forest land is comparatively very less than the Coochbehar and Jalpaiguri district. The total encroachment of forest land in Darjeeling was 148 hectares in the year 2008, which has been decreased to only 63 hectares in the year 2016.

Table. 3.7 **Status of Encroachment of forest land in Dooars (2008-16) (in Ha.)**

District	Forest Division	2008	2010	2013	2016
Darjeeling	Darjeeling	42.44	41.44	41.44	
	Kurseong	1.52	1.52	1.54	
	Kalimpong	40.25	-	-	
	Wildlife I	63.95	42.45	63.95	63.95
Dar. Total		**148.16**	**85.41**	**106.93**	**63.95**
Jalpaiguri	Baikunthapur	56.75	56.75	198.34	198.38
	Jalpaiguri	103.38	103.38	103.38	160.93
	B.T.R. East	98.51	98.51	98.51	-
	B.T.R. West	-	-	-	-
	Wildlife II	34.9	-	-	
Jal. Total		**293.54**	**258.64**	**400.23**	**718.62**
Coochbehar	Coochbehar	25	-	-	
	Coochbehar SF	970.96	947.09	947.09	974.09
Cob. Total		**995.96**	**947.09**	**947.09**	**974.09**
Grand Total		**1437.66**	**1291.14**	**1454.25**	**1756.66**

Source: Computed from State Forest Report 2008-09, 2009-10 and 2012-13 and Annual Administrative Report - 2015-2016, Department Of Forests, Govt. of West Bengal, p-97 Govt. of West Bengal.

Fig. 3.7 **Encroachments of Forest land in Dar, Jal and Cob. district (2008-2016)**



3.5 Present Status of Forest Cover and Tea Plantation Area in Dooars

The spatial distribution of forest cover in Dooars (1972-73 to 2016-17) is clearly shown in fig. 3.8 and 3.9. The forests areas in Dooars were very dense in nature. The

forest cover in different protected areas has been decreasing in Dooars. Though different official reports stated that the total notified area under forest cover remains same but, the density and canopy cover have been decreasing at an alarming rate in Dooars.

Due to the lack forest protection regulations in India, the early days of independence, the forest resources in Dooars were not regularised and managed properly. After the formulation of the Wildlife Protection Act and Forest Conservation Act, the forests areas have been started to regularise and manage more scientifically and in a regulated manner. On the other hand, the area under the tea plantation has been growing rapidly. Tea plantation occupies the forest fringe areas of Dooars without any consideration to the reserve forests.

The enactment of WPA 1972, Forest conservation Act, 1980 and Environment Protection Act, 1986 prohibited the large-scale human interaction of forest resources in India. Though, the development activities near the forest area have not yet been fully stopped. The forests cover in the year 1990-91 and 2016-17 in Dooars are shown in the fig. 3.8 and 3.9. The decreasing trends in the forest cover can easily be traced out from the figures.

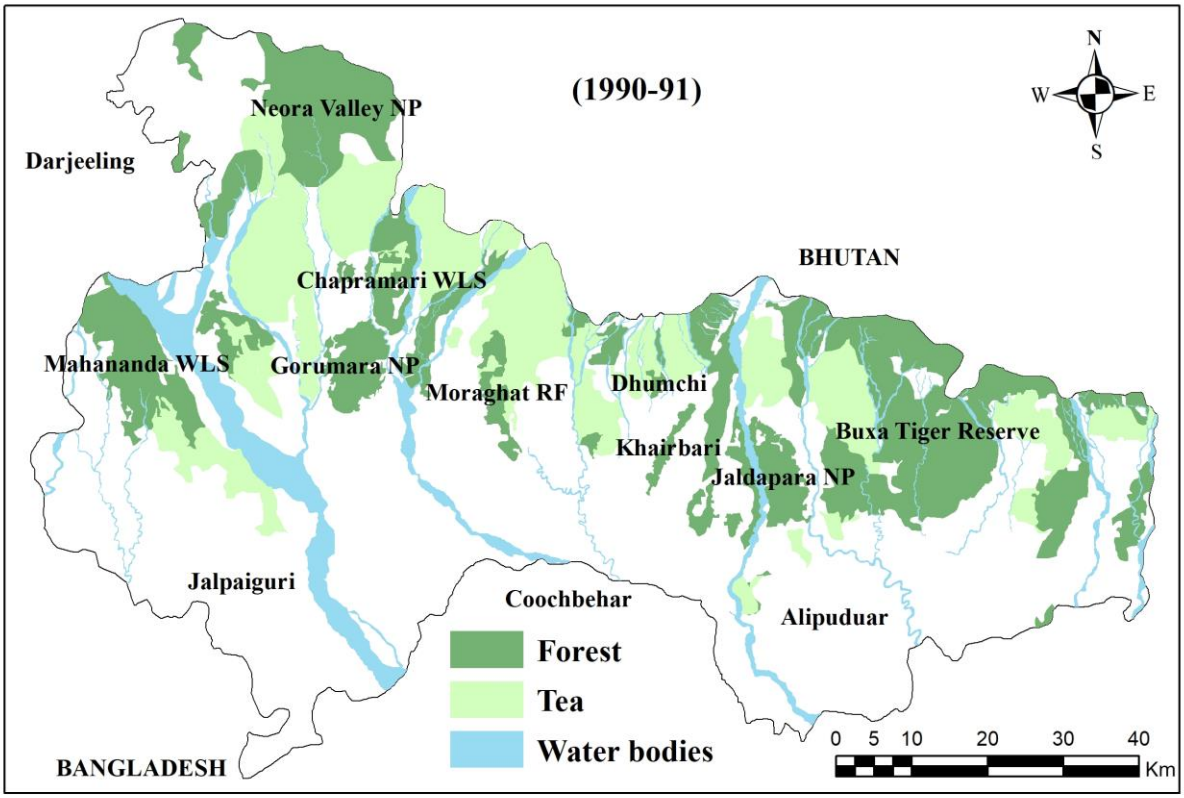
In India, tensions between conservation and development have been progressively critical in contemporary years. Between 1975 and 1998, the number of National Parks in India increased from 5 to 85, and the number of Wildlife Sanctuaries increased from 126 to 448. The majority of these ‘new’ protected areas were created from former reserve forest areas by improving the status of their protection, subsequent to a redrawing of protected area boundaries across India. Most areas set aside for protection, therefore, contain settlements located next to or within their boundaries, and

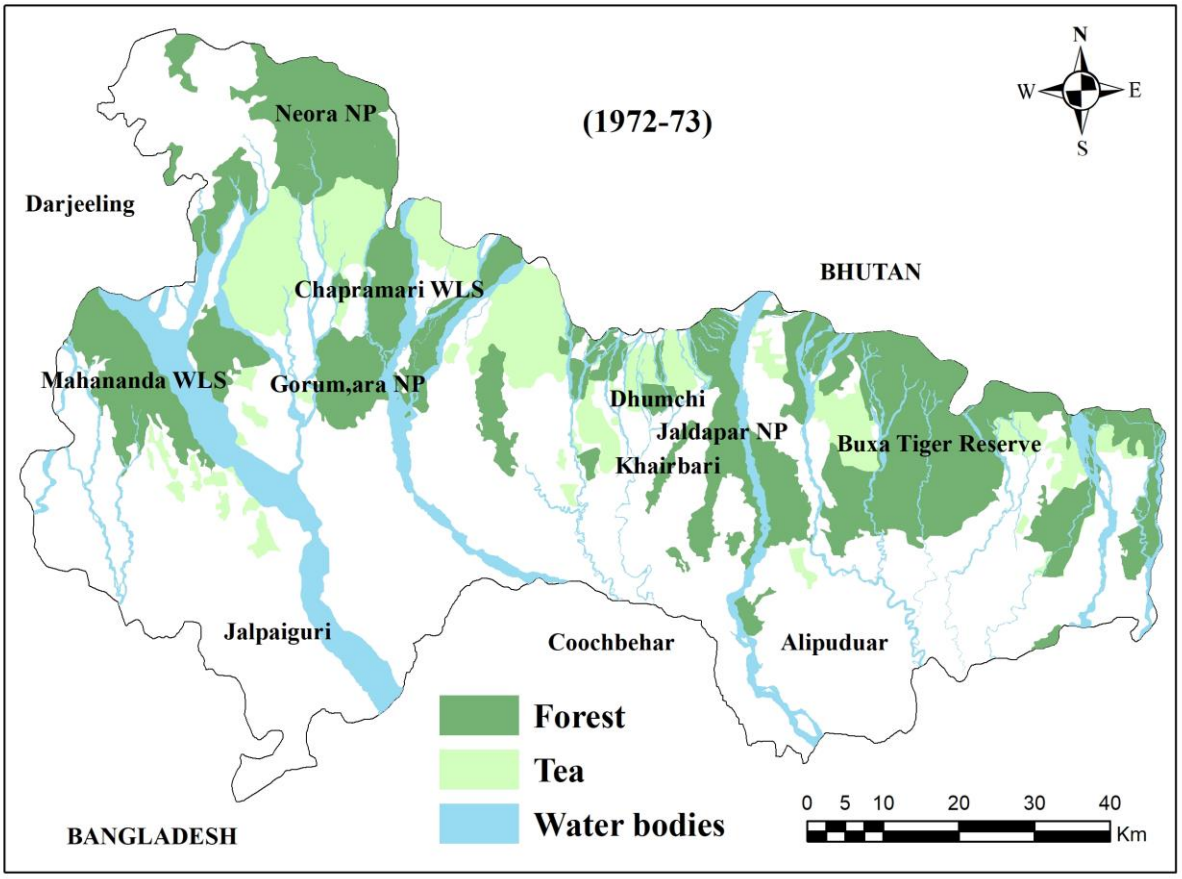
these communities find themselves subject to strict restrictions on the extraction of forest products (Madhusudhan 2005; Shahabuddin and Rangarajan, 2007).

The active interactions of the local residents near or inside the forest fringe not been able to stop or monitor properly by the forest management practitioners. A large portion of the wasteland and forests has been transformed into agricultural land and tea plantation in Dooars.

The total forest area in the year 2016-17 becomes only 1518 sq. km, it was1596 sq. km and 1923 sq. km in the year 1990-91 and 1972-73 respectively. The loss of forest cover and canopy density causes threat the biodiversity of the region. On the other hand, the area under tea plantation has been significantly increasing. According to the image data the total area under tea plantation in the years 1972-73 was 680 sq. km which subsequently rose to 984 sq. km in 1990-91 and 1168 sq. km. in 2016-17.

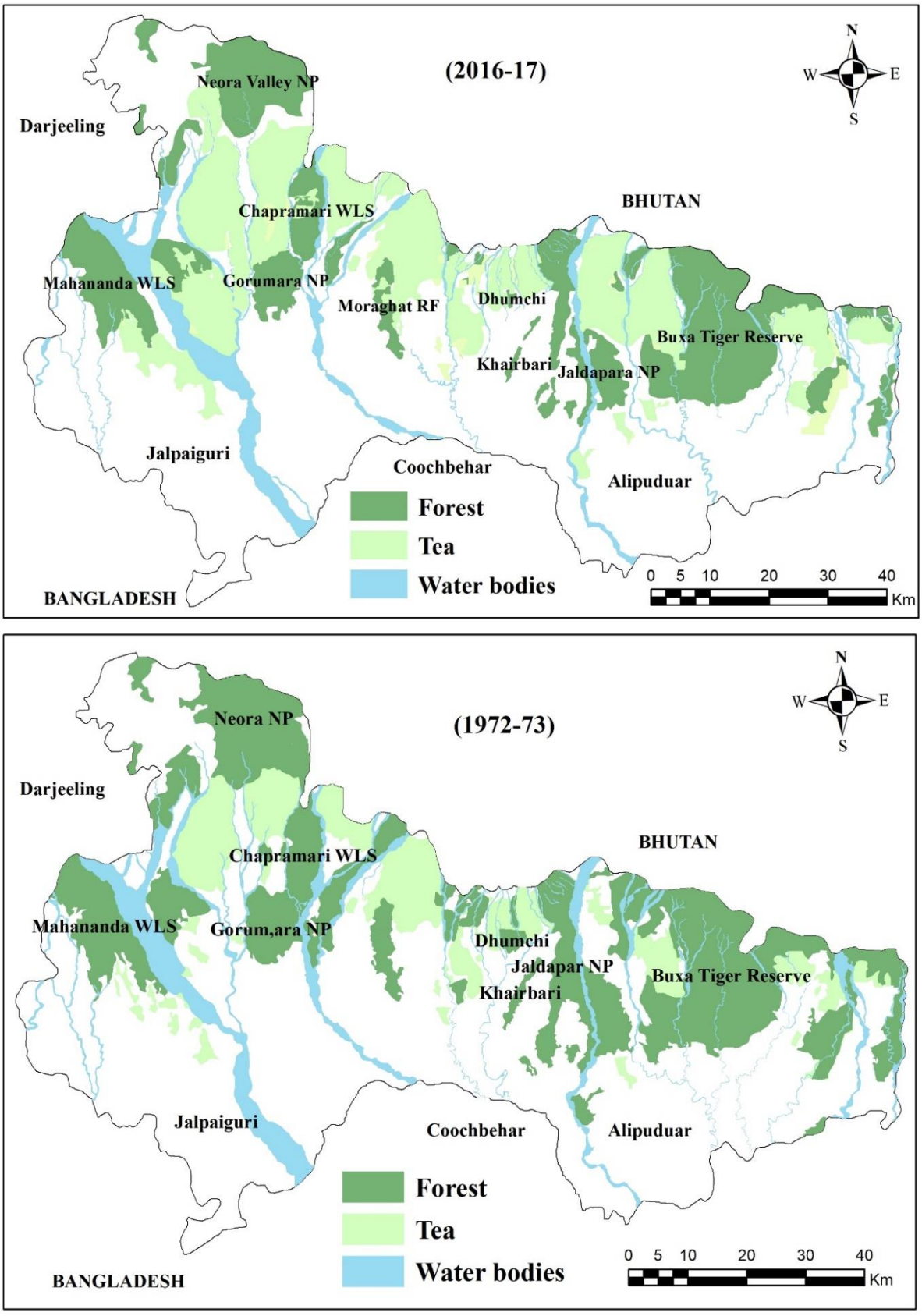
Fig. 3.8 **Forest Cover and Tea Plantation Area in Dooars (1972-73 to 1990-91)**





Source: Prepared by Researcher from Landsat-5 and LISS-III imageries, USGS Earth Explorer. October, 2017.

Fig. 3.9 **Forest Cover and Tea Plantation Area in Dooars (1972-73 to 2016-17)**



Source: Prepared by Researcher from Landsat-5 and LISS-III imageries, USGS Earth Explorer. October, 2017.

The forest cover in the year 2016-17 also shows the same fashion of decreasing trends like the year 1990s. The forest cover and tea plantations contrasting regarding their growth in Dooars. The forest cover has been decreasing with the passage of time, on the other hand, tea plantation area has been increasing continuously. The detail changed in forest cover and tea area is discussed in below.

3.6 Changes in Forest Cover in Dooars

The visual study shows a changing pattern of forest cover in Dooars. The variation that had taken place in during the period 1972-73, 1990-91 and 2016-17 are shown in the following figures, viz., 3.11, 3.12 and 3.13. The forest cover in the study area shows a significant decline. The declining rate of the forest cover was very high during the period of 1972-72 to 1990-91 (see table 3.8). The destruction of the forest cover has been lessened down during the period of 1990-91 to 2016-17.

The decelerating rate of the destruction of forest cover after the 1990s was the results of the enactments of different forest and wildlife protection laws and regulation in India. Thereby, the Dooars region is also given priority to protecting its biodiversity. Almost 50 years (1970-2017) of forest cover and its variation in Dooars has been analysed. The comparison of the forest cover portrays the clear history of the forests covers and its changes in Dooars. The total loss of forest cover during the period of 1972-73 to 2016-17 was 405 sq. km. which is -20.06 percent of the total forest area in Dooars. During the period 1972-73 to 1990-91, the highest area of forest cover loss has been identified in Buxa Tiger Reserve i.e. 71 sq. km (-10.13 %), which was followed by Jaldapara National Park i.e. 51 sq. km (-20.16 %) and other forests areas (like Dhumchi, Khairbari etc) 63 sq. km. (-29.30%). During the same time period, Gorumara region lost 44 sq. km. (-23.78%), Moraghat Reserve lost 13 sq. km (-26%), Neora

Valley lost 36 sq. km (-13.24%) and Mahananda including the Baikunthapur region lost 49 sq. km. (-19.84%) of the dense forest cover in Dooars.

In the period 1990-91 to 2016-17, the destructions of forest cover show a substantial decline in the rate of loss. Some of the areas which recorded for significant change in forest cover are Moraghat Reserves 6 sq. km (-16.22%) and the other forests areas 31 sq. km (-20.39%). The main reasons for such high rates of forests cover change in the other forests areas may be the human pressure as most of these forest areas contains a high density of population. The alteration of the forest land for plantation purpose and management intervention like regeneration and forest clearances in some areas are another important drivers of forest cover change in Dooars.

Table 3.8 **Comparative assessment of forest cover in Dooars (1972-73 to 2016-17) (Sq.km.)**

Year and Forest Areas				Changes					
				1972-73 to 1990-		1990-91 to		1972-72 to	
Protected	1972-72	1990-91	2016-17	sq. km	%	sq. km	%	sq. km	%
Jaldapara NP	253	202	194	51	-20.16	8	-3.96	59	-23.32
Moraghat RF	50	37	31	13	-26.00	6	-	19	-38.00
Gorumara NP	185	141	132	44	-23.78	9	-6.38	53	-28.65
B. T. R.	701	630	623	71	-10.13	7	-1.11	78	-11.13
Neora Valley	272	236	231	36	-13.24	5	-2.12	41	-15.07
Mahananda	247	198	186	49	-19.84	12	-6.06	61	-24.70
Others	215	152	121	63	-29.30	31	-	94	-43.72
Total	1923	1596	1518	327	-17.00	78	-4.89	405	-21.06

Notes: NP (National Park), WLS (Wildlife Sanctuary), RF (Reserve Forest), BTR (Buxa Tiger Reserve).
Source: Computed from Landsat-5 and LISS-III imageries obtained from Earth Explorer, USGS. October, 2017.

Fig 3.10 **Forest Cover in different protected areas of Dooars (1972-72 to 2016-17)**

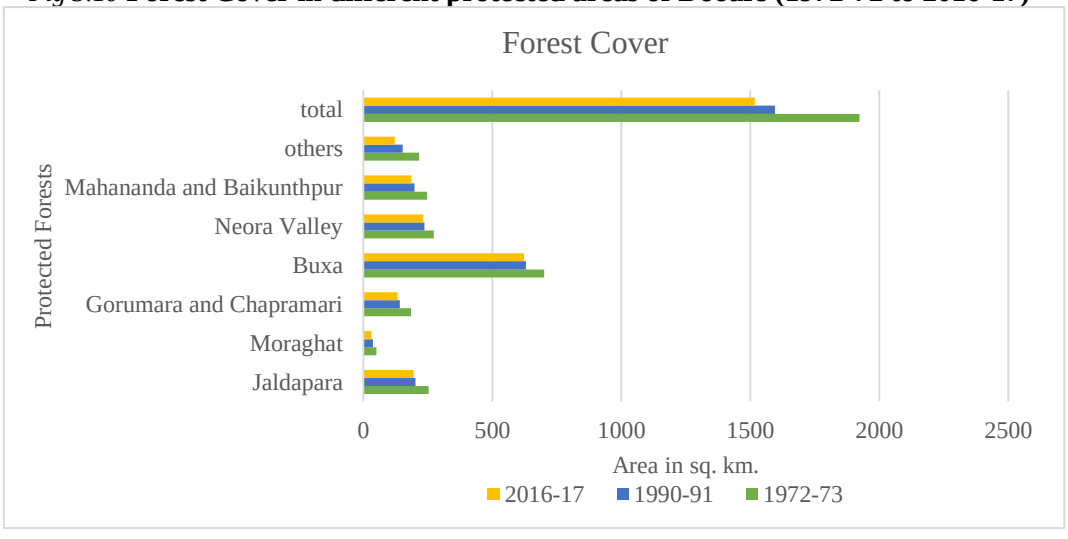
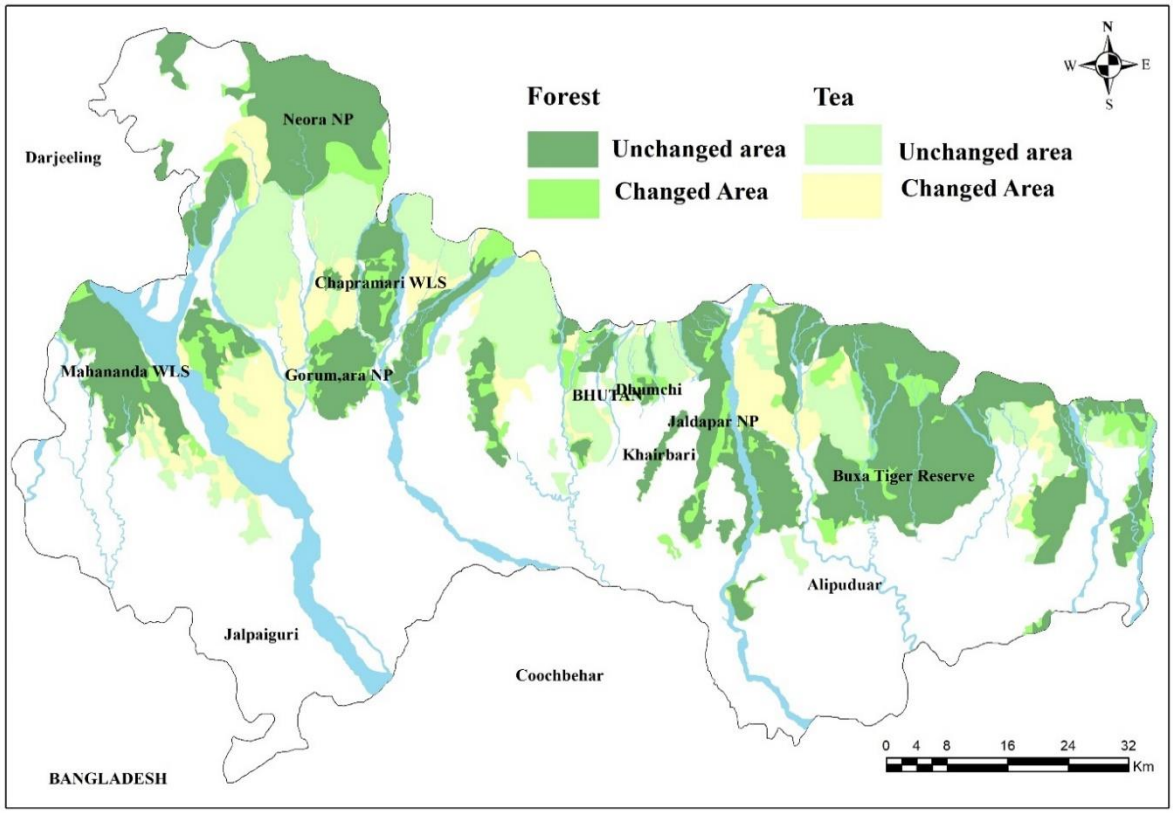
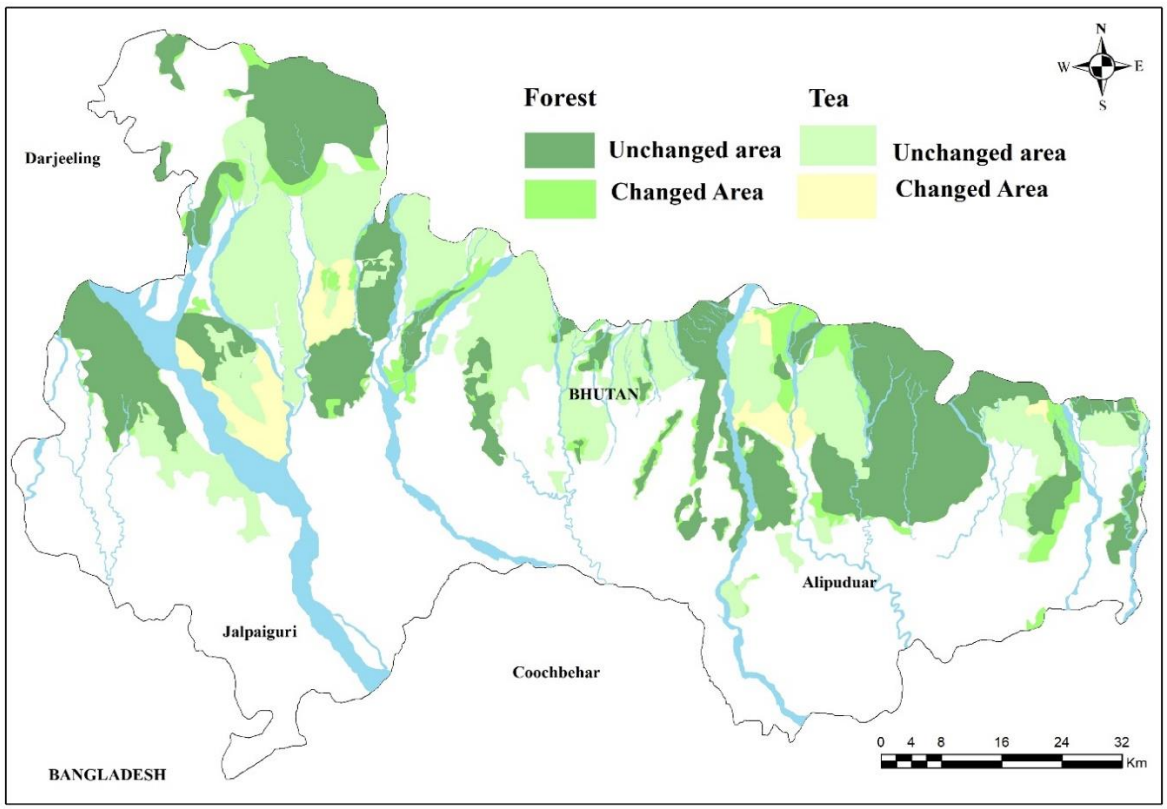


Fig 3.11 **Forest Cover Change in Dooars (1972-73 to 1990-91)**



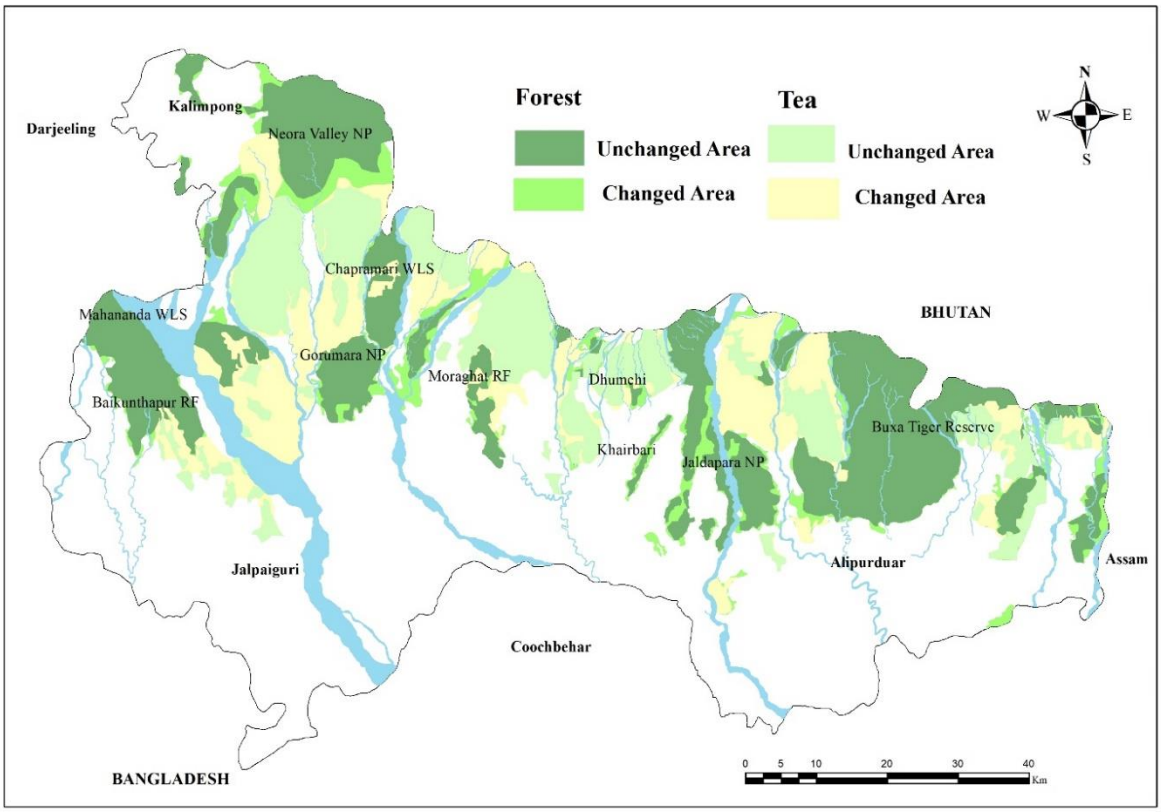
Source: Prepared by Researcher from Landsat-5 and IRS LISS-III imageries, USGS Earth Explorer. October, 2017.

Fig 3.12 **Forest Cover Change in Dooars (1990-91 to 2016-17)**



Source: *Ibid.*

Fig 3.13 **Forest Cover Change in Dooars (1972-73 to 2016-17)**



Source: *Ibid*.

3.7 Changes in Tea Plantation Areas in Dooars

The area under tea plantation has been increasing in Dooars. The most heartening fact is the decline in forest cover resulted in an increase in the area under tea plantation in Dooars. The introduction of plantation agriculture was the main reason behind the destruction and fragmentation of the forest land in the Dooars. The destructions processes of forests have been augmented by different developmental activities, especially after the independence.

In the year 1972-72, the area under tea plantation in Dooars was 680 sq. km. During the following years, it has been subsequently increased with an additional area of 304 sq. km (44.71%) to 984 sq. km. in 1990-91 and 180 sq. km. (18.29 %) 1164 in 2016-17 (see fig. 3.11, 3.12 and 3.13).

Table 3.9 **Area under tea plantation in Dooars (1972-2017) (Sq. km)**

Year and Plantation Area				Changes					
				1972-1990-91		1990-91 to 2016-17		1972-73 to 2016-17	
Year	1972-73	1990-91	2016-17	sq. km	%	sq. km	%	sq. km	%
Area	680	984	1164	304	44.71	180	18.29	484	71.18

Source: Computed from Landsat-5 and LISS-III imageries obtained from Earth Explorer, USGS. October, 2017.

3.8 Concluding Remarks

The distribution of forest cover under different canopy density in Darjeeling, Jalpaiguri and Coochbehar show an increase during the year 2001 to 2015. Prior to the year 2001, the total forest under different canopy density (very dense, moderate dense, dense and open forest) was 1455 sq. km., 1582 sq. km. and 32 sq. km in Darjeeling, Jalpaiguri and Coochbehar district respectively. In 2001, the total forest in the Darjeeling, Jalpaiguri and Coochbehar increased to 2196 sq. km., 2344 sq. km. and 38 sq. km. respectively. With a further increase it become 1004 sq. km. in Darjeeling, 2863 sq. km. in Jalpaiguri and 348 sq. km in Coochbehar during 2015. The unexpected increase of forest cover under different canopy density could be the results of satellite imagery analysis, earlier it was conducted through real ground survey of forests. It is very difficult to delineate a proper boundary between forests and tea areas in Dooars from the satellite imageries as the signature value overlaps each other which might resulted in increase of forest density. Therefore, an extensive field survey needed to be carried out to assess the actual forest cover in Dooars.

The encroachments and degradation of forest land in every protected areas of Dooars are very high. In Dooars the total forest area encroached in 2008 was 1437.66 hectares. The encroachments of forest area in Jalpaiguri district was 293.54 hectares. The encroachments of forest area in Darjeeling district was 148.16 hectares. The forests of Buxa and Baikunthapur in Jalpaiguri district has been impacted by encroachments.

The Buxa region and Baikunthapur forest lost 98.5 hectares and 56.75 hectares respectively during 2008. Although, there was a decrease in of encroachment in forest in the total area which encroached during 2010 was 1291. 14 hectares. During 2013, the total encroachment of forest was 1454.25 hectares in Dooars.

The encroachments of forests leads degradation in forest cover and thereby the wildlife becoming more vulnerable in protected areas of Dooars. The comparative assessment of forest cover in three district show an uneven trends of growth. During 1988 to 2006, Darjeeling district lost the more than seven percent of forest land. On the other hand, the forest land in Jalpaiguri and Coochbehar show an increase. The total percentage of forest land in Jalpaiguri was 25.72 (1602 sq. km) in 1988. With an increase it reached 29.93 percent (1864 sq. km) in 2006. Similarly, in the Coochbehar district the forest cover percentage was 1.03 (35 sq. km) in 1988 which increased to 1.3 percent (44 sq. km) in 2006. Though in the forest report increasing trends of forest cover has been showed, the question is that there may be an increase in forest, does the quality of the forest or originality of the forest cover remain same? the question remains unaddressed.

As said earlier, the plantation agriculture disturbed the whole mechanism of the forest ecosystem in Dooars. The loss in the canopy density of forests caused further problems of the wildlife management in Dooars. The loss in forest cover bring multifarious problems in Dooars; like break in natural food chains of the wildlife, fragmentation of the biological corridors and other socio-economic problems for the local human population. The depredation of wildlife from their natural habitats leads numerous cases of Human-Animal Interactions in Dooars.

All these observations clearly prove that forest cover decreased in the period of 1971-72 to 2016-17. It is also inferred that area under tea plantation in the study area

has also been notably changed from 1971-72 to 2016-17. The forest cover and tea plantation area changes indicate that the area under agriculture human habitation may also substantially increase due to the results of satellite imagery analysis of three time periods proves the changes in forest cover and tea plantation areas in Dooars. As it discussed in earlier that the introduction of plantation agriculture has changed the whole scenario of the region. Initially the forests of highlands of foothills of the Himalaya was cleared for the plantation purpose by colonial ruler and gradually the wastelands, scrub forests etc. have been altered in the nearby plain areas. The relationship between the forest cover and tea plantation areas contrasting with each other. The growth in tea plantation areas resulted decrease in the forest cover in Dooars. The analysis of forest cover in the protected areas of Dooars through the satellite imageries show continuous decline in forest cover. During the year 1972-73, the total forest cover in the protected areas of Dooars was 1923 sq. km which subsequently decreased in following years and become 1596 sq. km in 1990-91. With a further decline in 2016-17, the forest cover in protected areas of Dooars turn into 1518 sq. km.

On the other hands, the area under tea plantation has been increasing in Dooars. During the year 1972-73, total area under plantation in Dooars was only 680 sq. km. which subsequently become 984 sq. km in 1990-91 and 1168 sq. km in 2016-17.

Chapter- 4

Human-Animal Relationship in Dooars

The relationship between human and animal depends upon different factors. The major factors which influence the Human-Animal Relationship are; land use, the status of major wildlife species, the density of forest canopy, fodder base, the density of human population near the forest fringes, level of Human-Animal Interactions, forest and wildlife management policies of a particular region. The Human-Animal Relationship in Dooars is discussed as follows:

4.1 Status of Major Species in Protected Areas of Dooars

A flagship species is any species selected to act as an ambassador, icon or symbol for a distinct habitat issue, campaign or environmental cause. By focusing on, and achieving conservation of that species, the status of many other species which share its habitat or are vulnerable to the same threats may also be improved. The major flagship species in the protected areas of Dooars include- Indian bison (gaur), leopard and Asian elephant, rhinoceros and some other reptiles and birds. It has been recorded that there has been a steady growth in the number of some (gaur, elephant and rhino) animals in last few years in the protected areas in the Dooars, despite frequent Human-Animal Interactions and loss on both sides. The major wildlife species in Dooars are:

4.1.1 Elephant

The Asian Elephant (also known as the Indian elephant) is a huge herbivores animal. Most of the protected areas in Dooars are well endowed with elephants and commonly found in Buxa, Gorumara, Mahananda, Chapramari, and Jaldapara. This large herbivore needs an extensive area of their existence. The fodder base in the protected areas of Dooars is not enough to keep them within the reserves, often straying

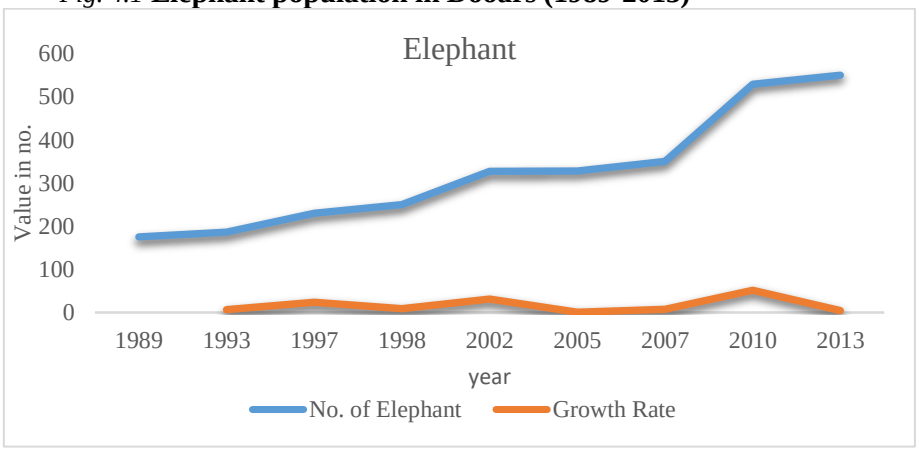
of elephant has been experienced all through the Dooars. The socio-economic pressure on forest areas is the main threat for the elephant (R. Sukumar et al, 2005 and C. Santiapillai, 2006).

Table. 4.1 **Elephant in Dooars (1989-2013)**

Year	No. of Elephant	Growth Rate
1989	175	-
1993	186	6.29
1997	230	23.66
1998	250	8.70
2002	327	30.80
2005	328	0.31
2007	350	6.71
2010	529	51.14
2013	550	3.97

Source: Computed from Annual Report 2013-14, Directorate of forest, Wildlife Wing, Govt. of W.B

Fig. 4.1 **Elephant population in Dooars (1989-2013)**



Elephant uses the tea estates as a corridor for their movements. The tea industry in Dooars has faced severe crisis whereby some tea gardens were abandoned or locked up almost overnight. The surrounding natural habitat has only faced increased human pressure owing to the mismanagement of these gardens. One of the major threats to the elephant in Asia is degradation and fragmentation of habitat. As traditional seasonal migratory routes are blocked, elephant populations will become genetically isolated from other populations and may become vulnerable to genetic impoverishment and stochastic extinction (Kemf and Santiapillai, 2000).

The positive growths in the number of elephants in Dooars (table 4.1) and migratory nature create a very challenging situation for the elephant management in Dooars. Among the different kinds of Human-Animal Interactions, the Human-Elephant Interactions rank the highest in Dooars.

4.1.2 Gaur (Indian Bison)

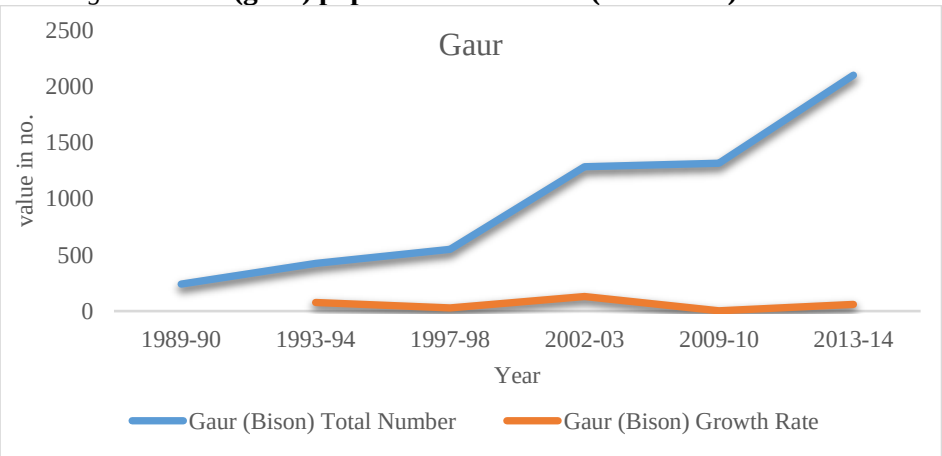
The Indian bison or gaur is a massive herbivore. There is a sizeable population of gaur, especially in Jaldapara, Mahananda, Chapramari and Buxa reserves. The gaur is listed in the vulnerable category on the IUCN red list since 1986, as the population of gaur decline in different parts of the world. The species range is likely to be well over 70 percent during the last three generations. The Indian Wildlife Protection Act of 1972 includes it under Schedule-I giving highest priority to its conservation. Hopefully, in India, the decline of Gaur population is considerably lower as compared to other Southeast Asian countries (Annual Report, WB Wildlife Wing, 2013-14).

Table. 4.2 **Bison (gaur) in Dooars (1989-2014)**

Year	Number of Bison	Growth Rate
1989-90	240	-
1993-94	425	77.08
1997-98	550	29.41
1998-99	560	1.82
2002-03	1284	129.29
2009-10	1315	2.41
2013-14	2097	59.47

Source: Computed from Annual Report 2013-14, Directorate of forest, Wildlife Wing, Govt. of W.B

Fig. 4.2 **Bison (gaur) population in Dooars (1989-2014)**



The gaur (Indian bison) population in India occurs in fragmented areas. The estimated population of Indian bison in India was between 12,000 and 22,000 according to the IUCN report (2008). According to State Forest Reports (2013-14), the number of Indian bison was 1,261 in the protected areas of Dooars as per 2002 census. In 2009-10 there was more than 901 bison only in Gorumara National Park and Chapramari Wild Life Sanctuary, while in 2013-14, 782 Bison were found only in Buxa Tiger Reserve. The census data cited by The Telegraph shows bison population to be around 2,000 in the year 2010 which was further rose to around 4,000 in the year 2012 in all reserves of Dooars. Hence, there has been a steady increase in Indian bison population in the protected areas of Dooars, The increase in Bison population in Dooars is depicted as above (fig. 4.2).

4.1.3 Leopard

The Indian leopard (*Panthera pardus fusca*) is a subspecies of leopard, widely distributed on the Indian subcontinent. The species *Panthera pardus* is classified as 'Near Threatened' by IUCN since, 2008 as populations have declined due to the following reason- habitat loss, fragmentation, Human-Leopard interactions, poaching etc. However, in India, 9,844 Leopards are being estimated in 2001 census. According to a recent report, currently, in India, they are over 11,000 in numbers. Leopard is a highly protected species in India as it is included in schedule-I of the WPA, 1972.

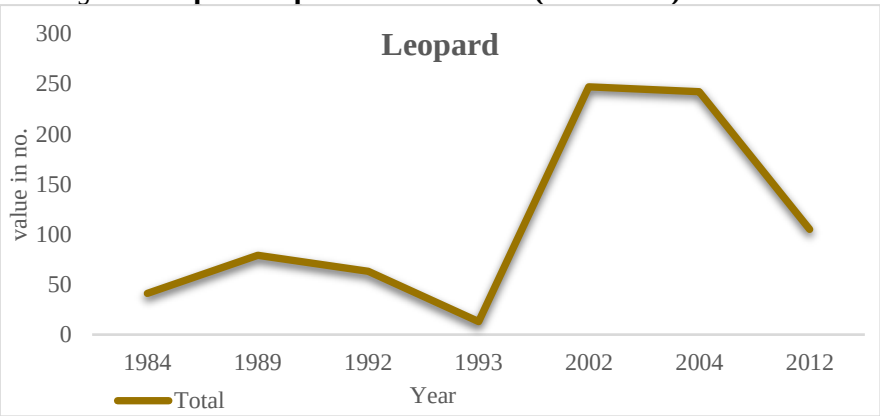
Table. 4.3 **Distribution of Leopards in protected area of Dooars (1984-2012)**

Year	Gorumara	Buxa	Jaldapara	Mahananda	Total	Growth Rate
1984	14	8	7	12	41	-
1989	14	50	5	10	79	92.68
1992	-	63	-	-	63	-
1993	2	0	9	2	13	-
2002	47	149	33	18	247	-
2004	43	145	28	26	242	-2.02
2012		105	-	-	105	-

Source: Computed from Annual Report 2013-14, Directorate of forest, Wildlife Wing, Govt. of W.B

Leopard is commonly found in different reserves in Dooars, although no reliable census report has been done yet. Leopards most commonly found in the close proximity of human habitats, especially in the tea estates of Dooars. Poaching and Human-Leopard interactions are distressing its conservation measures.

Fig. 4.3 **Leopard Population in Dooars (1984-2004)**



Leopard's natural traits e.g. high adaptability and the ability to live in wide range of habitats bring it close to the human settlements, mostly in search of prey, resulting in Human-Leopard interfaces. According to the census 2004 data of the West Bengal forest department, maximum number of leopards are present in the forests of Gorumara (43) followed by Jaldapara (28) and Mahananda (26). However, a census report in 2012 shows 105 leopards in Buxa Tiger reserve.

4.1.4 Rhinoceros

Rhinoceros are one of the largest land mammals. The Great Indian rhinoceros have a single horn, usually up to 53 cm long. The Rhino is found in the beautiful grassland and forests of Jaldapara and Gorumara. Rhino population in the two protected forests rises simultaneously during last three decades. In the year 1969, there were only 75 and 12 Rhino in the in the two well-known reserve forests of the Dooars, but the number of rhinos has been increased in the following decades. The implementation of Wildlife Protection Act 1972 has direct effects on the population of Rhinos as it was

started to grow significantly. A brief distribution of Rhino population described in table 4.4.

Table. 4.4 **Distribution of Rhinoceros in protected areas Dooars (1969-2014)**

Year	Jaldapara	Gorumara	Total	Growth Rate
1969	75	12	87	
1974	21	6	27	-68.97
1978	19	8	27	0.00
1986	14	8	22	-18.52
1989	27	12	39	77.27
1993	33	12	45	15.38
1996	42	14	56	24.44
1997	44	14	58	3.57
1999	55	19	74	27.59
2000	54	19	73	-1.35
2002	74	22	96	31.51
2004	96	25	121	26.04
2006	108	27	135	11.57
2008	113	31	144	6.67
2009	125	35	160	11.11
2011	149	35	184	15.00
2012	168	43	211	14.67
2013	186	45	231	9.48
2014	189	50	239	3.46

Source: Computed from Annual Report 2013-14, Directorate of forest, Wildlife Wing, Govt. of W.B

Fig. 4.4 **Rhino Population in Dooars (1969-2014)**

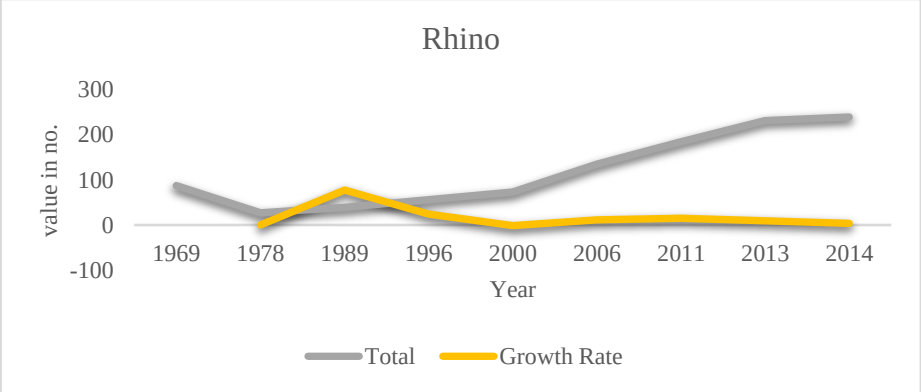
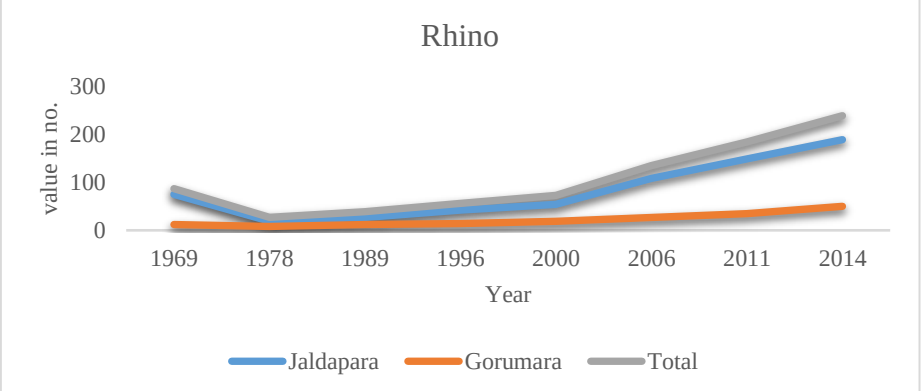


Fig. 4.5 **Distribution of Rhino Population in protected areas of Dooars (1969-2014)**



Historically, the Dooars of North Bengal has been well endowed with rhinoceros. The Jaldapara and Gorumara National Park have recorded second highest numbers of rhinoceros after the Kaziranga National Park in India. The number of rhinoceros has been growing in both the National Park. Increasing population of rhino and decreasing forest cover creates problems in the rhino management in the Dooars.

4.1.5 The Royal Bengal Tiger

The Royal Bengal tiger inhabits a wide range of habitats, from the high altitude, cold coniferous Himalayan forests to the streaming mangroves of the Sundarbans. At present, the tiger is found in the forests of Neora Valley in Dooars and the Sundarbans forests in South Bengal. The Sundarbans is the natural habitats of India's national animal the Royal Bengal tiger.

Table. 4.5 **Distribution of Tiger in protected areas of Dooars (1979-2011)**

Year	Gorumara	Buxa	Jaldapara	Mahananda	Total	Growth Rate
1979	7	27	12	10	56	-
1983	16	15	9	1	41	-26.79
1989	8	33	7	8	56	26.79
1993	-	29	9	12	50	-10.71
1997	-	32	13	12	57	12.50
1999	-	33	12	13	58	1.79
2002	-	31	12	15	58	-
2004	-	27	9	16	52	-10.71
2011	-	20	6	15	41	-19.64

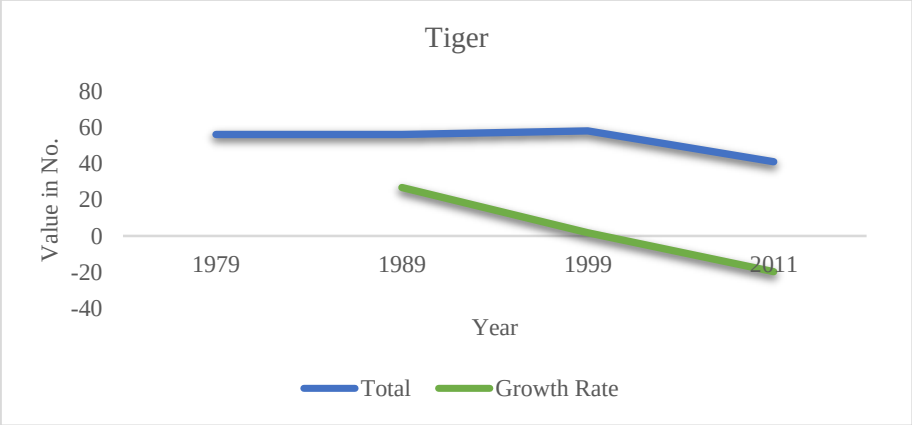
Source: Computed from Annual Report 2013-14, Directorate of forest, Wildlife Wing, Govt. of W.B

After the partition of Bengal greater parts of the mangrove forest went to Bangladesh and arises the problem of wildlife management particularly the tiger management, as the wild animal doesn't bother the international boundary, likewise, the trans-boundary problem of Tiger management arises (Annual Report, W.B Wildlife Wing, 2013-14).

In Dooars, though the census data on tiger population shows its existence and growth of its population, the real number of the tiger is always questionable here. It was the early 1980s when the tiger was found in Buxa Tiger Reserves. However, 3 tigers

have been sighted at Neora Valley National Park recently and it is one of the milestones achieved by wildlife management practitioners in Dooars.

Fig. 4.6 **Tiger population in Dooars (1979-2011)**



The other important wild species which are commonly found in Dooars are monkey, tokay gecko, Himalayan black bear, pangolin, peacock, python and different species of deer. Most of them are under risk and enlisted in IUCN red book as endangered or near to be extinct.

4.2 Human-Animal Interactions (HAI) in Dooars

Human-Animal Interactions takes many forms including crop or property damage, livestock predation, and attacks on people resulted deaths of injuries. Numerous studies, both in India and elsewhere, have shown that when residents of nearby areas are forced to absorb the costs of living with wildlife, local support for conservation may be seriously undermined (Brandon et al, 1998; Terborgh et al, 2002 and West et al, 2006).

The Human-Animal Interactions arises from a series of both direct and indirect negative interactions between Humans and wildlife. The HAI can be defined as- 'any interaction between Human and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment' (SAPRO, 2013). The HAI result in harming both the wild animals and

individuals which ultimately hamper the wildlife conservation. Apart from economic losses suffered by the human population like the destruction of agricultural crops, loss of cattle through lifting by carnivores, damage to permanent properties etc. death on both sides take the extreme form of Human-Animal interface. The retaliatory killings and accidental death of wild animals due to developmental activities in forest areas (Roadways, Railway tracks) severely obstruct the conservation measures of the threatened species. Different factors have been involved as driving forces responsible for causing Human-Wildlife Interactions worldwide. These include human population growth; land use transformations, species habitat loss, degradation and fragmentation of natural habitat; growing interest in ecotourism and increasing access to natural reserves; increasing livestock population and competitive exclusion of wild herbivores around the forest fringe; abundance and distribution of wild prey; increasing wildlife population as a result of conservation programmes, climatic factors and other events like forest fire. The frequency and severity of Human-Animal Interactions are increasing worldwide and the recent trends indicate a further escalation of such interaction. The competition for space, resources and places to call home are increasingly bringing wild animals and humans in close proximity in a violent manner. Protected areas continue to become islands of habitat encircled by increasing growth of cultivation and development. The HAI is not simply about the loss of property or life; it has serious consequences for bringing change in human behaviour and vice versa. The decrease in gratitude and increase in negative attitude towards wildlife has the serious detrimental potential to impact the natural bonding of Human-Animal coexistence.

The natural habitat in Dooars is highly fragmented due to land use change with various developmental activities like the conversion of forest into tea plantations,

settlements, agriculture and exploitation of timber. Expansion of human activities in the forest fringe resulted in the fragmented landscape which increased the frequency of Human-Animal Interfaces. There has been a number of Human-Animal Interface cases reported from Dooars on regular basis. It can be comprehended with more insight from the following discussions:

4.2.1 Analysis of Media Reports

4.2.1 a) The Telegraph

Different reports that have been published in The Telegraph (Sikkim and North Bengal section) highlighted that at least one human life has been lost every day over the last few years due to the attacks of elephants, leopards and tigers in India. A special reoprt of The Telegraph revealed that there have been at least 25 people killed every year, on an average, by wild tuskers throughout the Dooars of north Bengal. Another report said that the average death of human has been increased to 38 people in the year 2015 which was only 25 people earlier. The incidents of injuries due to the wildlife attacks have been increasing day by day.

Most of the human killings/injuries and hut/house damage has been occurred due to the wild elephant attacks. In most of the cases, the deaths of wildlife occurs due to the retaliatory killings, accidents with trains and vehicles and poaching etc. Poaching of animal parts (skin of leopards, tokay gecko, hide and the horn of rhino, venom of snake, ivory etc.) have high international markets. The seizure of such poached animal parts have been reported several times on newspaper.

The deaths of wildlife by accident with trains and vehicles is one of the major threat in recent times. The NH31 A is idenfied as one of the major hostpot of wildlife deaths due to the accident with high speed vehicles especially during the night time. The species which are often reported death on roads are deer, python, civet cat, jungle

cat etc. On the other hand, major animal which has been killed on railway tracks are elephant and bison (gaur).

The factors that has been reported for the such problematic and deterioration of Human-Animal Relationship in Dooars are shrinking wildlife habitats, vanishing animal corridors through land use changes. The newspaper reports analysis clearly portray the actual status of Human-Animal Relationship in Dooars. It is very clear that the frequency of the casualty has been intensified with time. Most of the attacks of a wild animal in Dooars are season specific. Harvesting season is the high time of wild animal straying, especially for the jumbo Asian Elephants. Most of the leopard attacks have been reported from Tea Gardens, which are closely located near the forest fringes. The following table shows the details of casualty reported in The Telegraph and *Uttarbanga Sambad*.

Table 4.6 **Human & Wildlife Casualties Reported in The Telegraph & *Uttarbanga Sambad* (2003-2017)**

	Year	Human killed	Human injured	Wildlife killed	Wildlife injured	Hut Damage	Crop damage in no.
The Telegraph	2003					25	
	2004			1			
	2005	9	1	1			
	2006		1			28	
	2007			2		30	
	2008	1		1		2	
	2009	13		1			
	2010	1				1	
	2011	1					
	2012	1					
	2013			4			
	2014		4		2		
	2015	2				8	
	2016	1					
	2017						
Uttarbanga Sambad	2015	2		2			
	2016	1					
	2017	6	11	5			5
Total		**38**	**17**	**17**	**2**	**94**	**5**

Source: Computed from table no. 4.7 and 4.8.

Table. 4.7 **Major Incidents of Human-Animal Interactions in Dooars Published in The Telegraph (2003-2017)**

Location	Year/ Date	Author/Title of the Article	Brief Summary	Human/ Property	Animal
Sukna, Siliguri	Nov 4, 2003	Kunal Sengupta	Two youths are preparing rice beer known locally as '*handia'*. The peaceful scene is disrupted by the sudden appearance of an elephant, lured to the spot by the heady smell of the liquor.	Hut damage	
Bagdogra, Siliguri	July 04, 2003	Correspondent	Eighteen houses were destroyed after a herd of wild Elephants entered Kestopur village in Bagdogra area.	House damage	
Satali T.E. Alipurduar	July 10, 2004	Correspondent	A Leopard was critically injured when residents of Satali Tea Estate Attacked the leopard with sharp weapons.		1 dead
Jalpaiguri	Nov 29, 2005	Correspondent	Four people were killed by elephants in three different incidents in various parts of the district.	4 dead	
Hatighisha & Jamindarguri,	Nov 30, 2005	Correspondent	Five-person in three days to have dead in elephant attacks. And a Tusker body found in Buxa tiger reserve.	5 dead	1 Elephnt. dead
Alipurduar	Mar 5, 2006	Correspondent	A person killed by an attack of Elephant. Almost 60 percent of accidents resulting from human-elephant conflict in the West Bengal takes place in this region.	1 dead	
Alipurduar	Mar 28, 2006	Correspondent	The Report says **every year**, on an average, **at least 25 people are killed** by wild tuskers throughout the Dooars in north Bengal.		
Sukna, Siliguri	July 14, 2006	Correspondent	A herd of around 50 Elephants attacked Malibhita village in the Simulbarie tea estate area and brought down as many as 28 huts in search of food.	Hut damage	
Siliguri	Nov 03, 2006	Correspondent	An Elephant was killed by an energised fence		1 Elephnt. dead
Dakshin Mendabari,	Jan 08, 2007	Correspondent	A man was trampled to death by a wild Elephant.	1 dead	
Sevoke, Siliguri	Feb 10, 2007	Correspondent	Elephant attacked women and resulted in broken hip and leg. Saved herself by poking the tusker in the eye.	1 injured	
Mahananda WLS,	July 26, 2007	Correspondent	A two-year-old Elephant calf, straggling behind its herd, was run over by an express train on the railway tracks running through Mahananda Wildlife Sanctuary.		1 Elephant injured
Mahananda WLS, Siliguri	July 28, 2007	Correspondent	An Elephant calf lying beside the Railway tracks inside Mahananda Wildlife Sanctuary. The calf was run over by the Guwahati-Jhajha Express.		1 Elephnt. dead
Tasati T.E. Alipurduar	Oct 12, 2007	Correspondent	At least 30 workers' quarters, including a few semi-pukka houses, in Tasati Tea Estate in Falakata were completely destroyed by wild Elephants. In the same month in Binnaguri Tea Estate, a herd razed another 30 huts to the ground	House damage	

	May 21, 2008	Correspondent	According to data available with authorities of Project Elephant, a conservation body formed under the Union ministry of forests and environment, **982 people have dead** in Elephant attacks in Bengal **between 1991-92 and 2006-07** and most of them occurred in Dooars of North Bengal.		
Indo-Nepal Border, Siliguri	Jun 26, 2008	Correspondent	Animesh Bose, an environmentalist of Siliguri said that **11 Elephants die** on the Indo-Nepal border in the past five-six years, after suffering injuries from the bullet, pellets, stones and live wire.		
Dooars T.E. Alipurduar	July 29, 2008	Correspondent	An Elephant trampled to death a man inside a Dooars tea estate adjacent to Buxa Tiger Reserve (East) last night. This is the fourth such incident in Dooars in the past one week.	1 dead	
Soongachhi T.E. Alipurduar.	Aug 13, 2008	Correspondent	An adult male Leopard suspected to have been hit by a speeding night train was found dead on the railway tracks near Soongachi Tea Estate in the Dooars.		1 Leopard dead
Goodhope T.E. Mal	May 15, 2009	Correspondent	2 person killed by Leopard	2 dead	
Alipurduar	Aug 12, 2009	Anirban Choudhury	Seven persons, including two children, have been killed and at least 60 have been mauled by Leopards between April 2008 and July this year.	7 dead	
Sevoke, Siliguri	Aug 14, 2009	Correspondent	Two wild Elephants in a midnight raid damaged a primary school at Sevoke Bazar and ate up sacks full of rice and pulses.	House damage	
Takimari, Siliguri	Oct 22, 2009	Correspondent	Three women killed by Elephant at Baikanthpur forest Division	3 dead	
Matiali, Jalpaiguri	Oct 28, 2009	Maya Roy	A 40-year-old resident of Dhupjhora in Matialli block was killed by an Elephant in Murti Range of Gorumara National Park.	1 dead	
Uttar Chakoakheti, Alipurduar	Oct 29, 2009	Correspondent	A female Barking Deer dead at Uttar Chakoakheti under Bania beat of Wild Life-III division on Wednesday morning.		1 Deer dead
Khuttimari forest near Dhupguri,	Apr 12, 2010	Correspondent	The Leopard attacked one village after another. Hearing the news, guards from the wildlife squads of Binnaguri and Malbazar reached the village to tranquillise and captured the leopard.	1 dead	
Naxalbari, Darjeeling	Jun 24, 2010	Correspondent	A herd of around 100 Elephants that have been roaming around in Naxalbari and the adjoining areas of Nepal. A senior forester said. This is the fourth incident in the last two years when an elephant that had crossed the border was killed either by bullets or by electrocution.		2 Elephant dead
Binnaguri, Alipurduar	Sept 24, 2010		Seven elephants were killed and one injured when a speeding goods train hit the animals while they were crossing the railway tracks near Binnaguri in Alipurduar district		7 Elephant dead

Lal Jhamelar Busti, Alipurduar	Dec 9, 2010	Correspondent	A herd of about 30 to 35 Elephants raided Lal Jhamela busti in Nagrakata and destroyed more than 200 betel nut trees.	Crop damage	
Jaigaon, Alipurduar	Jun 7, 2011	Madhu Thakur	A boy was hit by a brick that was knocked out of the wall of his house during an Elephant attack.	1 dead	
Hatipota, Alipurduar	Oct 11, 2012	Correspondent	An injured Spotted Deer was rescued from a village area. Animals straying into areas close to human habitation has exposed them to the man-made threat.	1 dead	
Binnaguri	May 30, 2013	Barney Henderson	A speeding passenger train has killed four Elephants near the forests of Moraghat in Dooars.		4 Elephant dead
Alipurduar	Jan 8, 2014	Correspondent	A Leopard that had come out of the Gorumara forest today attacked four persons. The Leopard was killed by an unidentified person.	4 injured	1
Kalchini & Hasimara,	July 1, 2014	Correspondent	A military special train mowed down two Elephants in Dooars around 2 am on Tuesday between Kalchini and Hashimara.		2 Elephant dead
Alipurduar	Aug 20, 2015	Correspondent	The herd of Elephant halted on the road surrounded by tea bushes of Gandrapara estate for nearly two hours. For those two hours, traffic was stopped on the road.		
Dalgaon T.E. Alipurduar	Nov 22, 2015	Correspondent	A herd of Elephants was crossing the railway track when the train passes through to Guwahati hit the jumbo caused death of the elephant.		1 Elephant dead
Between Damanpur & Rajabhatkhawa	Dec 25, 2015	Correspondent	A female Elephant and a calf dead after they were hit by a passenger train between Damanpur and Rajabhatkhaowa stations near Buxa Tiger Reserve. Forest sources said since 2004, 63 Elephants have dead in train accidents on the stretch.		2 Elephant dead
Siliguri	May 21, 2015	Correspondent	According to the data available with the WWF, man-animal conflicts are on the rise in the region from Mechi to Teesta in the **past five years, 38 persons dead because of Elephant attacks. Fourteen Elephants dead** during the same period. During the last five years, 12,192 bighas of crop have been damaged because of elephant depredation.		
Jaldapara NP	Feb 19, 2016		An Elephant called Tarzan throughout the night stood guarding the body of his caretaker of 10 years after he dead in a rhino attack. His master when he was being attacked by at least two rhinos.	1 dead	
Siliguri	Oct 3, 2017	Correspondent	Wild Elephant attacked in Siliguri near eastern bypass, huge damages.	Property damage	

Source: The incidents are collected and compiled by the Researcher from the English daily- 'The Telegraph', Kolkata. July, 2017.

4.2.1 b) The *Uttarbanga Sambad*

The *Uttarbanga Sambad* is a leading Bengali newspaper in North Bengal. The reports of the *Uttarbanga Sambad* revealed the hostile relationship between human and wildlife in Dooars. Different aspects of Human-Animal Interactions have been reported by the newspaper on a daily basis. Most of the time the human casualty has been reported due to the attacks of leopard and elephant. Six people has been dead during the time period of 2015 to 2017 (table no. 4.7). The case of human injury due to wildlife attacks are increasingly reported. More than 20 people has been reputedly injured during the same time period in different parts of the Dooars.

The wildlife deaths and forest related offences (seizure of animal parts, illegal felling of tree etc.) are also occasionally reported by the *Uttarbanga Sambad*. The places which have been identified from the different reports or the places which are well known for Human-Animal Interfaces in Dooars are Rajabhatkhawa and Madarihat of Buxa Tiger Reserve, Malbazar, Chalsa, Matiali and Nagrakata of Gorumara and Chapramari region etc.

The toll of property loss like hut and house damage, crop damage, livestock lifting are increasing day by day in different parts of the protected areas in Dooars. The adjacent area of Gorumara National Park has been reported on a daily basis for Human-Animal Interactions.

The evidences from different reports shows the poaching of wild animals from the protected areas of Dooars. The deaths of elephant due to the accidents with trains are one of the major problem in Dooars and it has been reported several times on *Uttarbanga Sambad* (table 4.8)

Table. 4.8 **Major Incidents of Human-Animal Interactions in Dooars Published in *Uttarbanga Sambad* (2015-17)**

Location	Year/Date	Author/Title of the Article	Brief Summary	Human/ Property	Animal
Rajabhatkhawa, Alipurduar	Dec 25, 2015	Suman Kanjilal	Death of Elephant with a calf due to the accident on the railway track near Alipurduar.		2 dead
Banarhat, Alipurduar	Dec 28, 2015	Correspondent	Bison and Leopard attacked people in Banarhat and two people have been severely injured by Bison and a women tea labours has been injured by leopard attack on the same day.	2 injured	
Malbazar	Feb 16, 2016		Women tea labour got injured by the attack of a Leopard.	1 injured	
Ambari, Siliguri	Feb 16, 2016	Correspondent	The quick response team has been prepared to tackle the Elephant attack. A man was killed by a tusker at Ambari.	1 dead	
Siliguri	Oct 4, 2016	Correspondent	A wild Tusker was out of the herd and attacked in the several places at Eastern bypass of Siliguri.	Huge damage	
Odlabari,	Mar 6, 2017	Correspondent	A man was killed by the attack of wild Elephant at Dhumsipara tea garden of Odlabari.	1 dead	
Matiali,	Mar 21, 2017	Correspondent	An injured fox was found on road near kalabari village.		1 injured
Chalsa, Jalpaiguri	Apr 3, 2016	Correspondent	An Anganwadi Kendra was destroyed by wild Tusker at chalsa in Malbazar block of Jalpaiguri.	Property damage	
Denguajhar, Jalpaiguri	Apr 5, 2017	Correspondent	A tea labour was injured due to the Leopard attack.	1 injured	
Lataguri	Apr 13, 2017	Correspondent	People are sleepless due to the fear of Elephant attack at Saraswati village near the Gorumara.		
Nagrakata and Lataguri	Apr 17, 2017	Correspondent	A lucky escape from wild tusker. An old man was escaped luckily from wild Elephant. An injured Elephant was found in Gorumara NP after a several day search operation by forest officials.		
Odlabari	Apr 22, 2017	Correspondent	Four house were rampantly destroyed by wild Elephant at Odlabari. The victims are demanded ex-gratia from forest department.	Hut damage	
Maynaguri	May 20, 2017	Correspondent	A Leopard was found on the house premises. Prior to that incident several cattle and other domesticated animals were reported as missing.	Cattle missing	
Ghoksadanga	May 11, 2017	Correspondent	Three Bison strayed from the protected area of Jaldapara and attacked several places at Mathabhanga block of Coochbehar district. Finally, two of them dead and another one back to the jungle by forest guard.	Many people injured	2 Bison dead
Garidhura	May 12, 2017	Correspondent	A Leopard was found dead near Siliguri-Kurseong road at Fulbaripaatan Tea Garden. The reason behind the death was not revealed and the body was sent for post-mortem.		1 Leopard dead
Malbazar	Jun 1, 2017	Correspondent	A temple was brought down by an Elephant at senpara of Malbazar block.	Temple damage	

Chalsa and Naxalbari	Jun 5, 2017	Correspondent	A tea labour was killed by wild Elephant at Nagti tea garden of Matiali block. On the other hand, several acres of pineapple garden was damaged by Elephant at Naxalbari on the same day.	1 dead and crop damage	
Coochbehar	Jun 26, 2017	Correspondent	Two people were killed by wild Tusker at dhandhingguri of Coochbehar and another one was dangerously injured. The news has been spread a fear in the nearby areas.	2 dead	
Gairkata	Jul 23, 2017	Correspondent	two houses damaged due to the attack of wild Tusker at midnight at Gairkata	House damage	
Malbazar	Sep 3, 2017	Correspondent	An Elephant attacked a house and destroy 8 houses and damaged paddy crops.	House and crop damage	
Banarhat	Sep 10, 2017	Correspondent	A herd of 20 Elephant found at Banarhat near the Hindi college. The herd was strayed from a protected area in search of food.		
Chalsa	Sep 20, 2017	Correspondent	A man was injured due to attack by Rhino near Dhupjhora village of Gorumara NP.	1 injured	
Malbazar	Oct 3, 2017	Correspondent	A Leopard was encaged at Rangamati Tea garden of Malbazar. The leopard was attacked by several people.	Injured many people	
Nagrakata	Oct 8, 2017	Correspondent	A herd of around 50 Elephant attacked Nagrakata near Diana tea garden and brought down as many as 8 houses as well as damaged around 50 bighas of paddy.	House and Crop damage	
Bagrakote	Oct 17, 2017	Correspondent	An Elephant calf was killed due to the electric shock. People are using electric fencing for the safeguard of their crops but the process has been killed the wild animals.		1 Elephant dead
Chalsa	Oct 23, 2017	Correspondent	A man got injured by the attack of Wild Bison.	1 injured	
Barobisha	Nov 3, 2017	Correspondent	An Elephant was killed by the poacher. The forest department has been very alert to trap that poacher.		1 Elephant dead
Lataguri & Malbazar	Nov 23, 2017	Correspondent	One people killed on NH31 by a wild Tusker in Gorumara NP, near Mahakal temple. The man went to the close to the Elephant to give a salute, by the way, the Elephant got angry and trampled down the man on the spot. On the other hand, a death of tea labourer due to the attack of elephant has been reported from Malbazar.	2 dead	
Rajganj	Dec 22, 2017	Correspondent	A herd of wild elephant attacked and damages crops and huts.	Crop and hut damage	
Permekhliganj, haldibari	Jan 9, 2018	Amit Roy	9 people injured due to the attack of a Leopard at Nayarhat of Haldibari. The leopard was tranquilised by the experts from Gorumara and Coochbehar wildlife with the help of locals and released into Gorumara National park.	11 injured	1 leopard injured

Source: The Reports are compiled and translated into English by the Researcher. Published in Uttarbanga Sambad, Siliguri. July, 2017.

4.3 Wildlife and Human killed/injured and damage of properties in Dooars

The details of wildlife death, human death as well as the crop damage and other property loss in the forest villages and forest fringes of the protected areas in Dooars is discussed in below:

4.3.1 Buxa Tiger Reserve (B.T.R)

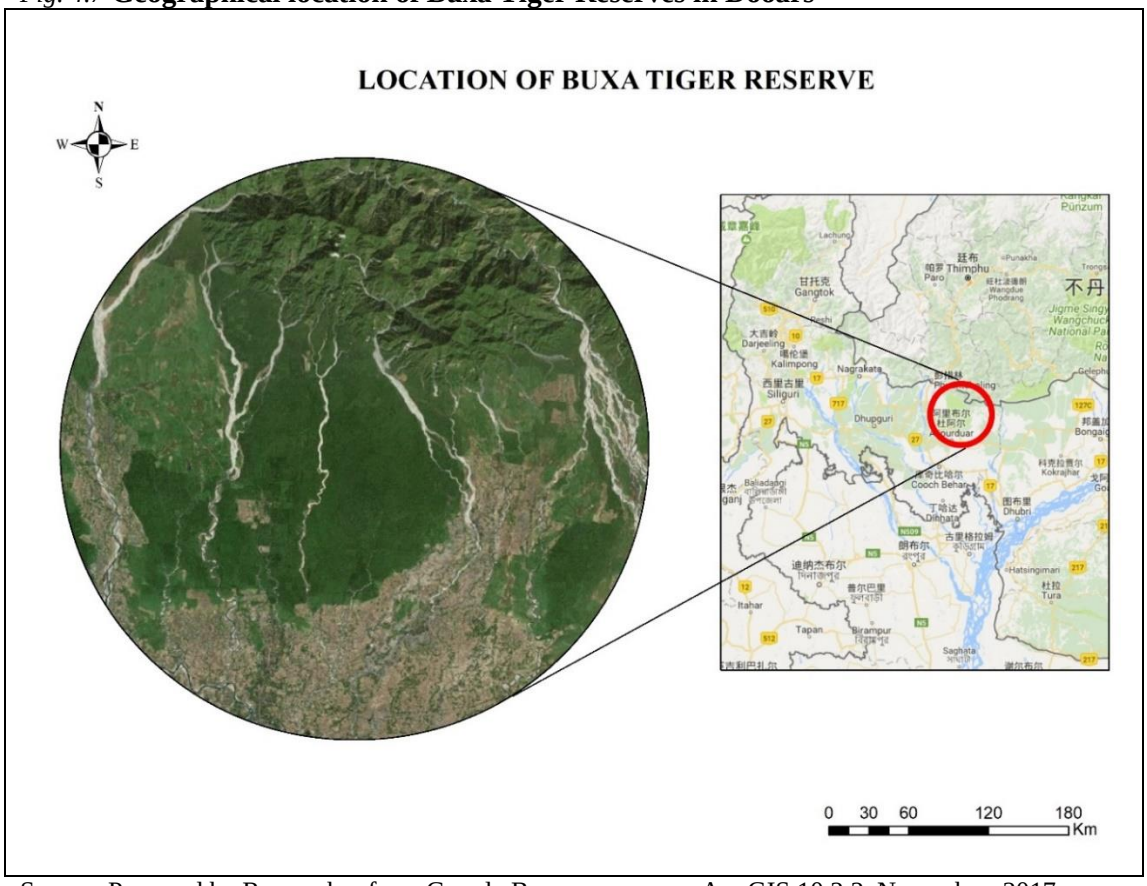
Buxa Tiger Reserve (B.T.R) is situated in the newly formed district of Alipurduar, West Bengal. The total area of the reserve is 760.87 sq. km. of which 385.02 sq. km. has been constituted as Buxa Sanctuary and National Park (Core Zone of the B.T.R) and the rest 375.85 sq. km. the area is lying outside treated as a buffer zone. Buxa Tiger Reserve was constituted in the year 1983 in Jalpaiguri district, vide no of the Govt. of India's Notification J-11025/18/B/FRY (PT). The BTR has been settled for rights and concessions u/s 19 to 25 of Indian Wildlife Protection Act, 1972 (BTR Management-cum-working plan, 2000. p-1).

It represents several species of biodiversity in India. No other Tiger Reserve in India (except Namdapha) can be compared Buxa in richness and diversity of species. About 60 percent of floral endemic species of North East India are available in Buxa. The Reserves consist of 35 Blocks and 195 compartments. It provides shelter and protection to various species of wildlife included in the Red Data Book of IUCN (The International Union for Conservation of Nature and Natural Resources) and appendix of CITES (Convention on International Trade in Engendered Species).

The Reserve lies in the Biogeographic Zone of Central Himalayas (2C) and lower Gangetic Plains (7B) as recognised by Rodgers and Panwar (W.I.I, 1988) as well as the presence of several species which are included in Scheduled I of WPA 1972.

Some of the species are given priority for the protection at national level are also been found in BTR.

Fig. 4.7 **Geographical location of Buxa Tiger Reserves in Dooars**



Source: Prepared by Researcher from Google Base map server, Arc GIS 10.2.2. November, 2017

The faunal diversity represents 68 species of mammals, 41 species of reptiles, 246 species of birds, 4 species of amphibians, 65 species of fishes and 500 species of flora and fauna. The floral diversity represents 352 species of trees, 133 species of shrubs, 189 species of herbs, 108 species of climbers, 154 species of orchids, 36 species of grasses and reeds, 6 species of canes and 4 species of bamboos (Sinha and Das, 2003). Indian Tiger, Leopard, Clouded Leopard, Jungle Cat, Civet Cat, Jackal, Mongoose, Fox are main carnivores. Among herbivores, Elephant, Gaur, Sambar, Chital, Barking deer, Hog deer, Wild pig etc. are predominant in BTR. For researchers, BTR provides an important source for gaining knowledge about biological and human

dimensions, as many endangered, threatened and rare species of flora and fauna co-exist with diverse ethnic groups and their culture for years. For the better management, the reserves are subdivided into two, which are as follows:

4.3.1 a) B.T.R West

The following discussion reveals a clear picture of the Human-Animal Relationship in the particular region of Dooars. The BTR is not only one of the biodiversity hotspot in North Bengal, often reported for Human injury/death as well as for the killings of wild animals. The types and consequences of the Huma-Animal interactions in BTR region are: a) Livestock Killing/Lifting by wild animals, b) Human death/injury by wildlife, c) Damage of Agricultural crops and Human properties by wild animal, d) death of wild animal due to human-animal interface etc.

The types of wildlife death include; natural death, poaching, Retaliatory killing, Gunshot, Arrowshot, fallen down of the electric transmission line, Accident by train, Accident on road, food poisoning, and others (Wounded, Dual fight, Cardiac failure, Bacterial infection, Failure respiratory system and Undetected cause etc.)

During the last decades, the frequency of Human and Animal death/injuries, crop damage, and property loss have significantly increased. The main reason behind such deaths are the destruction of the natural habitats, land use change in general and most particularly the change of forests cover in the area. Destruction of habitats leads by shifting in river course, converting the forest land into the plantation, illegal felling and collection of natural resources from forest, encroachments, mining, developing the railroads and other multipurpose projects. (BTR Management-cum-working plan, 2000. p-42-43)

The data reveals a clear history of the deterioration of the Human-Animal Relationship in Dooars. With the passage of time, it became acuter i.e. in 1991 only 3 animals were dead in BTR West, it becomes 30 and 21 wildlife death in 2015 and 2016 respectively. Though the death of Human has been decreased in the recent years, the crop loss and loss of property like hut damage, lifting of livestock etc. have been increasing at a huge scale in the forest fringes of different parts of the protected areas in the BTR West division. The western part of the BTR West division has been highly impacted by the Human-Animal Interactions. The beats which shares fringe land or close to the human habitation shows significant loss on both sides, the loss of wildlife and human casualty (fig. 4.10). The details of wild animal deaths can be obtains from the table 4.9.

Table. 4.9 **Chronology of wildlife deaths in B.T.R West division (1991-2017)**

Year	No. of Death	Location	Natural Death	Death due to HAI	UK
1991	3	Nimati-7 & Rydak River	2		1
1992	1	Adma			1
1993	4	Rescue Centre, Sankosh & North Bholka-2	2		2
1994	16	Rescue Centre, Panbari, Totopara, North Rydak, Marakata, Newland-2 & Cheko	5	4	7
1995	3	Damanpur, CRVK Beat, Raimatang	1	1	1
1996	4	Railway Track (GDB-3), Rescue Centre, Raimatang-8 Comptt, Pan-1 Comptt ERVK	2	2	
1997	2	Central Duars T.E. Bhurti Beat, Rescue Centre	1	1	
1998	4	Dima-4 Comptt, West Rvk, SRVK-15 Comptt, Panbari-4 Comptt	4		
1999	16	Rescue Centre, DPO-6 Copmtt, SRVK-5, SRVK-12, Radharani Tea Garden, Nimati-6 Comptt, Raimatang, RTG-3, Gudamdabri, SRVK-9, RTG-4, Shibkata Village	9	6	1
2000	21	Shibkata Village, Rescue Centre, Cheko Bridge, SRVK-6, Nimati-1, SRVK-4, Gudamdabri-3, SRVK-15, Kalchini Out Division, Gadadhar, Dima-4, Bhuti-4, Poro-5 Comptt	16	4	1
2001	12	Rescue Centre, Cheko-1, NRVK-15, West Poro Beat, SRVK-16, SRVK-2	6	5	1
2002	13	Rescue Centre, SRVK-9, Nimati-5, Panbari-1, SRVK-11, Panbari-4,	7	5	1
2003	11	Rescue Centre, RTG-5, Central Dooars T.E, SRVK-12, Poro-11, Bharnabari T.E, Cheko, Topshikhata	9	2	
2004	23	Panialguri Picnic Spot, DPO-8, Atialguri Bararangras, Rescue Centre, West Nimati, Uttar Panialguri,SRVK-5, Bhatpara T.G, Poro-6, RTG-4, Satali T.G, SRVK-3	11	7	5
2005	14	Nonai Bridge Near Cheko Beat, NRVK 22nd Mile, NRVK 15, Rescue Centre, Damanpur-3, Adma-3, GD-1 Comptt, Dalshingpara T.G, Garam Beat, Kokla Basti, Rajbhatkhawa	7	7	
2006	15	DPO-3, Bharnabari-3, Pan-3, SRVK-3, Nimati-7, Nimati Domohoni, DPO-06 Comptt East Garam Beat, Raimatang T.E, Pana Range, Gadadhar Range, Kaljani And Dima River Junction, Bhurti-4 Comptt, Poro	8	7	

2007	16	Arabindanagar (Alipurduar), 22nd Mile Tower, Salbari Railway Station Atiabari, Nimati, Dakshin Majher Dabri (East Damanpur Range), Dhap (Gadadhar Range), Nonai River, Nimati-2 Comptt, Hamiltonganj, Poro-8, DPO-2, RVK Rail Station, Patkapara	12	4	
2008	22	Panbari-10, Rajabhatkhawa, RVK-Jayanti PWD Road, Poro-4 (West Garam Beat), South Panbari Beat, Nimati Range, SRVK-9, Mechpara T.G, Pana, West Rajabhatkhawa Range, Patkapara T.G, Hamiltonganj, NH-31C (Poro Comptt), Nimtijhora T.E, SRVK-2, 25th Mile, RTG-3 Comptt, Pampu Basti, Poro-6	10	10	2
2009	15	Chaupara T.E, Poro West, Bhurti-1 (Hamiltonganj Range), East Garam Range, South Panbari Beat, Jitpur, West Garam Beat, SRVK-3, West Nimati Range, RTG-5, Mechpara T.G, Dima-3, Near Railway Track At RVK, Nimati-4	6	3	6
2010	15	Bharnabari-2, Adma-3, Mechpara T.G, Railway Track At Garopara-RVK Line (Nimati), Nimtijhora T.E, East Damanpur Range, Rajabhatkhawa Range, West Damanpur, Panbari-4, Gudamdabri Beat, Hamiltonganj Range	8	3	4
2011	23	Nimati, Dima-4, Bhatpara T.E, Rjabhatkhawa, Rescue Centre RVK, DPO-8, SRVK-7, 22nd Mile Tower, Central Dooars T.E, North Panbari Range, Chaupara T.E, SRVK On Rly Track, Madhubagan, Rly Track At RVK, Nimati, East Damanpur, Transportation Track Come From Ballavpur WL Sanctuary To B.T.R	10	10	3
2012	13	Mechpara T.G, West RVK Range, 23rd Mile, Poro Picnic Spot, Dima-4, Nimati, Hamiltonganj, Gudamdabri Beat, East Damanpur Range, Rajabhatkhawa, Chinchula T.E	10	2	1
2013	22	East Damanpur Range, West Rvk Range, West Dpo Range, Bhatkhawa T.E, Hamiltonganj Range, Kalchini T.E, Bhatpara T.E, Nimati Range	5	15	2
2014	25	West RVK Range, 25th Mile And PWD Road Junction, Dima, West Damanpur Range, Bhatkahawa T.E, Chaupara T.G, Pana Range, Bhatpara T.E, Hamiltonganj, NH31C Culvert No 211/2, Cheko Beat, West Garam Beat, Pana T.G	9	11	5
2015	30	Mechpara, West Garam Beat, Nimtijhora T.E, East Rvk Range, Rtg-7, Pana Range, Niamti Beat, Cheko-6, Uttar Patkapara, Dima-1, Labour Club Hanuman Mandir, West Damanpur Range, Atiabari T.E, Bharnabari T.E, Khokla Basti, Rvk T.E, Dpo-7, Gangutia Beat	12	16	2
2016	33	Nimati East, Bhatpara T.E, Cheko Beat, 25th Mile Buxa Feeder Road, Damanpur Range, Hamiltonganj, West Rajabhatkhawa, Dhamsibad Village, NRVK Beat, SRVK Beat, Near MES Chowpathi, Kalchini Out Division, Pana Range, Near Dalbadal Banachaya, Nimati Range,	13	15	5
2017 upto July	22	DPO8, Nimati, Rajbhatkhawa, Pan9, Ghospara, Nimtijhora, Adma2, Hamiltonganj, Bhatpara, Pana Range, NH31, Gudamdabri	11	11	
Total	**398**		**196**	**151**	**51**

Note: Types of Death Includes: **Natural death** includes *death due to old age, Sickness, wounded, dual fight, Cardiac failure, Bacterial infection, failure respiratory system;* **HAI (Death due to Human-Animal Interactions)** includes human-induced death such as *Poaching, Accident on NH, Accident by Train, Gunshot, Arrow shot, Fall of electric transmission, Fallen down in deep manmade earthen pit, Food poisoning etc.;* **(UK) Unknown** *includes no cause defined, decomposition of the carcass/death body etc.*

Source: Computed from unpublished institutional data Wildlife Division, B.T.R, Alipurduar. November, 2017.

Fig. 4.8 **Deaths of wildlife in BTR West (1991-2016)**

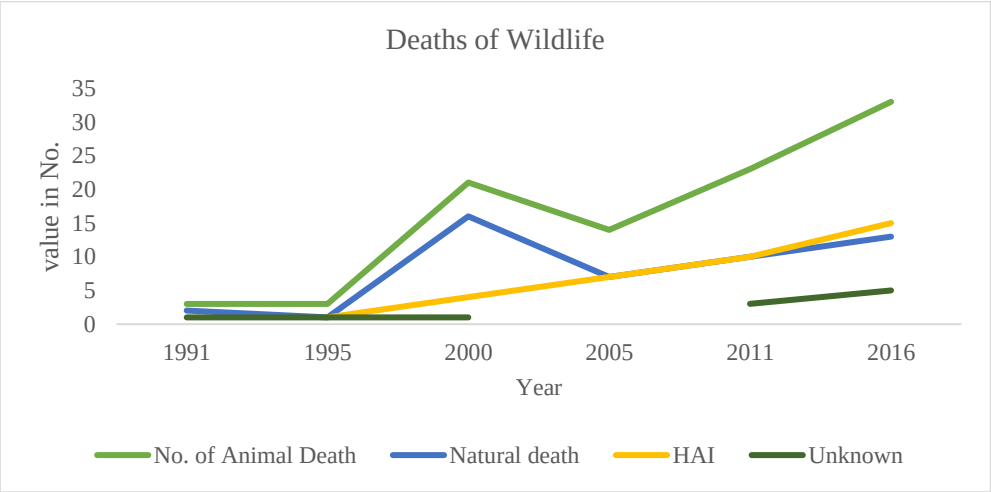
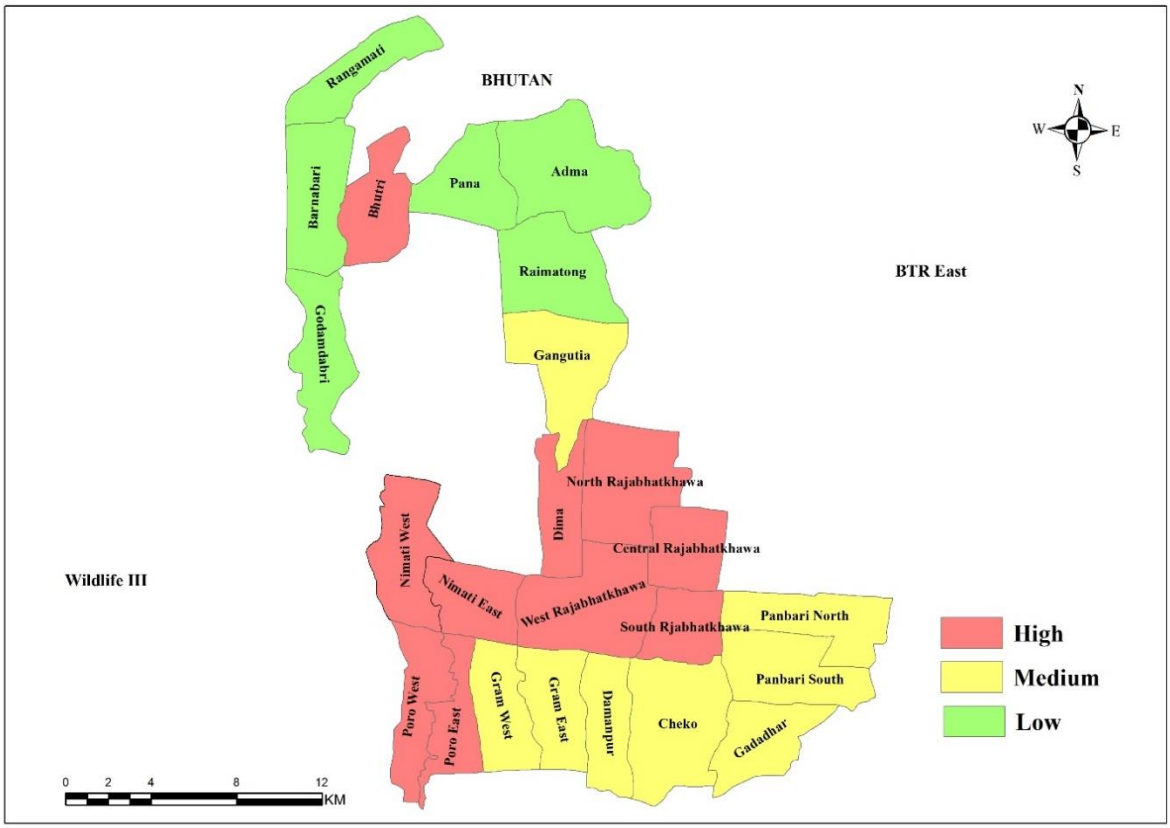


Fig. 4.9 **Levels of Human-Animal Interactions in BTR West division (1991-2016)**



Source: Prepared by Researcher based on the institutional data collected from D.F.O Buxa Tiger Reserve, Alipurduar and Forest Map gathered from Directorate of Forests Govt. of India. November, 2017.

Human death and injuries are reported in BTR mainly from tea gardens and fringe villages. Forest villages have also affected significantly. Human death and injuries are mainly caused by the Elephants, Bison in the forest fringes and by Leopards

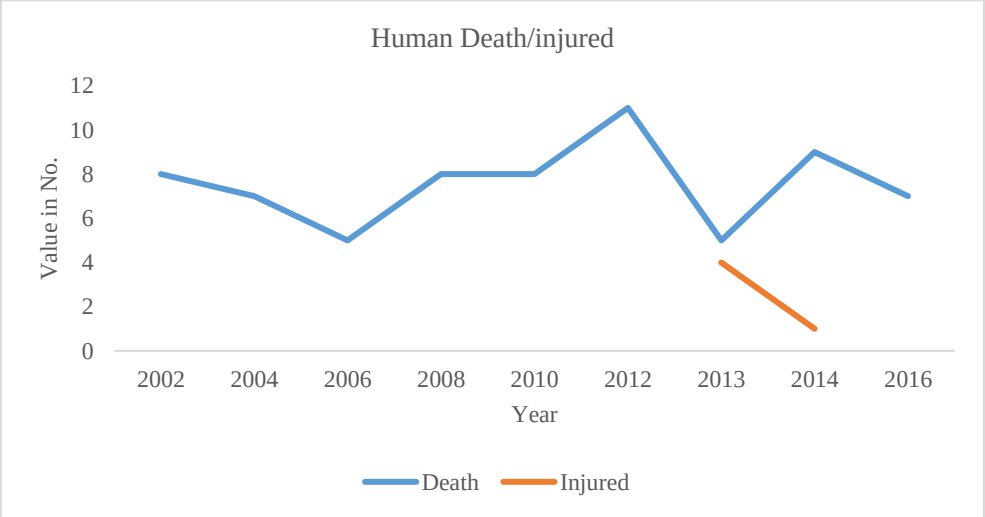
in the tea gardens. The following table (table 4.10) shows the details events of Human death, injuries, crop damage, and hut damage and livestock loss in BTR West. The intensity of crop damage is very high during the harvesting season of paddy which is August to December of the year.

Table. 4.10 **Human death/injured and property loss in BTR West Division (2002-2017)**

Year	Human dead	Human injured	Hut damage	Crop Damage in Ha.	No of Crop damage Cases	Livestock lifting
2002	8					
2003	9					
2004	7					
2005	13					
2006	5					
2007	5					
2008	8					
2009	6					
2010	8					
2011	3					
2012	11					
2013	5	4	318	241.5	40	205
2014	9	1	512		2080	143
2015	3		478		2090	2
2016	7		80	90.66	446	2
2017(up to July)	4					
Total	111	5	1388	332.16	4656	352

Source: Computed from unpublished institutional data collected from Wildlife division, BTR, Alipurduar. July, 2017.

Fig.4.10 **Human death/injured in BTR West (2002-2016)**



4.3.1 b) BTR East

The Eastern part of BTR is more vulnerable due to its close proximity to human settlement and international boundary with Bhutan. The tea gardens are the corridors for the Elephant movement towards Pipsu Reserves of Bhutan and Manas National Park in Assam Dooars. The total numbers of wildlife death in this region has been significantly increasing. The most important fact that out of the total death of wildlife, human-induced death is the highest. During the last eight years, 100 wild animals were dead and out of which 45 were due to the Human-Animal Interfaces. The following map (4.11) represents the level of Human-Animal Interactions in the BTR East division. The table 4.11 denotes the details of wildlife death cases in the region.

Table. 4.11 **Chronology of wildlife deaths in B.T.R East division (2008-2016)**

Year	No. of Death	Location	Natural death	Death due to HAI	UK
2008	9	Jainti, Hatipota, Phaskhawa-3, Rahimbad T.E, Mainabari, NRVK-2, 6, 13	2	6	1
2009	11	Jainti, Changmari, Bhutiabasti, Marakata, Rydak River, Dhowlajhora T.G, NRVK-3	4	3	4
2010	6	South Rydak, Dhowla-2, Jainti, NRVK-2,4	2	3	1
2011	9	Lankapara, Rydak T.G, Joydevpur Vill, Mainabari, Balapar, South Rydak	3	3	3
2012	11	Kartick, Ghoramara, Barobisha, Mainabari, Turturi T.E, North Chilkiguri	2	4	5
2013	20	Chipra, Barobisha, Buxa Road, Chunia, South Rydak, Chengmari, Balapara, Mainabari, Kumargram T.E, Bhutiabasti, Rydak T.G	8	10	2
2014	15	Tiamari, Phaskhawa, Newlands, Sankosh, Chipra, South Rydak, Marakata, Ghoramara, Chuniya, Balapara, South Jayanti	4	6	5
2015	15	Kumargram Forest Vill, Marakata, Kartick, Choto Daldali, Barobisha, Rydak T.G, Mainabari, Turtuti T.E, Balapara, Ghoramara, Newlands	1	8	6
2016 (up to Oct)	4	South Jainti, Tiamari, Hatipota, SRD		2	2
Total	**100**		**26**	**45**	**29**

Note: Types of Death Includes: **Natural death** includes *death due to old age, Sickness, wounded, dual fight, Cardiac failure, Bacterial infection, failure respiratory system;* **HAI (Death due to Human-Animal Interactions)** includes human-induced death such as *Poaching, Accident on NH, Accident by Train, Gunshot, Arrow shot, Fall of electric transmission, Fallen down in deep manmade earthen pit, Food poisoning etc.;* **(UK) Unknown** *includes no cause defined, decomposition of the carcass/death body etc.*

Source: Computed from unpublished institutional data Wildlife Division, B.T.R, Alipurduar. November, 2017.

Fig 4.11 **Deaths of Wildlife in BTR East (2008-2016)**

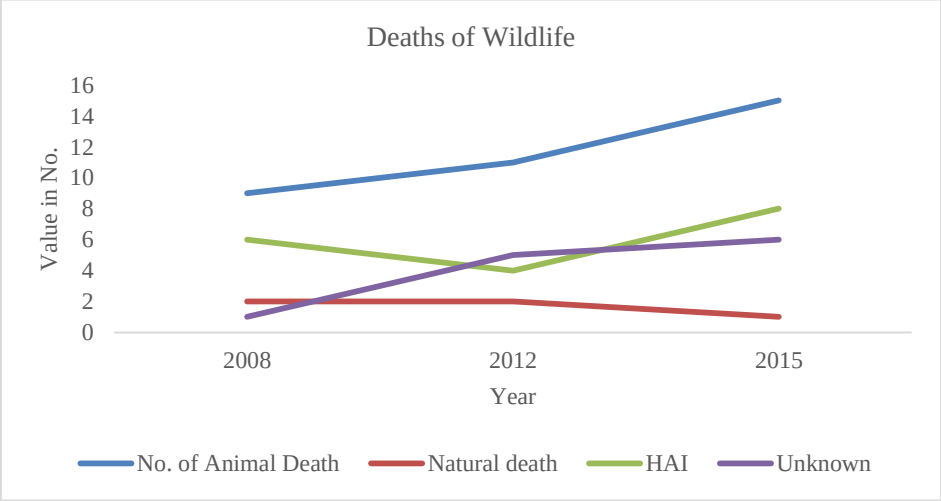
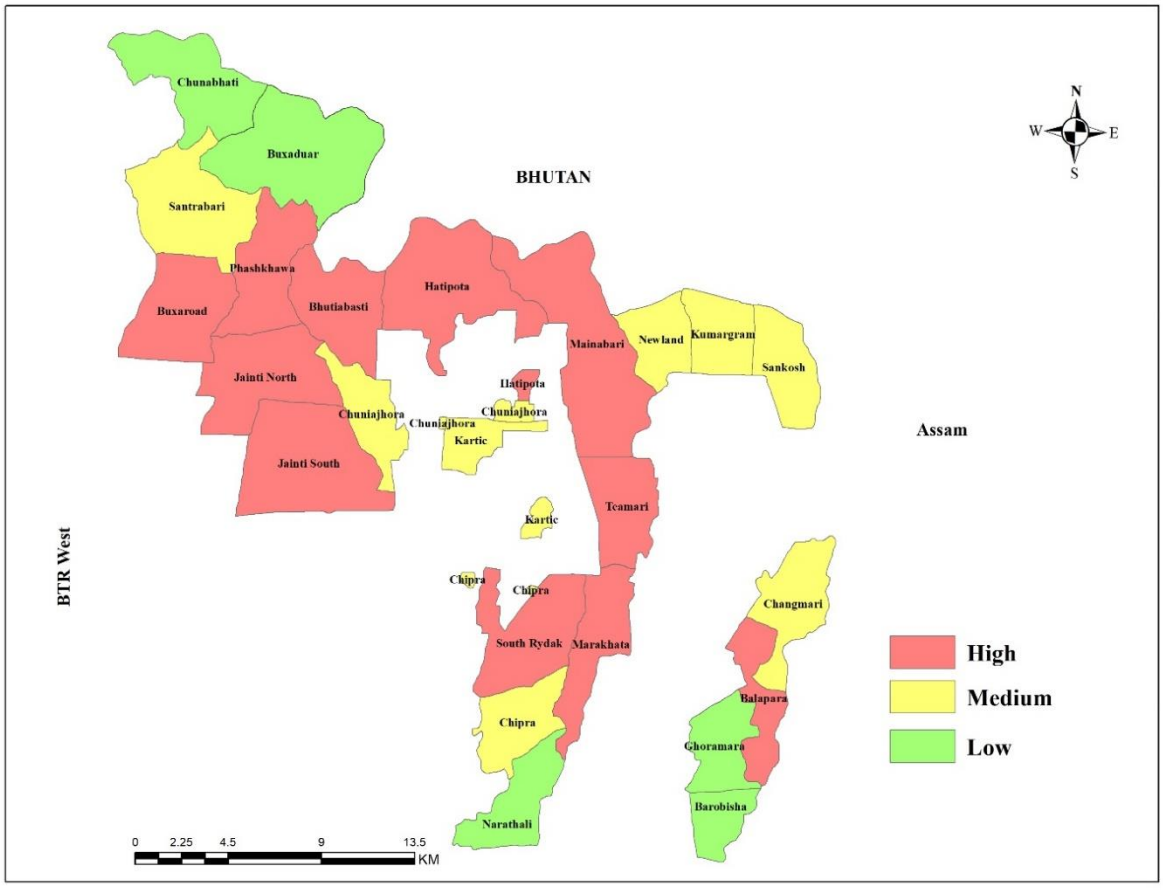


Fig. 4.12 **Levels of Human-Animal Interactions in BTR East division (2008-2016)**



Source: Prepared by Researcher based on the institutional data collected from D.F.O Buxa Tiger Reserve, Alipurduar and Forest Map gathered from Directorate of Forests Govt. of India. November, 2017.

Like the BTR West division, the human death/injuries and property loss are a very common feature in the East division too. Most of the human deaths are reported from the forest fringes, mainly from tea gardens. The number of straying of wild

animals has been increasing since the past decades (see table no. 4.12). The intensity of crop damage is also very high in this part of the reserve forest. There was 47 human death and 42 injured in last 10 years from 2005 to 2014.

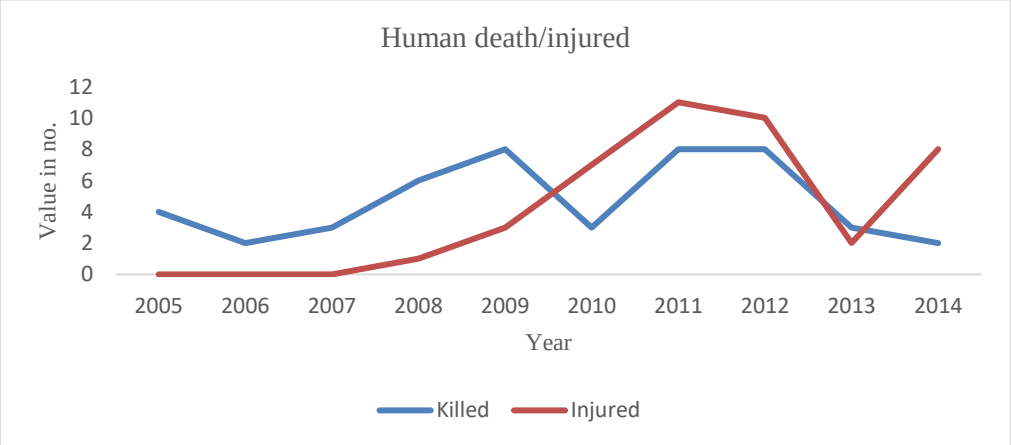
The Buxa Tiger Reserves is fringed by 34 tea gardens and 46 revenue villages with a population of more than 2.55 lakhs and density of population with 312 per sq. km. (1991 census). Most of the people living in the non-tea area depend primarily upon agriculture in forest fringes. Their main income is being supplemented by animal husbandry. The cultivation and rearing of a large number of cattle population cause pressure on the existing grassland of the protected areas which are in the zone of influence of the wildlife.

Table. 4.12 **Human death/injured and property loss in BTR East Division (2005-2014)**

Year	Human dead	Human injured	Hut Damage	Crop damage in ha.	No. of Crop damage cases	Livestock lifting
2005	4		101	198.7	496	
2006	2		169	360.13	771	
2007	3		514	335.93	629	
2008	6	1	105	254.26	635	
2009	8	3	90	193.13	579	
2010	3	7	148	115.8	434	
2011	8	11	113	171.8	644	
2012	8	10	421	283.36	708	
2013	3	2	318	241.5	603	
2014	2	8	331	241.93	659	
Total	47	42	2310	2396.54	6158	

Source: Computed from unpublished institutional data collected from Wildlife division, BTR, Alipurduar. July, 2017.

Fig.4.13 **Human death/injured in BTR East (2005-20114)**



The approximate zone of influence varies from 1-5km from the external boundary of the reserve in the southern and western parts. A radius of 2 km from the outside boundary of the reserve has been identified as a zone of influence. 46 revenue villages and 34 tea gardens are falling under the zone of influence. Four development blocks (Kalchini, Alipurduar I, Alipurduar II and Kumargram) falls under the zone of influence in Buxa Tiger Reserve. All the revenue villages and forest villages are directly involved in forest and wildlife protection. Such an interface exerts tremendous pressure on the reserve and has an eventual effect on the Human-Animal Relationship in the region (BTR Management-cum-working plan, 2000, p-108-09).

4.3.2 Jaldapara National Park

Jaldapara National Park is situated in Alipurduar and Coochbehar district of West Bengal. Jaldapara Wildlife Sanctuary was established in 1941 for the purpose of protecting the Indian one-horned Rhinoceros. In May 2012 it was declared as a National Park. The total area of the National Park is 216 Sq. Km. and the forest is mainly savannah covered with tall elephant grasses (Annual report, 2014, Wildlife wing, Govt. of WB).

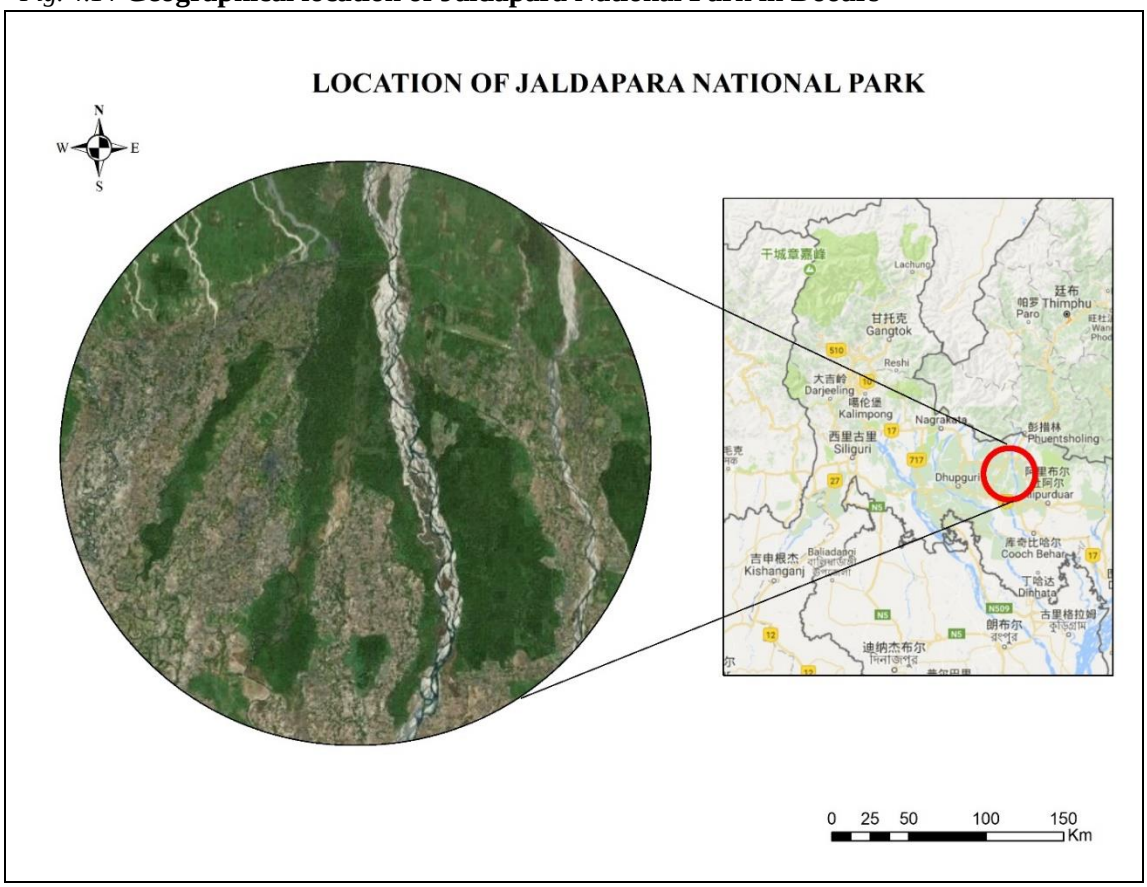
Jaldapara National Park is not just home to 186 Rhinoceroses but is also considered a success story in Rhino conservation in India. Jaldapara National Park in West Bengal and Kaziranga National Park in Assam together consist the largest habitat of the greater one-horned Rhinoceros in India.

The National Park is one of the highly rich biodiversity hotspots in the North Eastern part of India. A wide variety of flora and fauna found here. One horn Rhino is the crown of this National Park, other wild species includes, different types of Deer,

Bison, Leopard and birds. Most of the species are highly engendered and red-listed by IUCN.

Though it was a Wildlife Sanctuary, more than 60 Rhinos have been poached at Jaldapara in different times from 1971. Poaching reached maximum height in between 1968 and 1972 when as many as 28 Rhinos were poached. Incidents of poaching are not new for Jaldapara. The main reason behind the poaching of Rhinos has been the horn, which has a great international value. In most cases of poaching of Rhinos, the time patrolling forest guard could trace the carcass or dead body of Rhino, the horn was chopped off. Despite the poaching activities, forest department and conservation of Rhinos shows a great success in Jaldapara National Park. The often straying of Rhinos as well as interfaces with Human have been reported from the region.

Fig. 4.14 **Geographical location of Jaldapara National Park in Dooars**



Source: Prepared by Researcher from Google Base map server, Arc GIS 10.2.2. November, 2017.

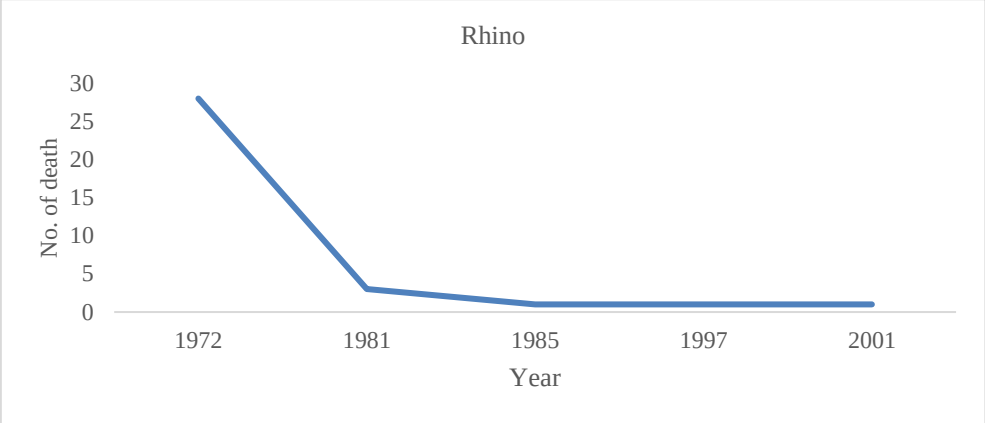
There are 11 revenue villages situated in between western and Eastern parts of the National Park and the concentration of the wildlife (especially Rhinoceros) in this parts is very appreciable. Moreover, two villages (Salkumarhat and Ballaguri) are located within the National Park, having around a thousand population and more than fifteen hundred cattle population. Fourteen tea gardens are also situated in the fringe areas. Labourer of the Tea gardens maintains large no. of cattle and carry out different illegal activities in and around the National Park. (Management-Cum Working Plan, Jaldapara NP, 2008).

Table. 4.13 **Chronology of Rhinoceros killed in Jaldapara National Park (1972-2016)**

Year	No. of Rhino killed
1972	28
1973	6
1978	1
1980	2
1981	3
1982	2
1983	2
1984	2
1985	1
1991	1
1992	1
1993	1
1997	1
1998	2
1999	1
2000	1
2001	1
2016	2
Total	**56**

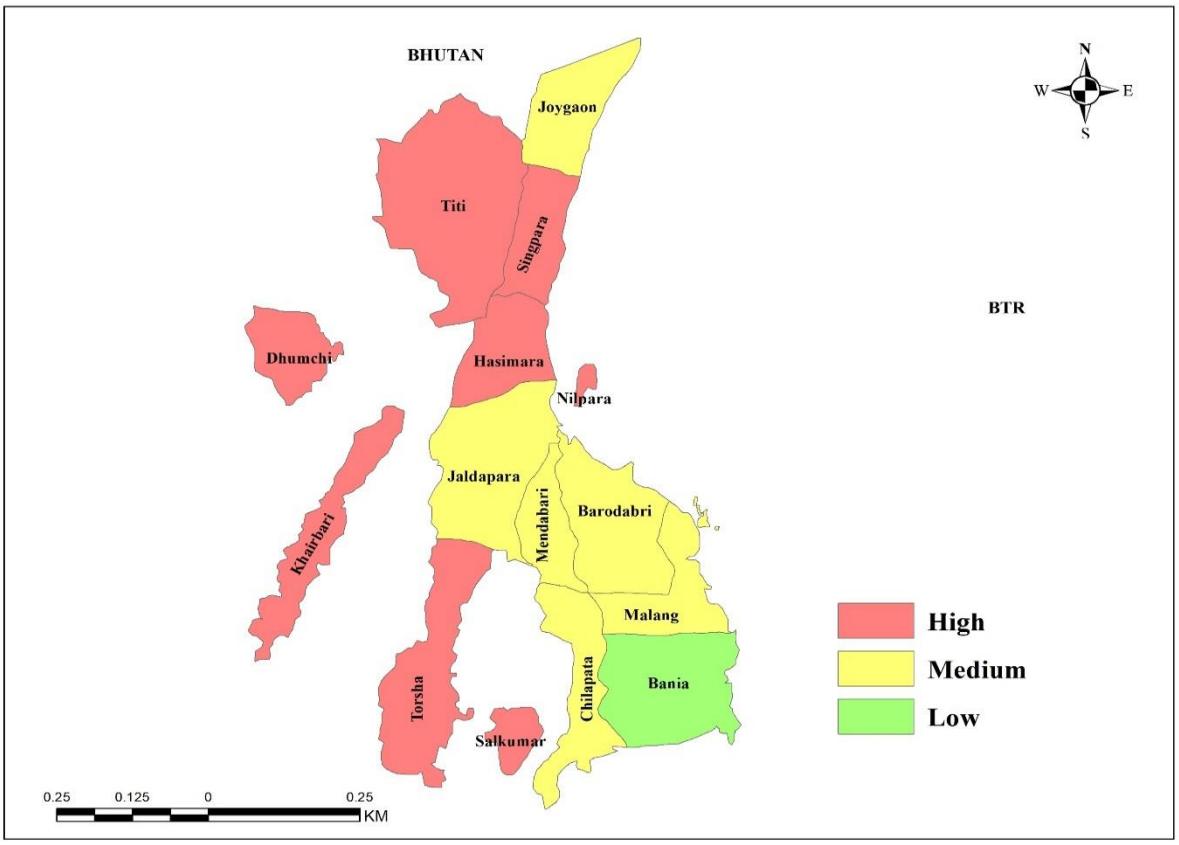
Source: Computed from unpublished institutional data collected from Jaldapara Wildlife Division, Coochbehar, July, 2017.

Fig. 4.15 **Deaths of Rhinos in Jaldapara National Park (1972-2016)**



There is a total of 32 fringe villages (excluding the forest villages) surrounding the National Park and having a huge human population. A lot of furniture shop and wood-based industries had been established in Madarihat and Falakata region. The sole source of wood is the National Park and nearby region.

Fig. 4.15 **Levels of Human-Animal Interactions in Jaldapara National Park (1972-2015)**



Source: Prepared by Researcher based on the institutional data collected from D.F.O Jaldapara National Park, Coochbehar and Forest Map gathered from Directorate of Forests Govt. of India. November, 2017.

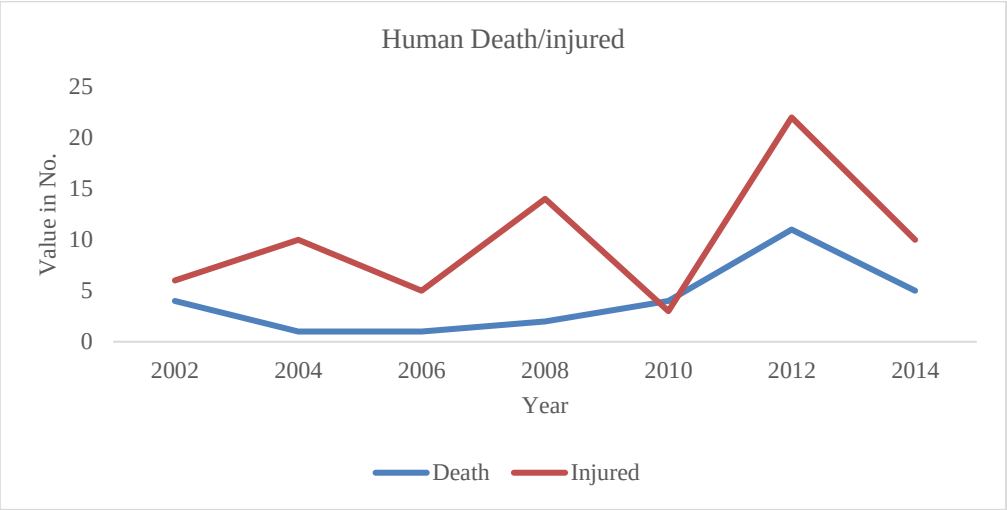
The income level of the people residing around the National Park region is in general very low and a substantial percentage of the population directly depends on the forest for their subsistence. Other employment generating activities are also very scarce. The interface of Human-Animal has been increasing at Jaldapara National Park region. Taking all these factors into account, the amount of biotic pressure exerted on the National Park is very high. The ultimate result of this factor is the deterioration of relationships between human and wildlife. Most of the death/injury cases of Human occurred in Jaldapara National Park have been due the Rhino-Human and Elephant-Human interactions. As a results, the wildlife protection is very challenging in Jaldapara National Park. To protect the Rhinos from the hand of poachers is one very challenging.

Table. 4.14 **Human death/injured and property loss in Jaldapara NP (2002-2015)**

Year	Human dead	Human injured	Hut Damage in No.	Crop damage in ha.	No. of Crop damage cases	Livestock lifting
2002	4	6	312	193.19	1402	
2003	4	7	332	123.04	875	
2004	1	10	477	120.06	863	
2005	3	9	382	96.19	1197	
2006	1	5		107.45	948	
2007	4	8		70.44	595	
2008	2	14		151.1	1155	
2009	2	13	172	69	547	
2010	4	3	530	100.74	765	
2011	1	20	654	73.81	628	
2012	11	22	880	486	624	
2013	5	13	486	370		
2014	5	10	370	194		
2015		2	194	178		
Total	47	142	3286	2333.02	9599	

Source: Computed from unpublished institutional data collected from Jaldapara Wildlife Division, Coochbehar. July, 2017.

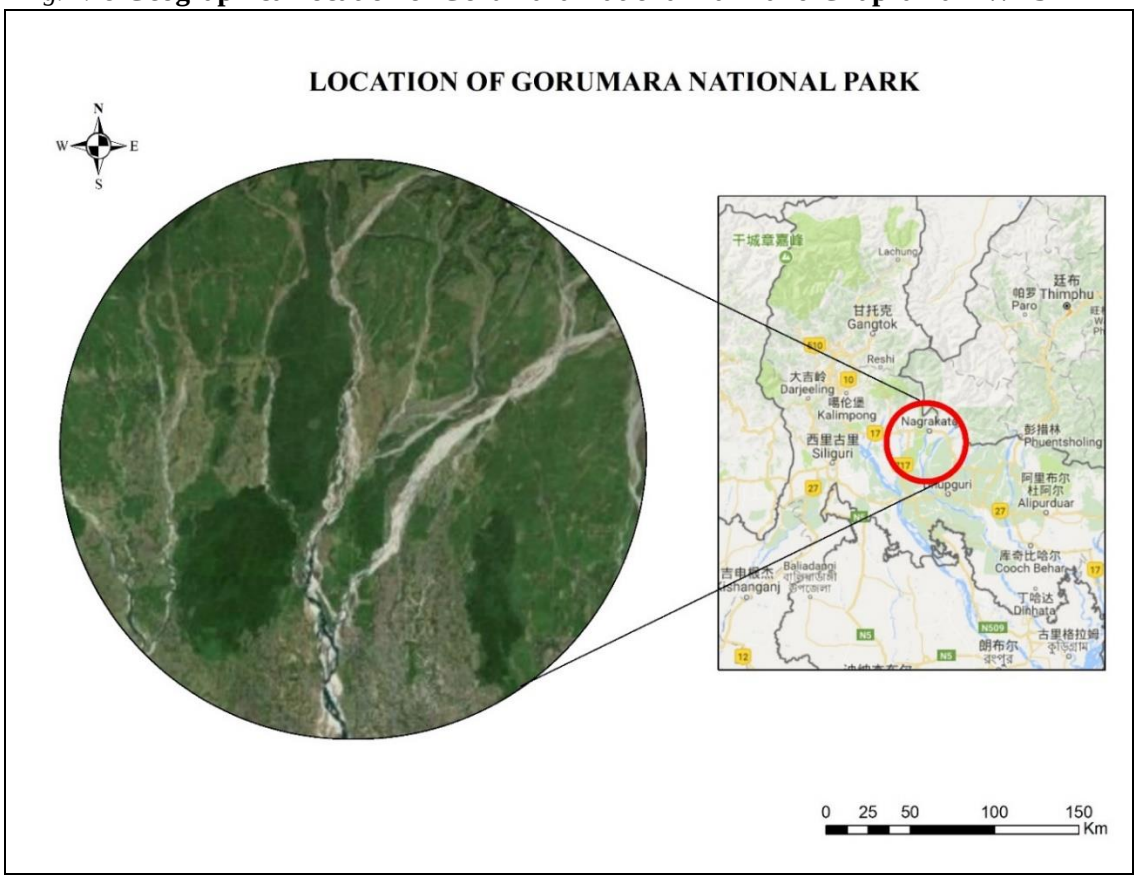
Fig. 4.17 **Human death/injured in Jaldapara National Park (2001-2015)**



4.3.3 Gorumara, Neora Valley National Park and Chapramari Wildlife Sanctuary

The Neora Valley National Park, Chapramari Wildlife Sanctuary and Gorumara National Park are under the Jalpaiguri wildlife division and treated as a same biological zone for the close proximity of these three protected areas. The increased population of some of the flagship species has created acute pressure on the available fodder base in the reserve. The reserve was only 7 sq. km and it has been increased to around 80 sq. km. The National Park is also known for one horn rhinoceros population. The other leading wild species which are commonly found in Gorumara are Leopard, deer, Bison, Elephant etc.

Fig. 4.18 **Geographical location of Gorumara National Park and Chapramari WLS**



Source: Google Base map server, Arc GIS 10.2.2. November, 2017.

The close vicinity of the high density of human habitation and other developmental processes caused a threat to the wildlife at Gorumara region. The death of wildlife in Gorumara National Park shows an increasing trend. The highest frequency of straying of wild animals is reported from this region only. These protected regions are very important in term of biodiversity richness. The Human-Animal Interactions and status of the relationship of these three protected areas have been discussed as follows:

There was the death of 475 wild animals during the last decades. Though the death of wild animals due to the Human-Animal Interfaces is accounted for only one-fourth, most of the natural deaths are also indirectly related to the Human-Animal Interactions. The main cause of the natural deaths is also partially related to tranquilization of wild animals during the time of depredations. The other causes which

are related to the high intensity of death rates of wild animals in Gorumara NP and Chapramari WLS are the effect of the road (NH31C) and railway (NFR) track. Most of the Elephant death which has been reported from this region was due to the accidents with trains (table no 4.15). There is a very less number of incidents of wildlife deaths in the Neora Valley National Park. The Neora valley is well known for its wide variety of bird species and the chance of Human-Animal interface in very less.

Table. 4.15 **Chronology of wildlife deaths in Gorumara National Park, Neora Valley National Park and Chapramari Wildlife Sanctuary (2003-2017)**

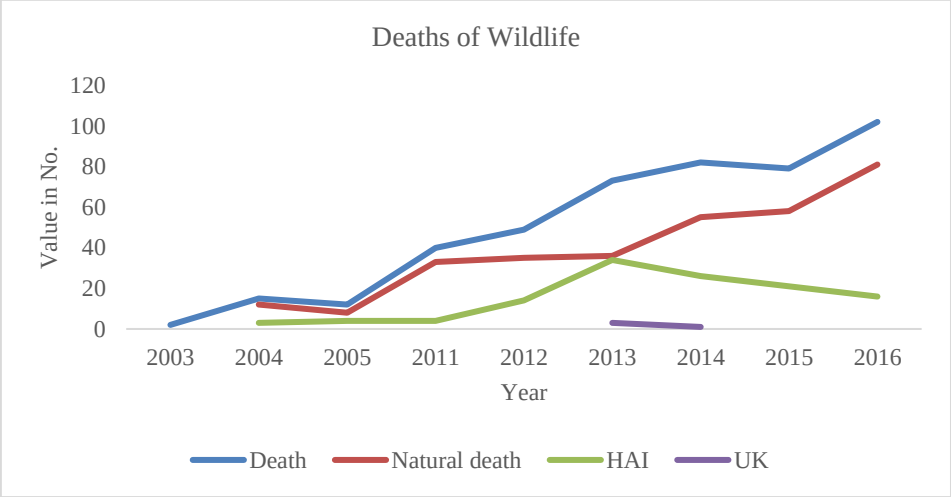
Year	Death	Location	Natural Death	Death due to HAI	UK
2003	2	Lukshan T.E, Caroon T.E, Binnaguri, Maynaguri Road, Pandapara, Moulani, Gorubathan, Bomandanga T.G		2	
2004	15	Gairkata T.G, Dharanipur T.E., On the Bank of Murti River, Rajbari T.G., Inside Grassland Gorumara	12	3	
2005	12	Lakipara T.G, On Highway near Khunia More, Northern side of Railway Line near Chalsa, Mal	8	4	
2011	40		33	4	3
2012	49	Jaldhaka-IB, Gorumara Beat, Uth Indong-I, Dhupjhora Beat, Tondu-I Compt. Nageswari TE Tondu-III Compt. Dhupjhora-I, Dhupjhora Beat Khunia F.V Lava HQ Range HQ South Indong-I, Dhupjhora Beat Gorumara-II, Gorumara Beat Bhagatpur TE Range HQ Selka-I Bamandanga TE Daina Range South Indong-II Panjhora-I(A) Dharanipur TE Jladhaka Bridge Meenglass TE Gandrapara TE, Section No. 59 Garkhuta Village Dharanipur TE Kakurjhora-II LTG Road, GMR-II South Indong-II, Gorumara Beat Ramsai Extension Budhram Beat Adhhya Salbari, Paramanikpara	35	14	
2013	73	Batabari Road Binnaguri MES Complex NH-31C near Panjhora Busty Tondu-I Bamandanga TE Near Chandrachur Tower Garokhuta Village, Sonakhali Beat BH-III, Budhram Beat Debpara TE, Division Line Mangalbari Bazar NH-31 BH-III, Budhram Beat Mogalkata TE, Gara Line Rhiabari TE Section 13 Chapramari-II Jaldhaka-IB, Gorumara Beat BH-I Bichabhanga Beat Burikhora Beat Area , Neora Range Hindupara, Gairkata Bhogalmardi-I Compt. Washabari TE Jaldhaka-IB, Gorumara Beat Dakshin salbari Kalairhat, Magurmari-I G.P. Kakurjhora-II	36	34	3
2014	82	Budhram Beat, Medla-III Uttar Dhupjhora South Indong-I Compartment Near Murti River Selka-I Compartment of Khunia Beat Khoar More, Sarkarpara, Kumlai G.P. Washabari T.E. NIC at Lataguri Kakurjhora-II Compartment Chaluani T.G. Tondu-IV Selka-II Compartment Rango Cinchona Plantation, Sec. No. 77 Chapramari-II Compartment Panjhora-Iva Compartment Jaldhaka	55	26	1
2015	79	Jaldhaka-Ib, Gorumara Beat Barohati-III, Budhram Beat South Indona-I, Dhupjhora Beat Ramsai Extension, Budhram Beat NIC NH 31(C) Road near Batabari more. Purbo MVill. Changmari T.G. Santhal Line. NIC Sec. No.17 of Mateli T.G. Deumali 31 Nos. Roadside. NH-31 near Bichabhanga Beat Jaldhaka Bridge NH -31 Road. Place of incidence Wildlife Squad- II, MAL. of Office Ground. Army Cantonment Near Karbala T.G. Panijhora - 4A Compt. Sec. No-19 of Lokhi Para T.G. N.H-31.C road Side Lokhi Para T.G. Dharanipur T.E. Jaldhaka-Ib, Gorumara Beat Sec. No-67/68 of Tota Para T.G.Chapramari-II Chapramari-II Sec. No. H-50, Chalsa T.E. Binnaguri T.G. Selka-II Aibheel T.	58	21	
2016	102	DHP-IC, Gorumara Beat Jal-IB, Gorumara Beat DHP-IC, Gorumara Beat Dhupjhora Beat NIC. Jal-IB, Gorumara Beat Tondu-3 comptt.	81	16	5

		Dhup-IB, Dhupjhora Beat Jal-IB, Gorumara Beat Chapramari-2 comptt. Chapramari-3 comptt. Kakorjhora-2 comptt. On NH31. Gorati camp. Gorumara Beat Chapramari-3 comptt. Kranti hat Barohati-III, Budhuram Beat Chapramari-2 comptt. Magurmari Dhup-IC, Gorumara Beat Dhup-IB, Dhupjhora Bat Ram. Extn, Budhuram Beat Khurti Tea Garden, Sec No. 7 Dhup-IC, Gorumara Beat Dhup-IC, Gorumara Beat NH-31 (C0) road near Panjhora Forest NH-31B Near Damdim Petral Pump, P.O.: Damdim, P.S.: Mal., Dist.: Jalpaiguri Gorumara Beat. Takeover from Panjhora Beat Officer. NIC. Changmari T.G.			
2017 up to Mar	21	NIC. South Indong-I, Dhupjhora Beat Chatt Tondu Selka-2 comptt. Gorumara Beat Kusaitari of Ramshai GP. Khemoner hat of Ramshai GP. Bhogolmardi-I comptt. Bhogolmardi-II comptt. Dhup-IB, Dhupjhora Beat. Lava	17	3	1
Total	**475**		**335**	**127**	**13**

Note: Types of Death Includes: **Natural death** includes *death due to old age, Sickness, wounded, dual fight, Cardiac failure, Bacterial infection, failure respiratory system;* **HAI (Death due to Human-Animal Interactions)** includes human-induced death such as *Poaching, Accident on NH, Accident by Train, Gunshot, Arrow shot, Fall of electric transmission, Fallen down in deep manmade earthen pit, Food poisoning etc.;* **(UK) Unknown** *includes no cause defined, decomposition of the carcass/death body etc.*

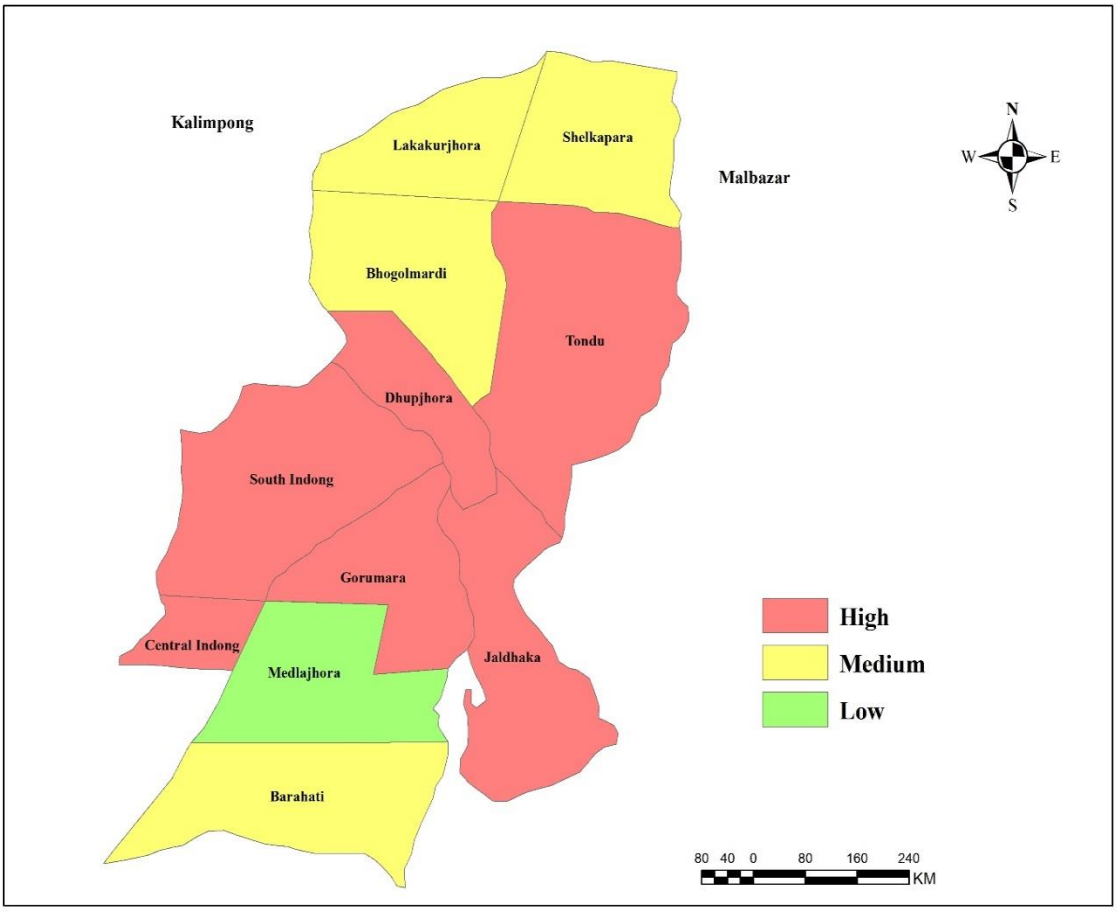
Source: Computed from unpublished institutional Data collected from Wildlife Division, BTR, Alipurduar. July, 2017.

Fig. 4.19 **Deaths of wildlife in Gorumara, Neora Valley & Chapramari (2003-2016)**



The Gorumara NP and Chapramari WLS have been reported for the highest number of killings and injury of the Human than the others protected forests in Dooars. Unlike, the Buxa region, Gorumara registered 843 cases of injury and a death of 156 humans in the last one and half years. Most of the Human-Animal Interaction reported from the nearby region of the Lataguri, Dhupjhora and NH31 (Between Malbazar and Lataguri). A very few incident of Human-Animal interface cases has been reported from Neora Valley National Park.

Fig. 4.20 **Levels of Human-Animal Interactions in Gorumara NP (2003-2016)**



Source: Prepared by Researcher based on the institutional data collected from D.F.O Gorumara National Park, Jalpaiguri and Forest Map gathered from Directorate of Forests Govt. of India. November, 2017.

There is a distinct rise of the crop damage, hut damage and livestock lifting cases in these protected areas. In the year 2003, only 183 cases of crop damage occurred which was only 19.52 hectares of land, while it increased to 526 cases and above 40 hectares of the crop was damaged. The same pace has been reported in the case of hut damage and livestock lifting by wild animal (see table no 4.16).

The wild animals involved in human killings and injuries are Jumbo Tuskers, Bison and Leopard. Crop damage has been done mostly by the Elephants, Bison, Deer, and Monkeys. These three protected areas are covered with 13 revenue villages and 5 tea estates in Gorumara, 2 revenue villages and 3 tea estates in Chapramari wildlife sanctuary and 7 revenue villages and 8 tea estates in Neora Valley National Park. The

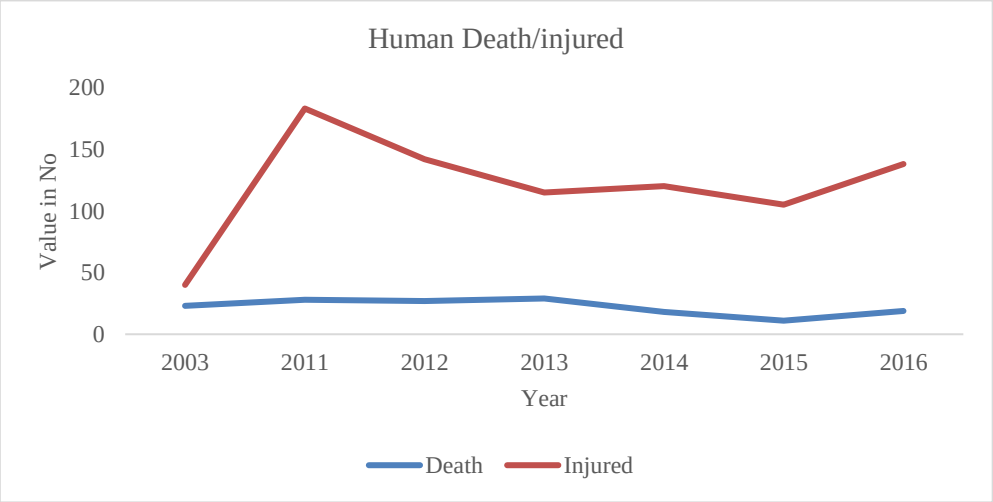
zone of influence is very wide in these region than the other part of the Dooars. Most of the revenue villages and tea estates are densely populated. The villagers highly depend upon the protected areas for their daily livelihood results often Human-Animal Interactions.

Table. 4.16 **Human death/injured and property loss in Gorumara, Neora Valley NP & Chapramari WLS (2003-2016)**

Year	Human dead	Human injured	Hut Damage in No.	Crop damage in Ha.	No. of Crop damage cases	Livestock
2003	23	40	38	19.52	183	2
2011	28	183	57	22.68	226	4
2012	27	142	43	15.93	176	6
2013	29	115	42	22.65	196	2
2014	18	120	78	30	321	9
2015	11	105	257	20	194	5
2016	20	138	108	40.46	526	11
Total	156	843	623	171.24	1822	39

Source: Computed from unpublished institutional data collected from Wildlife Division North, Jalpaiguri. July, 2017.

Fig. 4.21 **Human death/injured in Gorumara, Neora Valley NP and Chapramari WLS (2003-2016)**

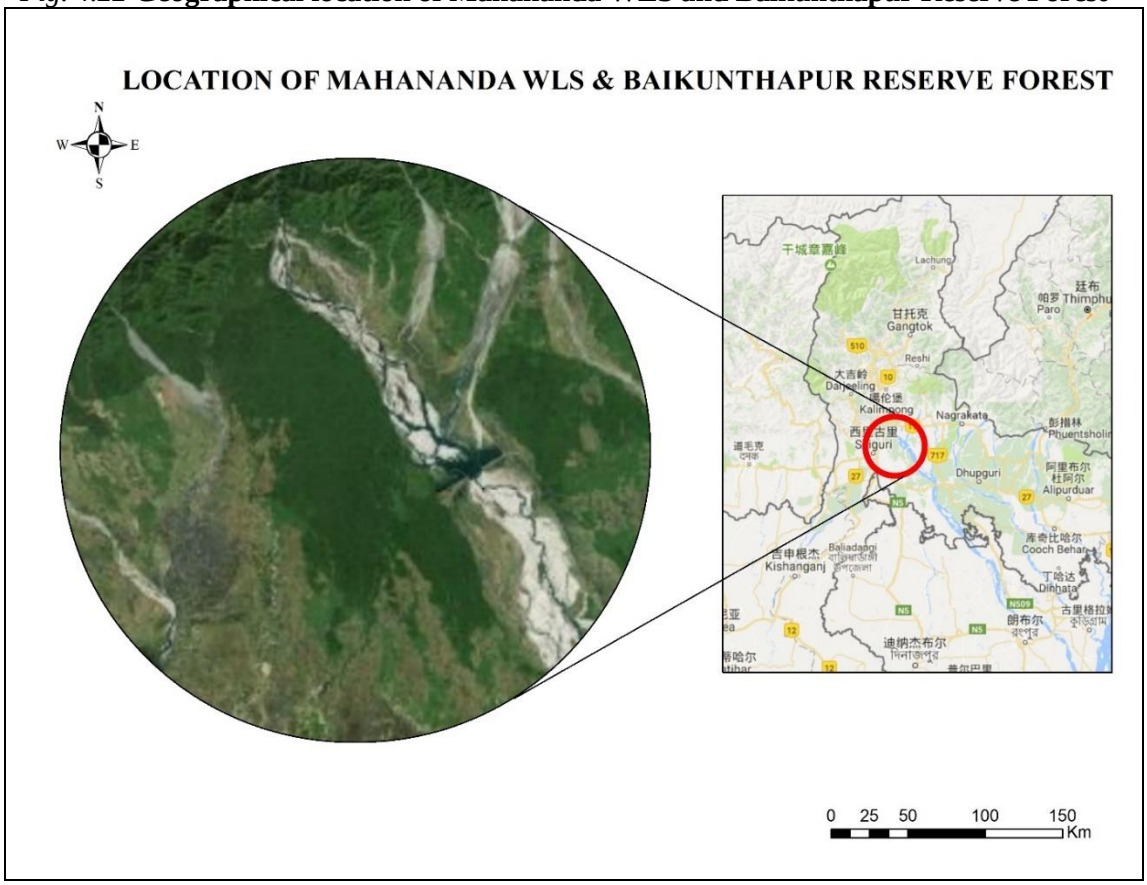


4.3.4 Mahananda Wildlife Sanctuary

Mahananda Wildlife Sanctuary is located in Darjeeling district of West Bengal. It stretches between the Teesta and Mahananda river with an area of 159 sq. km and shares boundary with Nepal through the Mechi River. The main aim of the upgrading the game sanctuary into the full-fledged sanctuary was to protect two flagship species

i.e. Bison and Tiger. This sanctuary has been given more importance because the sanctuary provides biological corridors with Nepal for the migration of wild animals.

Fig. 4.22 **Geographical location of Mahananda WLS and Baikunthapur Reserve Forest**



Source: Prepared by Researcher from Google Base map server, Arc GIS 10.2.2. November, 2017.

The deaths of wild animals are very less in Mahananda Wildlife Sanctuary, as the population density of wildlife, is very low. Most of the Human-Animal Interactions are reported from the NH31 and Railway track passes through the sanctuary. The Gulma and Ghoramara region are often reported for the HAI. Most of the Elephants deaths occur due to the accident with trains are also reported from this sanctuary only. The total number of wildlife deaths in Mahananda Wildlife Sanctuary was only 92 and out of which 37 were due to the Human-Animal Interactions and 37 were due to natural death. The number of wildlife deaths due to undetected cause are 18 (table no. 4.17). The year 2007 was registered for highest number of wildlife deaths in Mahananda Wildlife Sanctuary. The places which have been reported occasionally for wildlife

deaths in Mahananda Wildlife Sanctuary are Gulma, Laltong, Sukna, Panighatta and Ghoramara (see fig. 4.24).

Table. 4.17 **Chronology of wildlife deaths in Mahananda Wildlife Sanctuary (2002-2017)**

Year	Death	Location	Natural death	Death due to HAI	UK
2002	6	Kalijhora, Panighatta, Near Teesta river (tutori block), 33 Adaipur Army Campus, Lotabari Beat	1	2	3
2003	8	NH31, Chunavati near sukna, Gulma T.E, Laltong Comptt,	3	2	3
2004	6	Panchanai, Bagdogra, Gulma, Upper Ghoramara, Bengdubi	4	2	
2005	2	Laltong comptt, Lower Ghoramara		2	
2006	4	NH31 near 7th mile, Panchanai under West Range, Sukna	2	2	
2007	21	Fulbari patan T.E, Bamanpokhri range, Gulma, Rescue centre Sukna, E. Sevoke 10th mile river Teesta, Gulma Rly Bridge, Sukna R. Trihana T.E, Catchment I, Koklong Block, Simulbari T.G	14	5	2
2008	15	Lower Ghoramara, Upper Champasari, Jogijhora block, Punding block, Runding block, Silvita block, Gulma Valley, Nandi Khola under sevoke beat, Kolkong river, Marapur T.E, Kalijhora, Bagdogra	7	4	4
2009	5	Lower ghoramara, North range, Lower champasari, Punding beat, 16 FOD bagdogra range, Sangtram T.E		1	4
2010	5	Singamari Block under West Range, Bengdubi, taipu, Pilkhana Gulma, Bagdogra	3	2	
2011	4	Bandarjhora block Punding beat West Range, Taipo, Lohaghar Beat, Panighata Range, Gola Block Sevoke Beat Undre North Range		2	2
2012	3	Saldara, Punding Block under West range, Highway at Sevoke Road, Ghoranara Block North Range	1	2	
2014	1	Rescue Centre Sukna	1		
2015	2	Beyond koklong khola on the western side of sukna, Railway piller 21/8 to 21/9, Lower Ghoramara		2	
2016	5	Sukna Military Station, Kalijhora Beat Gola Block under North Range, NH-31 near Range office (Sevoke), NH-31A,North Range, Lower Ghoramara	1	4	
2017	5	NH31 near to office gate Sukna, 10th mile, 9th mile		5	
Total	**92**		**37**	**37**	**18**

Note: Types of Death Includes: **Natural death** *includes death due to old age, Sickness, wounded, dual fight, Cardiac failure, Bacterial infection, failure respiratory system;* **HAI (Human-Animal Interactions)** *includes human-induced death such as Poaching, Accident on NH, Accident by Train, Gunshot, Arrow shot, Fall of electric transmission, Fallen down in deep manmade earthen pit, Food poisoning etc.;* **(UK) Unknown** *includes no cause defined, decomposition of the carcass/death body etc.*
Source: Computed from unpublished institutional Data collected from Darjeeling Wildlife Division, A. November, 2017.

Fig 4.23 **Deaths of Wildlife in Mahananda Wildlife Sanctuary (2002-2016)**

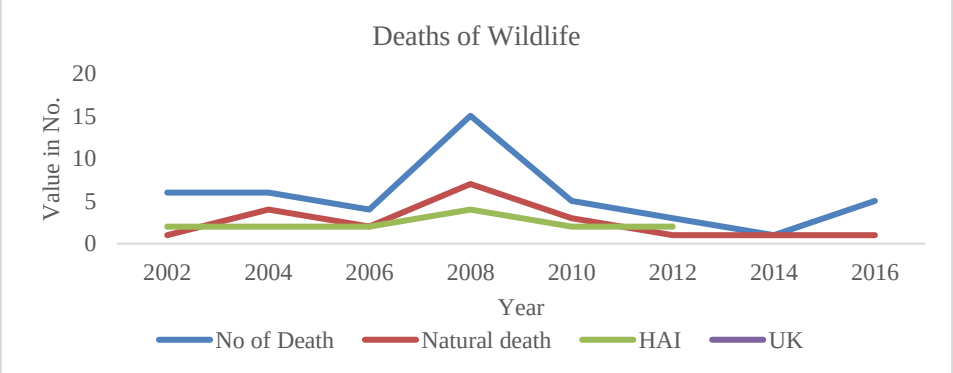
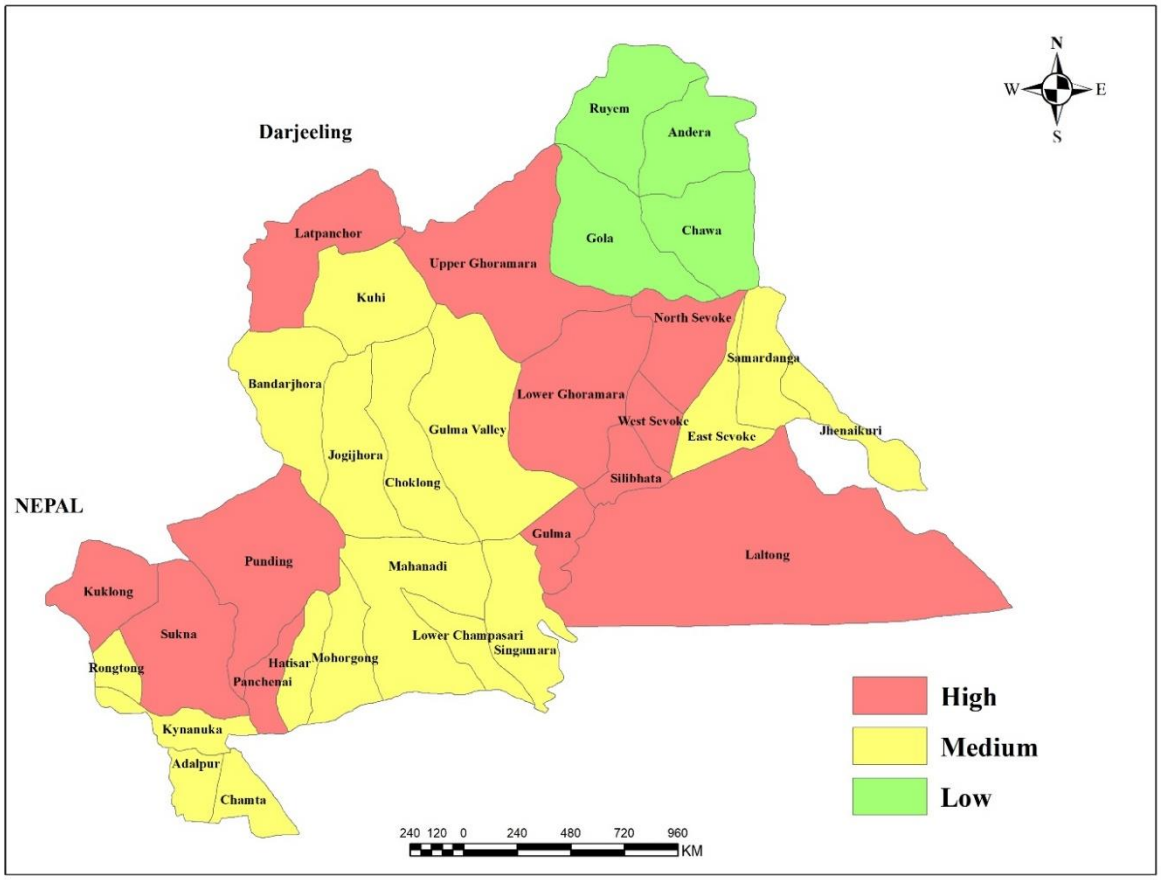


Fig. 4.24 **Levels of Human-Animal Interactions in Mahananda WLS (2002-2016)**



Source: Prepared by Researcher based on the institutional data collected from D.F.O Mahananda Wildlife Sanctuary, Darjeeling and Forest Map gathered from Directorate of Forests Govt. of India. November, 2017.

Human-Animal Interactions reach its most serious form when people are injured or killed by wild animals. Although big cats, bears, and wolves in other parts of the world are familiar and involved for such killing, wild Elephants in Dooars, probably kill more people than large carnivores like Tiger and Leopard in this region. The intensity of crop damage case is very high in this region. It has been intensified with times. The hut damage is also one of the main problems and often reported from this region. Most of the elephant death due to the accident with train has been reported from Mahananda Wildlife sanctuary. The Mahananda WLS with Baikunthapur Reserve constituted one of the important biodiversity zones in Western Dooars-Terai region.

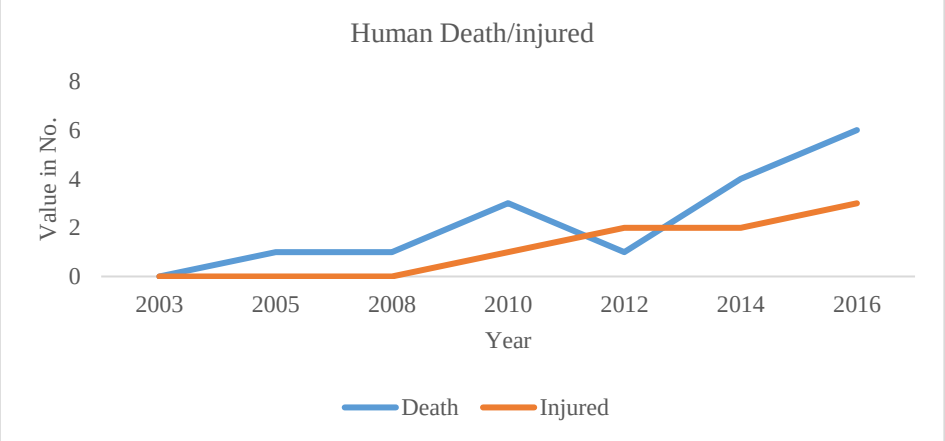
During the period of 13 years (2003-16), the total number of human deaths in Mahananda wildlife sanctuary is 26 and the number of injured people is 11 (table 4.18). During the same time period, 643 houses are damaged by wildlife attacks and 3438 times of crops damages cases have been registered which shows the levels of Human-Animal Interactions in the Sanctuary and nearby regions.

Table.4.18 **Human death/injured and property loss in Mahananda WLS (2003-2016)**

Year	Human dead	Human injured	Hut Damage in No.	No. of Crop damage cases	Livestock lifting
2003	-	-	68	90	
2004	1	-	23	524	
2005	1	-	20	331	
2007	5	-	68	498	
2008	1	-	29	44	
2009	1	3	40	253	
2010	3	1	48	293	
2012	1	2	61	359	
2013	2	-	59	457	
2014	4	2	75	247	
2015	1	-	16	151	
2016	6	3	136	191	
Total	26	11	643	3438	

Source: Computed from unpublished institutional data collected from Wildlife Division A, Darjeeling. November, 2017.

Fig. 4.25 **Human death/injured in Mahananda Wildlife Sanctuary (2003-2016)**



The close proximity of Siliguri city leads several problems of wildlife management in Mahananda Wildlife Sanctuary. The nearby areas of the sanctuary are occupied by tea estates and defence land. The highest degree of fragmentation of natural habitats has been reported from this protected forests. The introduction of the natural

zoo (Bengal Safari) in Mahananda wildlife sanctuary may cause further problems for the wildlife management in Mahananda Wildlife Sanctuary.

4.4 Concluding Remarks

The Human-Animal Relationship status can easily be traced from the above discussions of the salient features of the protected areas in Dooars. The increase of some major wildlife species in some protected areas, as well as degradation of the forest cover and fodder base in others, have created a contrary situation of wildlife management in Dooars. The recent increase of Elephant, Bison, Rhino and Leopard population creates a tremendous pressure on the nearby forest fringes. The total number of elephant was only 175 in the year 1989 which become 550 in 2013. The time period 2007-2010 registered the highest growth of elephant population in Dooars with an increase of 51.14 percent (table 4.1). The population of gaur has been increasing with a very fast pace in Dooars. The total number of gaur in Dooars was only 240 in 1989-90 which subsequently become 2097 in 2013-14 with the growth rate of 129.29 percent (table 4.2). The rhino is one of the important wildlife species found in Dooars has been increasing in the protected areas in Dooars, especially in Jaldapara and Gorumara National Parks. In the year 1969 the total number of rhino in Dooars was 87 (Jaldapara 75 and Gorumara 12). Though there was a decrease in rhino population in 1974 (only 27 rhino) and 1986 (only 22 rhino), the rhino population has been increasing after the year 1986. In the 2014, the total number of rhino was 239 (189 in Jaldapara NP and 50 in Gorumara NP) (see table 4.4). The increasing trends of depredation of wild animals are the results.

On the other hand the number of carnivores like leopard and tiger population have been decreasing in Dooars. The leopard population has been increasing from the

time period of 1984 to 2004 from 41 leopard to 242. In 2012 leopard census which was carried out only in Buxa Tiger Reserve shows significant decline of total number of leopard from 145 in 2004 to 105 in 2012 (see table 4.3). The tiger population has been decreasing in Dooars with an alarming rate. Tiger has been reported as highly threatened species and it is near no be extinct from protected areas of Dooars. According to the wildlife census report 2013-14, the total number of in Dooars was 56 in the year 1979, it becomes 57 in 1997 and 58 in 2002. During 2011 the total number of tiger was 41. There was 27 tiger in BTR, 12 in Jaldapara 10 in Mahananda and 7 in Gorumara national park. Though the reports of forests shows existence of tiger in different protected areas of Dooars, the recent scientific study reported only three tigers from Neora Valley National Park.

Traditionally, the local economy of the Dooars is dependent on the natural resources. The forest-based economy prevails the region since the pre-colonial periods (Xaxa, 1985). The peopling of the region is characterised by the ethnic group of tea tribes. Poor families depend on the forest for the sale of firewood and livestock rearing. The enactment of wildlife protection act 1972, prohibits people to enter the forests areas, creates lots of socio-economic problems in the region.

The media reports of The Telegraph and *Uttarbanga Sambad* have been portraying he problems of wildlife management and high levels of Human-Animal Interaction across the Dooars. The wildlife and human casualty that have been reported by both the newspapers are summarised as follows (table no.4.6 and 4.7). Among the different types of deaths (natural death, death due to HAI and death cause unknown) of wildlife, the HAI induced deaths of wildlife are substantially high and it has been increasing in recent years. Newspaper reports of The Telegraph and Uttarbanga Sambad reveals there has been deaths of more than 17 wildlife in 2003-04 to 2016-17 due to the

HAI. The human casualty due to wildlife have also been intensified in recent years. There was deaths more than of 38 people during the same time period. The other casualties were injuries of more than 17 people and more than 94 hut damages.

The dominant species which have occasionally attacks on humans in Dooars are elephant, rhino, leopard, gaur and monkey. The areas which reported very frequently for HAI are tea estates close to the protected areas. The common places of HAI in Dooars are Nimati, Rajabhatkhawa, Hamiltonganj, Dima and Rydak of BTR; Baradighi, Dhupjhora, Lataguri, Chalsa and Matiali of Gorumara and Chapramari region; Sukna, Gulma, ghoramara region of Mahananda WLS; and Chilapata, Salkumarhat, Madarihat, Binnaguri of Jaldapara National Park.

Different reports of The Telegraph and *Uttarbanga Sambad* have identified the NFR railway tracks in the protected areas of Dooars as killer tracks because on this track several wildlife gets killed due to the accidents with trains. The zone of influence of wildlife has been increasing in some of the protected areas in Dooars.

Human population living within or close vicinity of protected areas have always been seen as a threat to the wildlife. The protected areas of Dooars contains a huge population that eventually exerts pressure on the available forest resources. The spatial analyses of the protected areas in Dooars proves the existing hostile relationship between human and wildlife. The areas which are suffering the most are forest villages of Gorumara, Chapramari, Jaldapara and Buxa region, whereas the Neora Valley region is the least intervened area in Dooars.

Several cases of human casualty has been reported from protected areas of Dooars. It is seen that the number of human casualty and property loss cases are growing up on regular basis. Apart from the human-induced factors, the natural factors are also one of the determining factors of Human-Animal Relationship in the region.

Floods and soil erosions of the numerous river flowing through the region cause heavy damage to the vegetation of the region. The change in climate may also have an adverse effect on Human-Animal Interactions in Dooars.

Due to the above mentioned factors, the zone of influence both for the human and wildlife has been increasing day by day. The degree of loss is also increased. The deaths of the animals due to the interfaces of human and animal exceeds upon the natural deaths. The injury cases of both the human and animals are also growing. Therefore, new strategy/plan or policies should be implemented to save the forest and wildlife in Dooars. The present trends of Human-Animal Relationship pose a message to the wildlife management practitioners and other agencies to review and implement new policy, plan which can solve or maintain a healthy relationship between human and animal in Dooars.

Chapter- 5

Land use change and its impact on Human-Animal Relationship

Conservation is rapidly becoming one of the people's major land-use objectives. According to recent estimates, there are over 100,000 protected areas covering 11.7 percent of the Earth's surface (Phillips 2004). A major problem for many communities, especially where the protected area borders come close to or overlap with villages of communities, is direct interactions with wild animals, often leads loss of both sides. In India, the problem is particularly significant, given that at least 65 percent of the country's protected areas contain human settlements or are located adjacent to them (Kothari et al, 1989). Human-Animal Interaction is a phenomenon where humans negatively impact on wildlife's well-being or when the actions of people are harmful to the survival of wildlife (Madden, 2004). These interactions are spatio-temporal events that disrupt the psychological as well as physical well-being of communities who share common space with wildlife (Ogra, 2008).

In India, tensions between conservation and development have been very critical in recent years. Between 1975 and 1998, the number of National Parks in India increased from 5 to 85 and the number of wildlife sanctuaries increased from 126 to 448. The majority of these new protected areas were created from former reserve forest areas by upgrading the status of their protection, resulting in a redrawing of protected area boundaries across India. Therefore, contain settlements located adjacent to, or within the boundaries of protected areas, and suddenly, the communities find themselves subject to strict restrictions on the extraction of forest products (Madhusudhan 2005; Shahabuddin and Rangarajan 2007).

Changes in land use in terms of the transformation of forest land into cultivation as well as developmental activities intensified Human-Animal Interactions. Thus

natural habitat of wildlife gets lost and in order to survive, wildlife move into human territory. The diversion of forest land for developmental activities like irrigation project, hydel power project, and mining project, construction of the road, laying of the railway line and transmission line or pipeline leads to the destruction of forest land. Above all, Tea plantation has the highest impacts on land use, as it alters the whole mechanism of ecological balance in the Dooars. The problem of wildlife conservation is intimately related to the issues of 'land use'. The impacts of land use change in Human-Animal Relationship in Dooars are discussed as follows:

Transformation of forest areas into settlement and cultivation have been done to meet the needs of growing population. Encroachments of the forest land are one of the major problems in Dooars. This has given rise many problems related to the Human-Animal Relationship. Encroachments of the forest have been found almost in all of the protected areas in Dooars.

Human pressure on land use is increasing in the unprotected landscapes that surround many protected areas across the world (Hansen and DeFries 2007). Even when land cover within protected areas remains unaffected, changes in the surrounding landscape can significantly impact ecological processes within the protected area, by changing ecosystem size, altering flows of species and energy into and outside the protected regions, and providing increased exposure to human-impacted, high disturbance edge areas (Nagendra et al, 2007). Almost all of the protected areas in Dooars have been suffering from the huge pressure of human population which eventually brought adverse effects on Human-Animal Relationship.

However, the land-use transformation is a product of the changes in the wider socio-economic system. Tourism, one of the emerging economic activities worldwide, is also closely related to land use and land cover. Many developing countries in the

tropics have relied on tourism to generate economic wealth and job opportunities to diversify their economy as well (Gossling, 2001; and Rico-Amoros et al, 2009). The recent development of eco-tourism exaggerated the existing problems of Human-Animal Relationship in Dooars.

The land use in Dooars varies depending on the nature of the soil, terrain, hydrological conditions, drainage, and temperature etc. The soils are more fertile in South than the North Dooars (Gruuning, 2008). The transformation history of the land in Dooars is very complex in nature (See chapter 2).

The most heartening factors of land use change in Dooars are the introduction of plantation agriculture during the colonial period, development of roads and railway as a supply chain of tea industry in Dooars, the unexpected growth of population during the partition of Bengal and the recent emergence of urban centres throughout the Dooars (Xaxa, 1984). Thus, the Human-Animal Relationship in Dooars has been affected by all those factors of land use.

The development programmes in the protected areas are taken up by the development authorities of Panchayat functionaries with the help of forest department. Forest department looks after the developmental activities in forest villages. There is some contradiction between the civil administration and forest department about the developmental policy and plan in the protected areas. The information and co-operation gap between the civil administrations and forest department creates further problems for wildlife management in Dooars.

5.1 Spatial Analysis of Human-Animal Relationship in Dooars

The dynamics of Human-Animal Relationship and its related issues are discussed as follows;

5.1.1 Forest and Tea plantation area

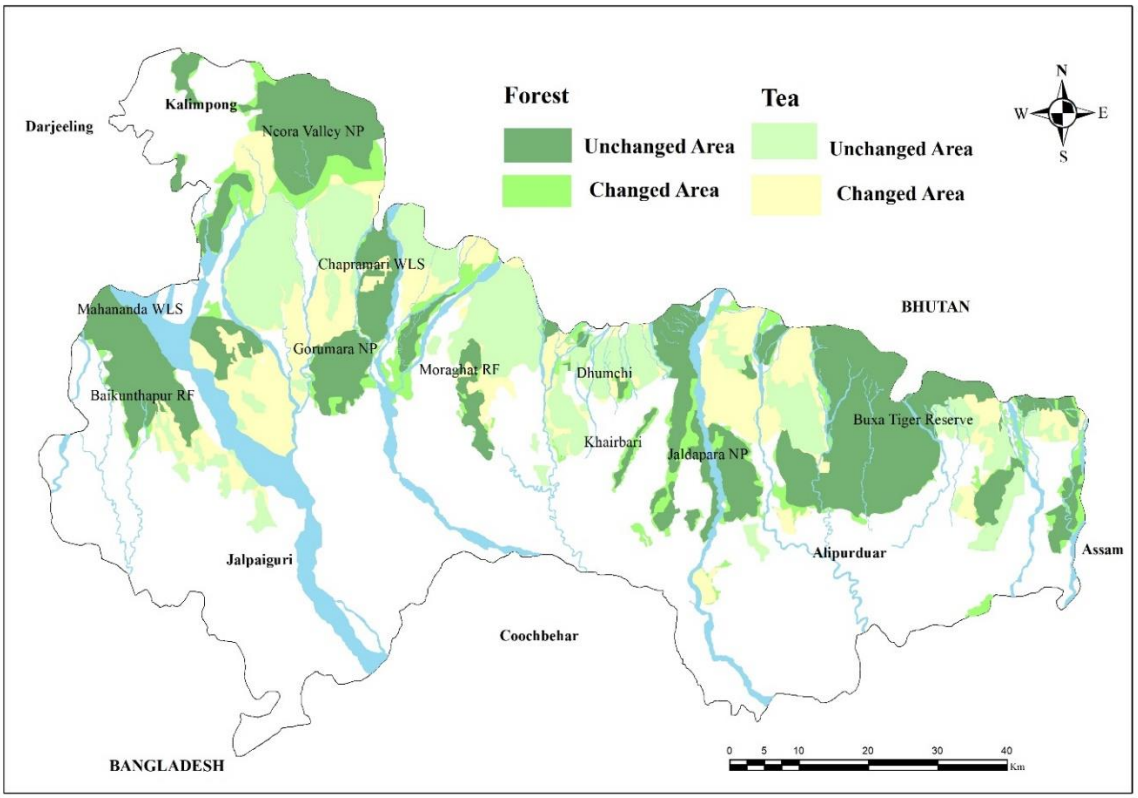
The Dooars was covered by dense forest land with rich biodiversity. The virgin forest land had degraded by colonial ruler under the regime of different land settlement systems. A vast area of forest cover was cleared by the British for plantation agriculture in Dooars. The waste land and scrub land near the forest fringes have been transformed into tea plantation and thereby disturbed the habitats of wildlife.

The tea plantation was augmented by the construction of supply chain of transport network i.e. railway and roadways. The forced emigration of tea labourers from the tribal belt of middle India leads demographic changes in Dooars. All these processes have adverse effects on available resources which eventually brought several changes in land use in Dooars.

The forest and tea plantation area show the contradictory relation between their respective growths. The decrease in forest cover resulted in an increase in tea plantation area in Dooars. The total forest cover during 1972-73 was 1923 sq. km. in Dooars. The decades after 1972-73 show decrease in forest cover. In the year 1990-91, the forest cover was 1596 sq. km. and in 2016-17 it reduced to 1518 sq. km (see table 3.8 of chapter 3).

On the other hand, tea plantation area has been increasing continuously in Dooars. The year 1972-73 was only 680 sq. km. and in the following years, it becomes 984 sq. km in 1990-91 and 1168 sq. km. in 2016-17 (table 3.9).

Fig. 5.1 **Forest cover and Tea plantation area in Dooars (1972-73 to 2016-17)**



Source: Prepared by Researcher from Landsat-5 and LISS-III imageries obtained from Earth Explorer, USGS. October, 2017.

The instances of forest cover loss due to the encroachments and degradation of forest land in Dooars is also very high. Most of the forest land in Dooars have been affected by degradation. The human-induced factors (encroachments, overgrazing, felling of tree, etc.) are the drivers of forest land degradation in Dooars. The protected areas which have been experiencing encroachments and degradation are Baikanthapur, Mahananda WLS, BTR and Jaldapara.

5.1.2 Wildlife deaths in Dooars (Natural death vs. HAI death)

All the protected areas have high intensity of wildlife deaths in Dooars. The total number of wildlife death in Dooars during 1991 to 2017 was 1121 with an average death of 42 wildlife in every year. The total number of wildlife death due to natural and HAI was 594 and 416 with an average rate of 22 and 15 wildlife death in every year respectively (table 5.1).

The Gorumara, Chapramari and Neora Valley region has the highest number of wildlife deaths in between 2003 to 2017. The total number of wildlife deaths in Gorumara region was 475. The average death of wildlife in this region was 34 wildlife every year. Out of which the natural death of wildlife was 335 and HAI death 127 in every year with the average rate of 24 animals and 10 animals respectively.

The Buxa Tiger Reserve is also shown the high intensity of wildlife death during 1991 to 2017. The total number of animal deaths in BTR was 498 with an average death of 19 animal per year. During the time period of 1991 to 2017, the total number of wildlife death in BTR West division was 398 which includes an average death of 15 animal per year. The natural death of wildlife in BTR West was 196 and HAI death was 151 with the average death of 8 and 6 wildlife in every year respectively.

Table 5.1 **Index/Rate of Animal death in Dooars (1991-2017)**

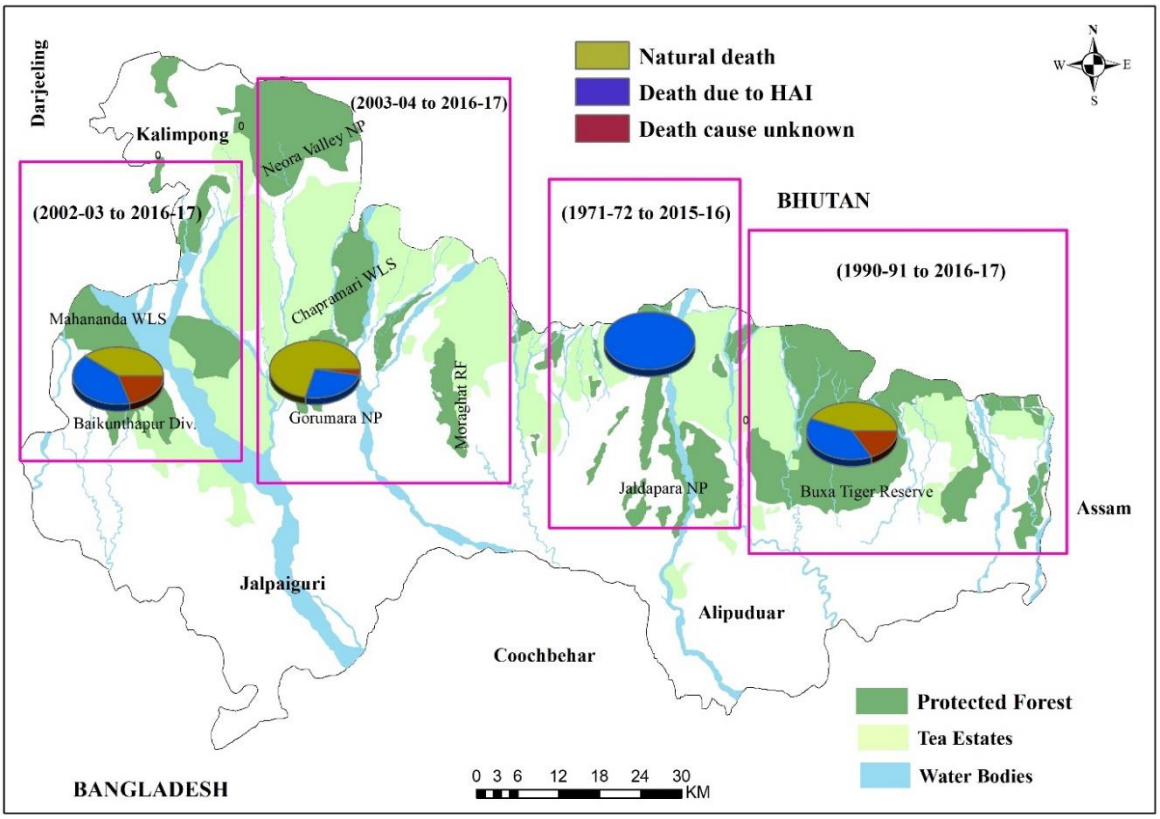
Name of Div./P.A	Year	Total death	Natural death	Death due to HAI	Avg. of Total death	Avg. of Natural Death	Avg. of HAI death
BTR West div.	1991-2017	398	196	151	15	8	6
BTR East div.	2008-16	100	26	45	13	4	6
BTR (Total)	1991-2017	498	222	196	19	9	8
Jaldapara NP	1972-2016	56		56	2		2
Gorumara, Neora Valley NP & Chapramari WLS	2003-2017	475	335	127	34	24	10
Mahananda WLS	2002-2017	92	37	37	7	3	3
Total	1991-2017	1121	594	416	42	22	15

Note: Div. (Forest Division); PA (Protected Area) BTR (Buxa Tiger Reserve); NP (National Park); WLS (Wildlife Sanctuary); HAI (Human-Animal Interaction); Avg. (Average).

Source: Computed from unpublished institutional data collected from DFO Darjeeling, Jalpaiguri and Coochbehar. November, 2017.

On the other hand, BTR East division may have a number of wildlife deaths in the same time period but the data of wildlife death was available only for the time period of 2008 to 2016. In this eight years, the number of wildlife deaths in BTR East was 100 wildlife. The natural death of wildlife in BTR East is exceeded by death due to HAI. The number of natural death and HAI death of wildlife was 26 and 45 with the average death of 4 and 6 animal per year (table 5.1).

Fig. 5.2 **Wildlife deaths in Protected Areas of Dooars due to different causes (2002-2017)**



Source: Prepared by Researcher from unpublished Institutional data collected from Wildlife Division of Darjeeling, Jalpaiguri and Coochbehar Govt. of West Bengal. July, 2017.

While in the Mahananda Wildlife Sanctuary, the death of wildlife has been relatively low due to less density of wildlife population. The total number of wildlife death in Mahananda Wildlife Sanctuary was 92 with the average death of 7 animal in between 1991 to 2017. The natural death of wildlife and death due to HAI comprises 37 wildlife each with an average death of 3 animal per year. In Jaldapara National Park, only the data of rhino death is available. There was 56 death of rhino in Jaldapara due to poaching in between 1972 to 2016 (see fig. 5.1).

5.1.3 Human deaths/injuries in Dooars due to HAI

The number and intensity of human casualty have been increasing in the protected areas of Dooars. The total number of human death and injury during the time period of 2002 to 2017 was 343 person and 1045 person with an average rate of 26 human death and 70 human injuries per year respectively caused by mainly of wild

animal attacks. The highest cases of human death and injury occurred in BTR. The total number of human death in BTR was 158 and total injured was 47 which comprises an average rate of eight death and one injury per year in 2002 to 2017.

The Gorumara, Neora Valley and Chapramari region are registered with the highest intensity of human injury. The human death is also significantly high in this region. During the year 2003 to 2016, the total number of human death and injury was 156 person and 843 people respectively. The average rate of death and injury was 12 person and 67 people per year respectively.

The Jaldapara National Park have reported for 47 human death and 142 injuries during 2002 to 2017. The average rate of human death was 4 person per year and the rate of human injury was 11 person per year.

Table 5.2 **Index/Rate of Human death and injury in Dooars due to wildlife attacks (2002-2017)**

Name of Div./PA	Year	Total death	Total injured	Avg. of total death	Avg. of Total injured
BTR West div.	2002-2017	111	5	8	1
BTR East div.	2005-2014	47	42	6	5
BTR (Total)	2002-2017	158	47	11	4
Jaldapara NP	2002-2015	47	142	4	11
Gorumara, Neora Valley NP & Chapramari WLS	2003-2016	156	843	12	67
Mahananda WLS	2003-2016	26	11	2	1
Total	2002-2017	387	1043	26	70

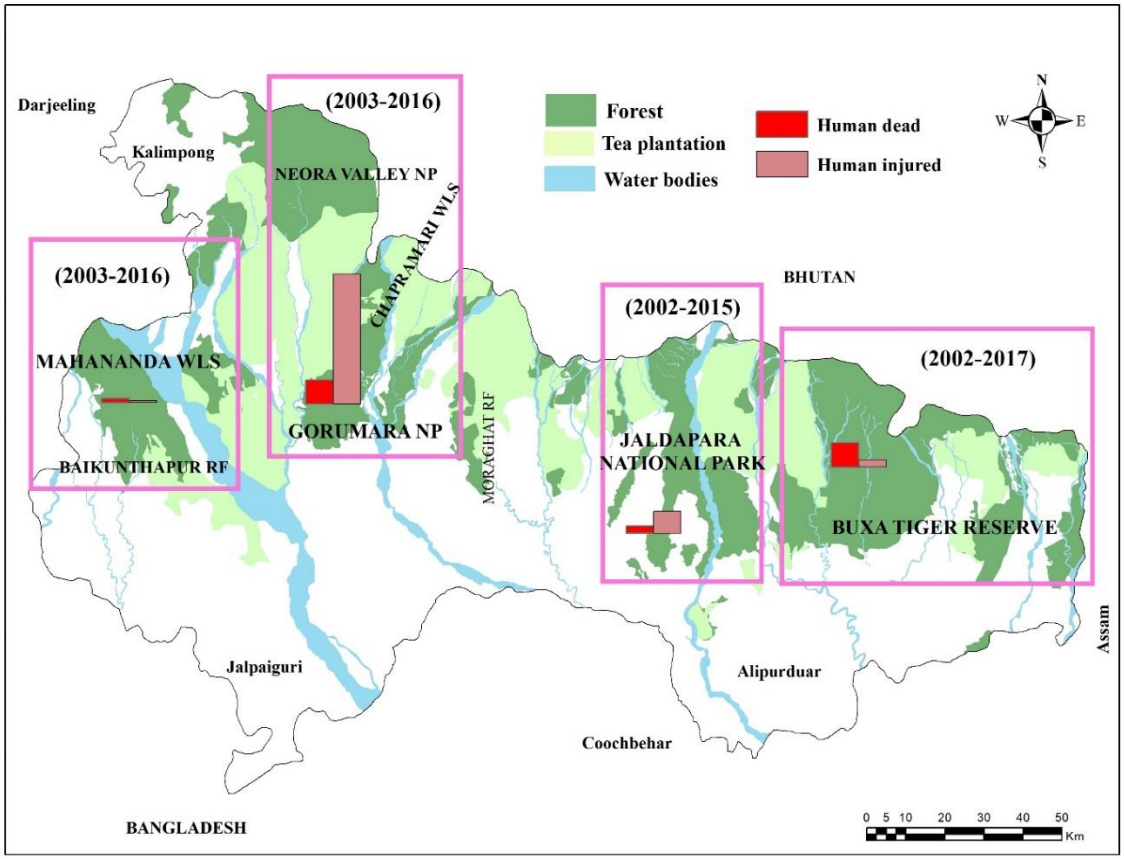
Note: Div. (Forest Division); PA (Protected Area) BTR (Buxa Tiger Reserve); NP (National Park); WLS (Wildlife Sanctuary); Avg. (Average).

Source: Computed from unpublished institutional data collected from DFO Darjeeling, Jalpaiguri and Coochbehar. November, 2017.

The Mahananda Wildlife Sanctuary shows very less number of human deaths and injuries. In the Sanctuary, the wildlife density is comparatively less than the other protected areas of Dooars. There was the death of 26 people in between 2003 to 2016 and the number of people who injured due to wild animal attacks was 11. The average

death of human in Mahananda Wildlife Sanctuary was two person per year and the injury rate was one person per year (table 5.2).

Fig. 5.3 **Human deaths/injuries in different Protected Areas of Dooars due to HAI (2002-2016)**



Source: Prepared by Researcher from unpublished Institutional data collected from Wildlife Division of Darjeeling, Jalpaiguri and Coochbehar Govt. of West Bengal. July, 2017.

5.1.4 Crop damage, Hut damage and Livestock lifting by wild animals in Dooars

The high rate of property loss in term of crop damage, hut damage and livestock lifting show the recent status of Human-Animal Interactions in Dooars. During the last fifteen years (2002-2015), the total number of crop damage cases was 36478 with an average rate of 2433 cases of crop damage in every year.

The highest number of crop damage cases have been reported from Buxa Tiger Reserves. In BTR, the total number of crop damage cases during 2002 to 2017 was 10814 (includes 4656 in BTR West div. and 6158 in BTR East div.) with an average rate of 3698 times in a year. Followed by BTR, the Jaldapara National Park was

reported for 9599 times for crop damage cases due to wildlife attacks. The average rate of crop damage cases in Jaldapara National Park during 2002 to 2015 was 739 times per year. In the Mahananda Wildlife Sanctuary and Gorumara region crop damage cases are less than the other parts of the Dooars i.e. BTR and Jaldapara. The total number of crop damage cases in Mahananda WLS and Gorumara region was 3438 and 1822 times in a year respectively. The average number of crop damage cases in Mahananda WLS was 265 per year and in Gorumara, Chapramari region it was only 141 times per year (table no 5.3).

Table 5.3 **Index/Rate of Crop damage, Hut damage and Livestock lifting by wildlife in Dooars (2002-2017)**

Name of Div./PA	Year	No. of crop damage cases	Hut damage in no.	No. of livestock lifting	Avg. of Crop damage cases	Avg. of Hut damage	Avg. of livestock lifting
BTR West div.	2013-2017	4656	1388	352	1164	347	88
BTR East div.	2005-2014	6158	2310		685	257	
BTR (Total)	2002-2017	10814	3698		1202	721	
Jaldapara NP	2002-2015	9599	3286		739	253	
Gorumara, Neora Valley NP & Chapramari WLS	2003-2016	1822	623	39	141	48	3
Mahananda WLS	2003-2016	3438	643		265	50	
Total	2002-2017	36487	11948		2433	799	

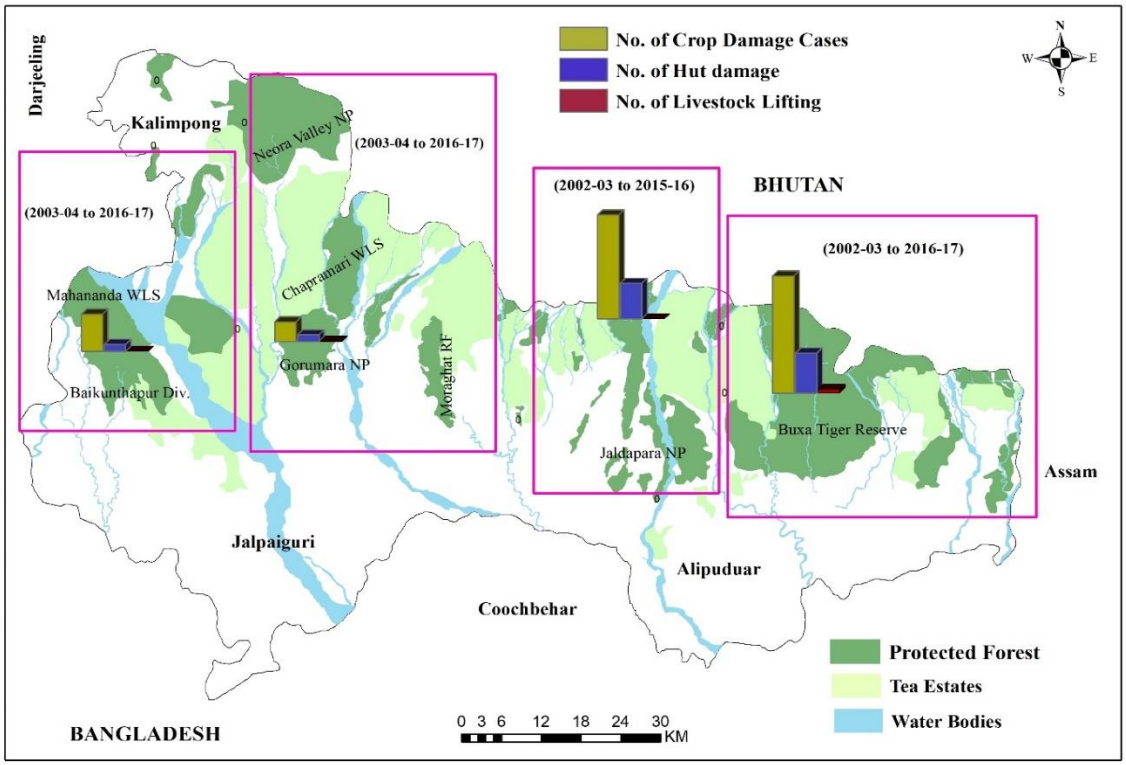
Note: Div. (Forest Division); PA (Protected Area) BTR (Buxa Tiger Reserve); NP (National Park); WLS (Wildlife Sanctuary); Avg. (Average).

Source: Computed from unpublished institutional data collected from DFO Darjeeling, Jalpaiguri and Coochbehar. November, 2017.

The hut damage cases have been significantly increasing in Dooars. Hut damage occurs mainly due to the elephant attacks. The total number of hut damage in Dooars during 2002-2017 was 11948 with an average damage of 799 huts in a year. The highest number of hut damage has been reported once again from the BTR region (table 5.3). The total number of hut damage in BTR region including BTR West (13388 huts) and

East division (2310) was 3698 and the average rate of 1202 hut damage per year. The intensity of hut damage is high in BTR East division than the West division. The number of hut Damage cases indicates the density of human habitation in different protected areas of Dooars (table 5.3 & fig 5.4).

Fig. 5.4 **Crops and Hut damages due to wildlife attacks in Protected Areas of Dooars (2002-2017)**



Source: Prepared by Researcher from unpublished Institutional data collected from Wildlife Division of Darjeeling, Jalpaiguri and Coochbehar Govt. of West Bengal. July, 2017.

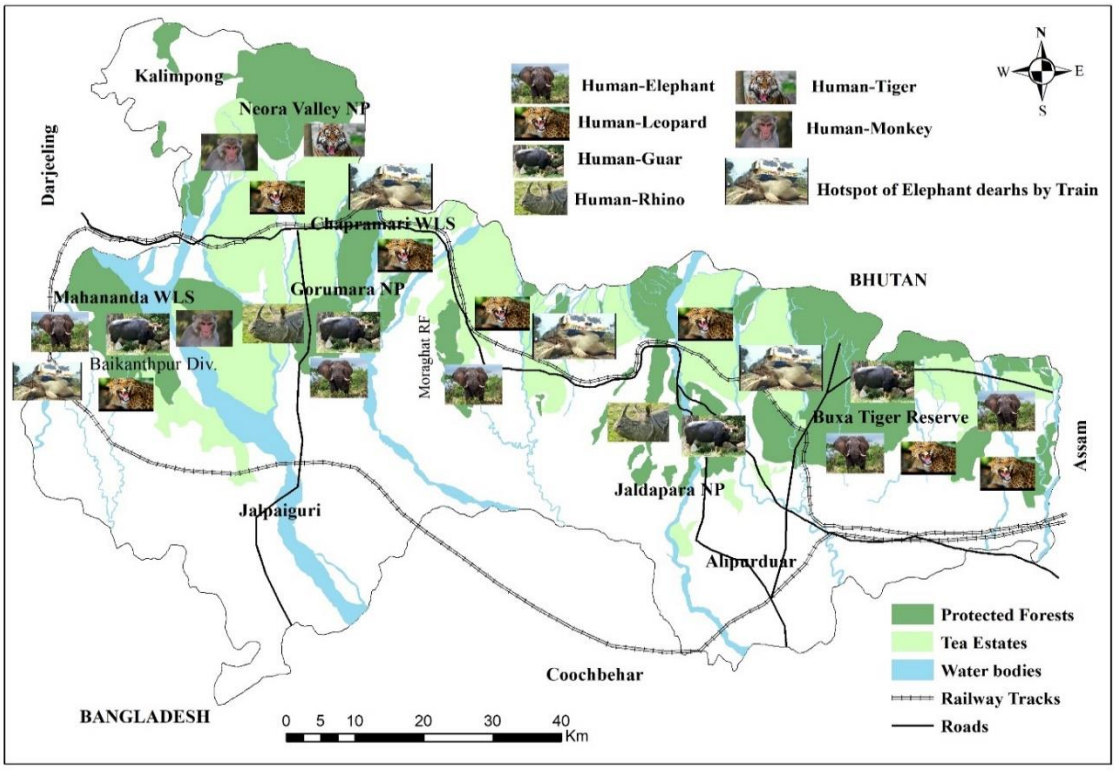
The number of hut damages in Jaldapara region during the time period of 2002 to 2015 was 3286 and the average was 253 huts per year. In Gorumara 643 huts were damaged during 2003 to 2016 with 48 hut damage in a year. There was 643 hut damaged in Mahananda WLS region during 2002 to 2017. The average number of hut damage in Mahananda WLS was 50 per year (see fig. 5.3).

5.1.5 Spatial distribution of HAI in Dooars

The protected areas in Dooars are well endowed with specific species of wildlife. The Jaldapara and Gorumara region is known for its one horn rhino population.

The Buxa region is famous for gaur and leopard population (earlier it was known for The Royal Bengal Tiger). The Chapramari and Mahananda region is famous for leopard and elephant corridors. Elephants are extensively migratory in nature and found all the protected areas in Dooars. Recently, The Royal Bengal Tiger has been sighted in Neora Valley National Park (see fig. 5.4).

Fig. 5.5 **Hotspots zone of Human-Animal Interaction and animal involves in Dooars**



Source: Prepared by Researcher from Annual Report 2013-14, wildlife Wing, Govt. of West Bengal. p-51.

In different parts of the protected areas in Dooars, the Human-Animal Interactions have been occurring with specific wild species like the Jaldapara and Gorumara region are prone to Human-Rhino Interaction; the Buxa region is prone to Human-Leopard and Human-Gaur Interaction, etc. Among the different types of Human-Animal Interactions, the Human-Elephant Interactions are dominant in Dooars and occurs almost in all the protected areas as well as nearby regions of reserves. The Human-Leopard Interactions have been reported mostly from the tea plantation villages which are located close to the protected forests.

5.2 The Forest Conservation and Wildlife Protection Policies

Forest policy in independent India was not very different from the policy that existed during colonial times. The National Forest Policy of 1952 strengthened the right of the state to exclusive control over forest protection, production and management. The one major difference in the post-1947 policy has been that the demands of the commercial-industrial sector have replaced strategic imperial needs.

In West Bengal, the Estate Acquisition Act was promulgated in 1953. During the 1970s, some new laws and policies were introduced at the national level. In West Bengal, the concept of preservation of wildlife and its habitat was well established since the 1940s. Sanctuaries of Senchal, Jaldapara, Gorumara and Chapramari were notified for this purpose. With the promulgation of the Wildlife Protection Act, 1972, the preservation of floral and faunal biodiversity got high importance and started to get statutory support during this decade (150 Years of Forestry, West Bengal, 2014).

Forest land acquisition was an easy process before the 1980s but with the Environmental Protection Act, 1986 and Environmental Impact Assessment, 1994 amended in 2006, the process of forest land clearance become more regulated. Some developmental projects like railway continued to be exempted from such laws (Ghosh, 2014). The evolution of resources related conflicts are portrayed in table 5.2.

Table 5.4 **Change in intensity of different resource-related conflict before and after independence**

Form of conflict	Comparative intensity (Post-47/Pre-47)
Hunter-gatherers vs the State	Sharply reduced on the mainlands; intensifying in areas like the Andamans
Jhumiyas vs the State	Reduced in peninsular India; intensifying in North-East India
Settled cultivators vs the State	Reduced in some areas (where forests are no longer important), constant in other areas (Himalaya, Western Ghats)
Conflicts within Village society	Sharply increased
Cultivators vs Nomads	Sharply increased
Artisans vs Nomads	Diminished for some categories (charcoal maker), increased or constant for others (basket weavers)

Labourers vs the Contractors	Sharply increased
Wildlife vs Villagers	Largely new conflict

Source: Cited from Madhav Gadgil and Ramchandran Guha. (1911), 'The use and abuse nature'. p-237

Though the post independent period witnessed the Forest Conservation and Wildlife Protection Act, most of them have been inadequate to address the existing and upcoming problems. Under the WPA, 1972 (Wildlife Protection Act), the Birds protection (No. X of 1887) was passed which only prohibited sale or possession but not killings of any specified wild birds during the breeding season (Panjawan, 1994). The WPA 1972, itself showed concerns for only selected species of fauna, which represent less than one percent of the wildlife diversity in India (Ghosh, 2014, p-34). The Poachers and illegal merchants have been taking the advantages of the loopholes of WPA and Forest Protection Act.

The WPA, 1972 also empowered to declare its intention to constitute any area, other than reserve forest or territorial water as a sanctuary for the purpose of 'protecting, propagating or developing wildlife or its environment'. The WPA provides right to the people for their suitable relocation processes but most of the time the customary rights of traditional forest dwellers have often been taken away with the purpose of conservation, leading to conflicts which may not be conducive for 'conservation' (ibid, p-35). The recent notification of Green Tribunal to relocate the Bhutiabasti and Jayanti village of BTR is one of the examples of such reluctance.

It is clearly said by the UNESCO in a programme called 'Man and Biosphere', conservation cannot be without people's participation. The conservation will be more fruitful if it keeps the interest of the local community in view. The protected areas in Dooars are lacking such community-based conservation. There is no proper assessment of the total number settlements in the core and buffer areas of protected areas. People living in and around the protected areas are about 4.5 million in India (Kothari, 1996).

The Wildlife Protection Act was adopted in 1972 which had different loopholes and drawbacks, some of them are stated above. After the long duration of being not reviewed the WPA 1972 was amended in the year 2013.

The recent development of eco-tourism in India creates lots of environmental problems and adverse effects on the Human-Animal Relationship. Increased eco-tourism in the protected area is considered to be large detriments of its animal inhabitants (Banerjee, 2014. p-80). The touristic urbanisation in the fringe areas of the protected region causes several problems in ecological balance in Dooars. Therefore, the ecological footprint of any tourist and entertainment activities inside the protected areas (jungle safari, picnic in the fringe, loudspeaker etc.) should be checked and regularised in a well-mannered way.

Conservation has failed with respect to the biodiversity at a global level (Wilson, 1999). While some of the protected areas in India have been managed well to fulfil the desired objectives, many of them have, in fact, degraded. Animal census reports show failures in forest conservation with reduction of overall animal population. Though the number of some engendered species in the country has increased, the extinction rate has raised for some other species.

There are different challenges have been arises due to the late adaptation and regulation of Forest Conservation and Wildlife Protection laws in India. These regulations have immediate and long-term impacts on the wildlife in India. The growth of some of the flagship species are the results of such rules and regulations. The review and scientific investigation of laws and regulation will bring new lights in the sector of forest and wildlife management in India.

The State Government provides assistance and to compensate for the damages, the number of damage cases is increasing day by day. The latest rate of ex-gratia which

is given in table no 5.2. The ex-gratia payment process is very complex and lengthy. The notified amount of ex-gratia is never reached to the victims due to the bureaucratic reluctances.

Table 5.5 **Present rate of compensation and ex-gratia for wildlife-related damages**

Category	Rate of Compensation / Ex-gratia
Person Killed	Rs.1,00.000/-
Person injured	Free medical treatment in Govt. Hospital
Person against permanent disability	Rs.50,000/-
Person against loss of single limb	Rs.7,500/- with free medical treatment in Govt. Hospital
Damage to crops	Rs.7500/- per hectares
Damage to livestock	Rs.100/-to Rs.700/- Subject to actual extent of loss
Damage to huts/buildings	Kuccha house Rs.3,000/-. Partial damage to kuccha house Rs.1,500/-
Damage to semi-permanent house (G.I. sheet or Tali roof)	Up to Rs.5,000/-
Damage to permanent house with RCC roof	Up to Rs.10,000/-

Source: Cited from Das. K, 'Man-Elephant Conflict in North Bengal'. p-8.

The reluctance of forest officials to assist the villagers at the time of wildlife attacks have been the major complaints. Lack of prompt actions at the time of animal attacks or depredation is another threat to the forest villagers.

The Human-Animal Interaction has been increasing gradually due to the adverse effects of land use change. The human settlement, conversion of forests land into agriculture and tea plantations and other developmental activities are the main agents of land use change in Dooars. The wild animals are getting disturbed as their natural habitat gets shrinking day by day.

5.3 Findings from the Field Survey

The key factors which influence the Human-Animal Relationship in Dooars have been discussed with evidence from the field. The FGDs and interviews conducted to understand the in-depth factors of the impacts of land use change and other associated complexities of Human-Animal Relationship in Dooars have been discussed as follows:

5.3.1 Land use

People clear large areas of forest areas for development of agricultural and plantation lands. They also clear the areas for developmental activities - The construction of roads, railway tracks and hydroelectric projects results in submergence of nearby forest lands and fragmentation of habitats. The clearance of forests land for mining and industries also leads to breaking of large natural habitats into small forest covers and fragmentation of such habitats. In Dooars, the land use has been changing through different agents which have discussed in below:

India's road network is expanding at a rapid pace due to the expanding economy and increase in vehicular traffic. The traffic density is growing at the rate of ten percent annually. Some of this road network is being expanded through protected areas. Apart from fragmentation, roads are becoming a serious threat to wildlife as several wild animals are killed on a daily basis by speeding vehicles. Vehicles today travel at high speeds and this combined with poor eyesight and slow response time of animals results in the death of innumerable wildlife during winter.

The areas adjacent to the Gorumara National Park have been experiencing growing number of wildlife attacks in recent years. The localities surrounded by tea gardens occasionally reported for leopard attack. The construction of infrastructure like hotels, lodges and roads within the forest fringes have greatly been impacted on wildlife. The hut damage and crop damage by wildlife are common incidents for villagers at Gorumara National park. The deaths and injuries are also increasing in recent years due to the wild elephant attacks. The NH31 which passage through the heartland of the National park cause deaths of wildlife due to an accident with vehicles. Quick response and timely payments of ex-gratia are the main demands of villagers.

- A resident of Baradighi Tea Estate (Gorumara National Park).

Plate 5.1 **The NH-31 obstructing elephant movement at Gorumara National Park**

Source: Captured by Researcher during the field survey, Gorumara NP. November, 2017.

Commonly killed species normally include nocturnal animals such as deer, snake. There have been several instances of elephant and other large mammals killed due to road accidents. Scores of reptiles, birds and amphibians are killed due to vehicular traffic in protected areas. In North Bengal, the NH31A and 37C are considered one of the killer roads in the region as it is passed through the heartland of the protected areas like Jaldapara, Buxa and Chapramari.

Main Rivers of North Bengal flows in between protected areas are Teesta, Torsa, Raidak, Jainti, Phaskhowa, Diana, Basra, Dima, Bala, Lish, Murti, Jaldhaka, etc. Most of the rivers are originated from the mighty Himalayas and perennial in nature. The rivers get sufficient precipitation during monsoon resulted in flash floods in Dooars. The soil erosion is another common problem which leads forest land degradation and death of numerous death of wildlife in the region.

The forest cover loss may also cause a number of environmental problems like soil degradation, river bank erosion and flooding of forest lands. The natural processes are surpassed by the human interference and thereby accelerated the processes of forest

destruction in the study area. The River flooding is one of the major problems of the Buxa Tiger reserves as the area is often affected by floods due to the heavy rainfall (see table 5.4).

Table. 5.6 **Affected areas due to changing course of rivers and floods which in BTR (2012) (in Ha.)**

River/Jhora (Stream)	Range	Total area affected
Jainti	Jainti	250
Rydak II	Do	230
Kalikhola	Do	14
Sankosh	Do	01
Hathinalajhora	Do	12
Khuruljhora	Buxaduar	05
Dima	Do	400
Buxajhora	Do	300
Bala	Pana	300
Pana	Do	15
Gangutiajhora	Do	02
Raimatang	Do	15
Swetikhola	North Rydak	02
Rydak I	Do	15
Dhoksha	Hamiltonganj	20
Basra	Hamiltonganj	15
Total		1596

Source: Cited from B.K Das. 'Losing Biodiversity, Impoverishing Forest Villagers: Analysing forest policies in the context of Flood Disaster in a National Park of Sub Himalayan Bengal, India'.

One of the most important agents of the destruction of forests in Dooars is the unscientific and illegal mining activities in the Sub-Himalayan areas of this region, West Bengal and adjacent Bhutan. Forest lands have been greatly destroyed either by erosion or by unscientific mining or due to over-extraction of sands and pebbles from river beds. An excessively high amount of dolomitic dust transported by air and river water accumulates on the forest floor and leads to a rise in the pH value of the soil. The alkalinity of the soil hinders the availability of phosphate to the plants. Non-availability of phosphate along with alkalinity is found to be responsible for dying of valuable plant species. These factors are compelling the wild animals to move farther down south, leading to high-frequency Human-Animal Interactions. Reportedly, elephants, bison and leopards often enter Coochbehar district closer to Terai-Dooars frequently and even to Bangladesh (Sarkar, 2008).The fragmentation of habitat and loss of biodiversity in

the Dooars has been the major problem to keep the Human-Animal Relationship sound. The Land use changes are the main reason behind the fragmentation of natural habitats in Dooars.

5.3.2 Nature of Cropping

Though, cultivation of paddy is the main, the agricultural land near to the forest areas in Dooars has been converted into betel nut gardens, lemon gardens, tea gardens etc. This conversion of agricultural land into the permanent garden is basically to check the crop damages from wild Elephant, Rhino and Bison. The other alien species of tree that has been recently introduced by the forest dwellers in Jaldapara National Park region is *Simul* tree (*Bombax ceiba*) (plate 5.2).

Plate 5.2 **The villagers of Salkumarhat planted hybrid species of *Simul* tree and Betel nut gardens in the agricultural land close to the protected forests of Jaldapara National Park to avoid crop damages from wildlife attacks**

Source: Captured by Researcher during the field survey conducted at Salkumarhat (Jaldapara National Park). November, 2017.

The hybrid species of Simul grows very fast as well as wild animals does not like the tree as a fodder. The other major changes in land use which villagers from

fringe areas opined that people are being forced to reduce cultivation area due to increase in protection related works. Eventually, villagers become landless resulted migration of the young people to the different parts of the country in search of livelihood.

5.3.3 Forest Governance

India's forest management system, inherited from the British, is still based on the premise that forests cover a specific territory that has to be governed in a repressive fashion for the extraction of profit. The forest management has been failed to reduce the Human-Animal Interactions or minimise the rate of extinction of wild species. There is a number of instances that can be drawn from Dooars on this regards.

As very little interactions of the locals are allowed into the forest, people illegally fell trees (table 5.7), cut fodder grasses, graze cattle inside the protected areas outcomes Human-Animal Interactions and often such interactions resulted to the death/injuries of human and wildlife both. The pace of destruction of natural resources has been increasing with the intensification and diversification of existing economy as result of human population growth in the Dooars.

Table 5.7 **Detailed Timber seized in Dooars (2015-16). (Timber in m3)**

Division	Seizure of timber	Stolen timber	Total
Darjeeling WL	93.031	74.583	167.614
Baikunthapur	26.087	2.185	28.272
Jalpaiguri	762.093	44.813	806.906
BTR East	758.14	0	758.14
BTR West	1028.91	368.24	1397.15
Jaldapara	598.363	0	598.363
Gorumara	0.173	3.6	3.773

Source: Computed from the Annual administrative report- 2015-2016, Department of Forests. Govt. of W.B. p-98.

People with subsistence nature of agriculture and daily labourer at different tea estates are highly vulnerable and committed different types of crimes (poaching of wild

animals, sandalwoods etc.) in the region. The co-operation between Forest and Wildlife Department has not been so sound in Dooars. Above all, the exclusion of local community for forest and wildlife management have created a detrimental attitude among the forest villagers which eventually leads several problems of forest governance.

5.3.4 Occurrence/Frequency of Human-Animal Interactions (HAI) in Dooars

The Human-Animal Interactions have been reported in a daily basis from different parts of the Dooars. During the harvesting season (Oct-Jan) it has been intensified. People of Salkumarhat opined that elephant attacks on home in search of food during night and dawn.

Plate 5.3 **Betel nut garden damaged due to elephant attack at Bhutiabasti**

Source: Captured by Researcher during the field survey at Bhutiabasti (Jayanti Range of B.T.R). November, 2017.

The people of Bhutiabasti have experience of living in both inside and outside of the forest, as the village was relocated from the core area of Buxa Tiger Reserves. They shared their concerns about the Human-Animal Relationship. Elephant attacks occur almost daily and other animals which are frequently come across the village are

Bison and Leopard. Highest cases of depredation and Human-Animal Interactions have occurred in the harvesting season of paddy (Oct-Jan) every year.

Close to the protected forest areas in Dooars, cultivation of different food crops have been carried by the forest villagers. The decrease of fodder base in the protected forests during the winter season leads high intensity of wildlife depredation in forest villages in search of fodder resulted in crop damage. A resident of Bhutiabasti said as- 'There is very less fodder base in the forests, therefore, wild animals strayed in villages caused crop damages especially during the night time'(Translated from Bengali).

5.3.5 Types and Nature of HAI in Dooars

The types of Human-Animal Interactions include crop damage, hut damage, killing and injury of human, poaching of wildlife, retaliatory killings and deaths due to an accident with speeding vehicles and trains. The NFR railway track which passes through different protected areas have the major concerns for wildlife death and several numbers of elephant have been killed on this tracks. The details can be visualised from the following discussions:

Elephant management has been the major problem of wildlife management as most of the Human-Animal interaction occur in Dooars are in the form of Human-Elephant Interactions. India is the home to an estimated 25,000 wild elephants but their numbers are fast depleting due to poaching, loss of habitat and also train accidents, particularly in eastern and North-Eastern states. Train accidents of this sort have of late become a concern in the Dooars, adding that according to official figures at least 42 elephants had been killed in the Dooars since 2004.

The relations between Human and Elephant is a key issue in Dooars. Almost 5 Elephant deaths on an average every year in the killer track of NFR Railway. Siliguri

is connected by railways to the rest of the North Eastern part of India through Alipurduar by two separate lines, one of which Siliguri Junction to Alipurduar Junction stretches over 168 km and crosses protected forests over 74 km i.e. almost 44 percent of the length. The railway track passes through the buffer zone of BTR including nine sensitive Elephant corridors in the reserved forests.

The Banarhat railway crossing has been reported for elephant deaths due to an accident with trains. The evening time (6 pm to 8 pm) and the dawn time (4am-5am) are very crucial for elephant crossing over the railway tracks. Due to the low visibility and lack of information about the railway schedule, most of the elephant's deaths occur. Recently there was a death of 8 elephants due to collision with a goods train at Banarhat railway crossing. The railway track around Banarhat covered by large tea estates which provide natural corridors for elephant migration. The sudden appearance of an elephant on the railway tracks and lack of communication between the forest and railway department are the main reason of elephant death at Banarhat.

-A resident near the Banarhat railway crossing who has witnessed the incidents of elephant death.

Plate 5.4 **The Railway Tracks Passage through Elephant Corridor at Banarhat and often reported for Elephant deaths by Trains**

Source: Captured by Researcher during the field survey at Banarhat, Jalpaiguri. November, 2017.

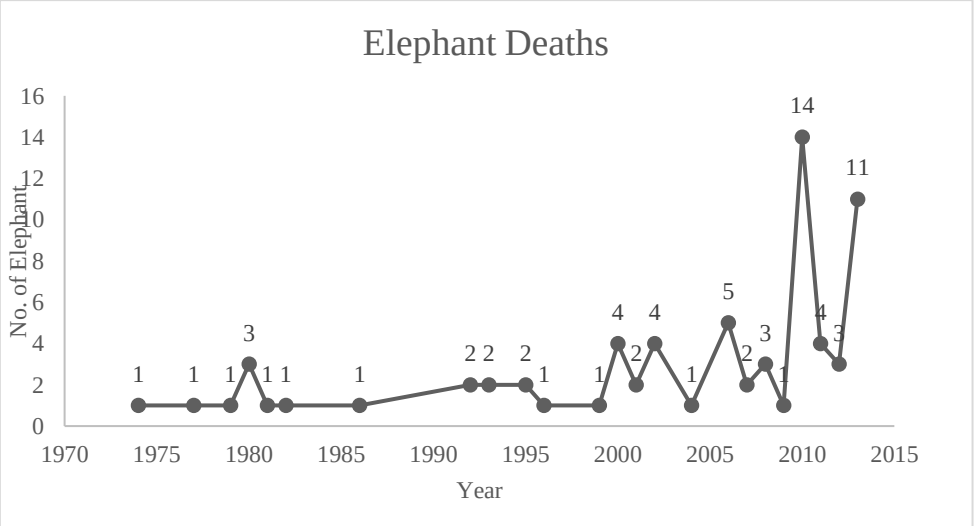
The following table shows the locations and number of elephant deaths due to the accident with train in Dooars.

Table 5.8 **Elephant Death on Railway Track (1974-2013)**

Year	No. of Death	Location
1974	1	Mahananda WLS
1977	1	Mahananda WLS
1979	1	Mahananda WLS
1980	3	Mahananda WLS, Bagrakot T.G
1981	1	Mahananda WLS
1982	1	Mahananda WLS
1986	1	Mahananda WLS
1992	2	Jaldapara WLS, Below Chapramari WLS
1993	2	Mahananda WLS, Jaldapara WLS
1995	2	Mongpong RF
1996	1	Buxa Tiger Reserve (BTR)
1999	1	Chapramari WLS
2000	4	Below Chapramari WLS, Jaldapara NP
2001	2	BTR, Mongpong RF
2002	4	Below Chapramari WLS
2004	1	Mahananda WLS
2006	5	Mahananda WLS, BTR, Mongpong RF, Madarihat
2007	2	BTR, Mahananda WLS
2008	3	BTR, Mahananda WLS
2009	1	Jaldapara NP
2010	14	Mahananda WLS, Rahimpur T.E, Banarhat Crossing, Chapramari WLS, Singimari, Garopara Chowpathi BTR, Red Bank T.G
2011	4	Red Bank T.G, Mahananda WLS, Jaldapara NP
2012	3	Daina T. E.
2013	11	Maraghat, BTR, Rjabhatkhawa, Mahananda WLS
Total	71	

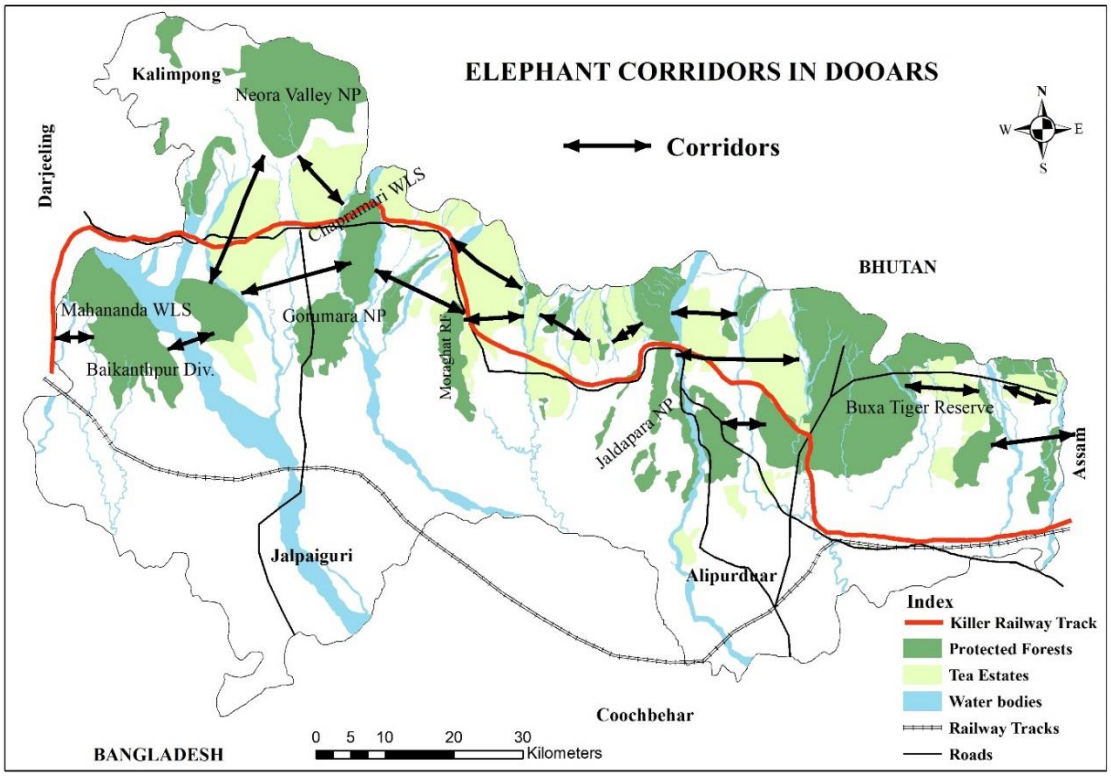
Source: North Eastern Frontier Railway, Govt. of India

Fig. 5.6 **Elephant deaths on Railway Tracks in Dooars**



The major zones of influences are 1) Mahananda Wildlife Sanctuary, 2) Forests of Kalimpong Forest Division, 3) Forest tracts of Tondu (Chalsa) between Chapramari Wildlife Sanctuary and Gorumara National Park, 4) Diana reserve forest under Jalpaiguri Division including Moraghat and Bannarhat area, (Rethi-Moraghat corridor) 5) Jaldapara National Park and 6) Buxa Tiger Reserve (Das, 2014) (See fig. 5.7).

Fig. 5.7 **Railway Tracks and Roads obstructed Elephant Corridors in Dooars**



Source: Prepared by Researcher from Pastorini, J. 'Gajah, the Journal of Asian Elephant Specialist group'. Nov 43, p-33.

Elephant deaths generally occurred at night, between 6 pm and 6 am. It said the single line railway track from New Jalpaiguri to Falakata-Alipurduar route should be upgraded into a double line track so that the traffic of through the protected areas can be diverted through it. State wildlife advisory board member Animesh Basu said, 'most such incidents take place in the evening when non-stop superfast trains pass through the Dooars. (Times of India, Nov 14, 2013).

Animals are respected by many people on religious grounds in some places, but the stress on their livelihood has pushed people to retaliate and kill nuisance causing

animals. When leopards attack livestock, people retaliate. The same is the case for peacocks invading cropland. Farmers poisoning peacocks have been reported frequently. To prevent birds from attacking the crop, farmers spread poison in the area, thus killing not just peacocks but also other birds present in the area (*ibid*).

Most of the protected areas in Dooars, retaliatory killings are increasing. Less fodder base within the protected area bounds wild animal to straying. Thus the Human-Animal Interactions happen. The crop damage, hut damage and livestock lifting by the wild animals develop retaliatory feeling in humans' mind to kill wildlife.

Unless there is proper social and democratic land use planning in the country, there is little hope of the task force's many recommendations achieving anything substantial (Gopalkrishnan, 2010). The repeated case of Elephant death due to collision with train in Dooars needs to be checked. Different NGOs and Environmentalists demanding to stop rail route through the protected forest area.

Table 5.9 **Locational Analysis of FGDs in Dooars**

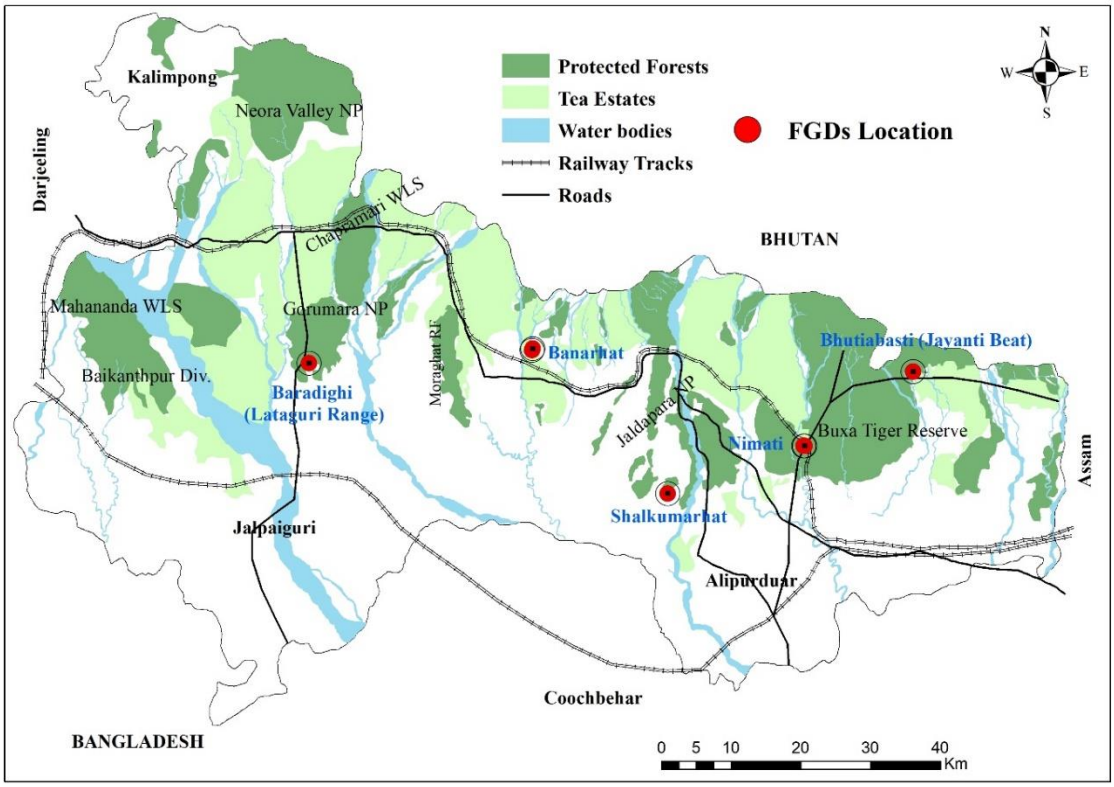
Indicators/Location	Salkumarhat	Nimati	Bhutiabasti	Banarhat	Baradighi
Land use	The transformation forest land into agricultural land and further conversion of agricultural lands into garden and orchard near the forest fringes and construction of irrigation canal, etc. have degraded the forest land.	The expansion of NH31 has destructed a huge area of protected forest as well as tea estates.	The Conversion of tea estates into settlements, as the village was resettled from the core area of BTR (Jayanti) to present location. The tea estate was converted into the settlement.	Development of new infrastructure in between the Elephant corridors and old tea bushes uprooted in some waste lands have been converted into tea plantation.	Erosion of forest land due to the bank erosion of Neora River and encroachments of forest land for the purpose of agriculture in the outer area of Gorumara National Park.
Nature of Cropping	Cultivation of paddy is the main but some of the agricultural lands on the fringes converted of betel nut gardens, lemon garden, and jujube palm and hybrid *simul* trees (*Bombax ceiba*) to protect crop damage by wildlife attacks.	Banana gardens have been transformed into plantations and others fruit crops which do not attract the wild animals. Paddy grows in the fringe areas of forest.	Some of the plantation areas have been transformed into betel nut gardens. Vegetables and corns are the main crops but get damaged by wildlife attacks.	Dominated mostly by tea estates. Farming of some vegetables is also found.	It's a tea estate. Paddy is the main crop which grows outside the tea estate.
Forest Governance	Very little interactions with the locals are allowed into the forest. Livestock grazing in the buffer zones has been prohibited completely. Prompt action has been taken at the time of wildlife attack. The process of the ex-gratia is very complex and time-consuming. People get a very meagre percent of ex-gratia as compare to their	The quick response team has been created to tackle the Elephant attack. Death of wildlife due to the accidents on NH is the major problems here. Respondents said that forest department is very active at the time of straying off the wild animals.	The Panchayat Pradhan of the area said that no compensation/ex-gratia has been paid for the wildlife attacks. The process to make a claim of ex-gratia is very lengthy and bureaucratic reluctance demoralise people to make a claim for it. The payments of ex-gratia as per government notified amount have never been made by the authority.	There is a communication gap between the Railway and Forest department. Railway department has never informed about the new trains and schedule of the traffic to the forest department.	No proactive measures have been implanted to prevent the wildlife attacks. The response of the forest department is not very sound at the time of wildlife depredation. People have several complaints about the payments of ex-gratia.

	amount of property/crop/lives loss.				
Occurrences/frequencies of Human-Animal Interactions (HAI)	Almost every day. during harvesting (Oct-Jan) seasons it is very high.	The intensity of the Human-Animal Interactions is very high all through the year.	Almost every day in the harvesting seasons. Rest of the year it is frequently.	Twice/thrice in a month. During winter wildlife death on Railway track increase due to low visibility.	The intensity of the HAI is very high throughout the year.
Types and Nature of HAI	Crop damage, Hut damage, Livestock lifting, Killing and injuries to Human, Animal death, injuries, cardiac failure, Poaching, retaliatory killings etc. are reported from Jaldapara National Park. Poaching of rhino horn is reported several times.	Several deaths and injuries of wildlife on roads (NH31). Most of the time crop damages happened due to the elephant attacks. The frequencies of crop damages by wildlife (Gaur, Elephant and Monkey etc.) are a common problem in Nimati.	Elephant attacks are the main sources of Human-Animal Interactions at Bhutiabasti. Livestock lifting cases have been the other problems due to the leopard attacks.	Frequent deaths of wildlife on railway tracks due to the accident with a train. Numbers of elephant deaths have been reported in a recent year.	Leopard attacks are very high Gorumara National Park as compares to the other protected areas in Dooars. Deaths and injuries due to the elephant attacks are also reported. Crop damage due to the attacks of Gaur and elephant and livestock lifting are the very common types of HAI at Baradighi.
Name of the Animals causing damages	Rhinoceros are the main. The other animals are Elephant and Gaur.	Elephants are dominating and the other animals are Leopard, gaur, Monkey, etc.	Elephant and Leopard are the leading wildlife species.	Elephant and Leopard	Leopards, Rhinoceros and Elephants are the main. The other animals are gaur and monkey etc.
Others information	The Brewing of local liquor (*Cholai*) and rice beer (*Handia*) from the rice and molasses are found. The smell of such liquor attracts elephants. 'If you brew liquor any and everywhere, then for elephant		Electric fencing to guard the crop, obstruct the free migratory routes of Elephants and other wildlife.		During the winter season, the drains in the Tea estates are used by the leopard for breeding. The leopards become furious during their breeding and attack on the tea workers. Winter season is

	harassment do prepare', - Baruah, 2014. In search of such liquor, the hut damage has been reported due to the attacks of elephants at salkumarhat and mejbill areas of Jaldapara National Park.				reported for most of the leopard attacks.
What are the major causes of animal depredation?	Less fodder base, destruction of natural habitats and planting alien species of grasses, etc.	The attraction of food crops especially rice one of the favourite fodder for Elephant. Nimati is a part of Elephant corridor. Due to the often HAI in Dooars the nature of the wildlife has been changed.	It is a biological corridor for wildlife movement.	It is an Elephant corridor	Less fodder base and the increase in the population of some wild species, the close proximity of agricultural lands, etc.
Do you have any suggestions to improve the Human-Animal Relationship?	Electric fencing of the village, 24x7 patrolling by the forest guard, joint wildlife management, etc.	Awareness and cooperation between the forest department and local villagers. Awareness programme for the importance of wildlife, etc.	Electric fencing and High drains in the boundary of the village, easy policies for the payments of Ex-gratia, quick response at the time of wildlife attacks.	There should be a strong and viable cooperation between the Railway department and Forest department, speed limits of the trains, patrolling of the forest guard, etc.	Increase the forest land, relocation of the overpopulated species, bring some carnivore (Tiger) to check the population of prey animals like deer, bison, etc. Easy and rationale payments of ex-gratia.

Source: FGDs conducted at Nimati, Bhutiabasti, Salkumarhat, Banarhat and Baradighi. November, 201

Fig. 5.8 **Location sites of FGDs in the study area**



Source: Prepared by Researcher, November, 2017.

5.4 Concluding Remarks

This study has confirmed the prevalent of Human-Animal Interactions in Dooars and that despite different measures being put to resolve and mitigate the problems but it is still going on. The Human-Animal Interaction alleviation is a two-sided equation. Both wildlife and people are in trouble.

This region has been historically known for one of the richest biodiversity zones in India, experiencing threats from anthropogenic factors in recent decades and become biodiversity hotspot. Different developmental projects, reckless deforestation creates such situation where some of the well-known wild species are in endanger and identified to be extinct after few years. This region used to be one of the biological corridors of wildlife, but with the increase of population and decrease of forest cover leads the wild animal attacking human habitats. The number of cases of anthropogenic

losses is increased due to Human-Animal Interactions with time. In addition to life losses, these HAI produce a negative psychological effect among the locals encountering these routinely. This increases the chances of revengeful effects among the locale. Hence, if this trend continues it will be a huge challenge to conserve wildlife in Dooars.

All the protected areas have high intensity of wildlife deaths in Dooars. The total number of wildlife death in Dooars during 1991 to 2017 was 1121 with an average death of 42 wildlife in every year. The total number of wildlife death due to natural and HAI was 594 and 416 with an average rate of 22 and 15 wildlife death in every year respectively.

The Gorumara, Chapramari and Neora Valley region has the highest number of wildlife deaths in between 2003 to 2017. The total number of wildlife deaths in Gorumara region was 475. The average death of wildlife in this region was 34 wildlife every year. Out of which the natural death of wildlife was 335 and HAI death 127 in every year with the average rate of 24 animals and 10 animals respectively.

The number and intensity of human casualty have been increasing in the protected areas of Dooars. The total number of human death and injury during the time period of 2002 to 2017 was 343 person and 1045 person with an average rate of 26 human death and 70 human injuries per year respectively caused by mainly of wild animal attacks. The highest cases of human death and injury occurred in BTR. The total number of human death in BTR was 158 and total injured was 47 which comprises an average rate of eight death and one injury per year in 2002 to 2017.

The highest number of crop damage cases have been reported from Buxa Tiger Reserves. In BTR, the total number of crop damage cases during 2002 to 2017 was 10814 (includes 4656 in BTR West div. and 6158 in BTR East div.) with an average

rate of 3698 times in a year. Followed by BTR, the Jaldapara National Park was reported for 9599 times for crop damage cases due to wildlife attacks.

The hut damage cases have been significantly increasing in Dooars. Hut damage occurs mainly due to the elephant attacks. The total number of hut damage in Dooars during 2002-2017 was 11948 with an average damage of 799 huts in a year. The highest number of hut damage has been reported once again from the BTR region. The HAI has been intensified with a rapid pace in Dooars and it is the high time to adopt or implement different measure to minimise HAI, failing this, the extinction rates of wildlife will increase.

The WPA act of 1972 was not solving any problem as the local people complained that their lives were considered of less value than that of animals. They sought compensation when animals damage their crops, property but they seek more effective rules and regulations to protect the animals, and they further said that the officials were slow and ineffective in responding when called to help. According to them, the authorities had no sympathy with the communities who are facing many problems due to Human-Wildlife Interactions.

It is found that with the advanced conservation strategies with new environmental protection policies fruitfully influencing on wildlife and forest management in some parts of Dooars. The number of some major wildlife has been increasing in protected areas of Dooars during past few years. However, with an increase in a number of wild animals, the occurrences of Human-Animal Interactions has also gone up tremendously resulting in huge casualties on both sides. It is noticed in most research reports, wildlife losses are mostly highlighted, at the same time ignoring human deaths and injuries.

The opinion of villagers within the forest fringes and near the forest area differs from the government officials those who (the beat officer, forest guard) are engaged with a primary level of forest protection and management. Most of the forest dwellers in Dooars have been directly influenced by the wildlife and forest resources since time immemorial.

The forest department has been trying their level best to minimise the damage toll at different protected areas of Dooars. The increase of some flagship species like elephant, bison (gaur) and rhino and decrease in the fodder base due to the change in forest cover and density leads often staring of such animals into human habitations. The forest department may not be able to fully stop or check the wildlife straying as well as illegal activities of forest dwellers in different parts of the Dooars. Different initiatives, programme and use of modern technologies have been adopted by Forest Department to maintain a peaceful relationship between Human and wildlife in Dooars.

There are need to be a proper management of forests area with greater and advance the use of technology as well as traditional knowledge to mitigate or reduce the frequency of Human-Animal Interactions. The main objective of wildlife protection is thus to enable coexistence and sharing of resources at the same level. To addressing the problems, finding a balance between conservation of wildlife as well as priorities and the needs of people who live alongside wildlife should take note of. Therefore, there is need to test new solutions to Human-Animal Interactions. The Villages and households in heavy-risk areas can be educated on preventing and mitigating Human-Animal Interactions. Also, these need to be reported to the authorities in an organized and timely manner.

Chapter- 6

Summary of Findings and Recommendations

The study shows that land use change has been impacted on the Human-Animal Relationship in Dooars in many ways. The present deteriorated status of Human-Animal Relationship in Dooars has its roots in the early years of peopling and extraction of natural resources. The destruction process of forest cover and forest land have their roots in the early years of British India. The Colonial ruler started to exploit forest resources as well as converted scrub land and waste land near the forest fringes into value-added cultivation of plantation (tea and cinchona) agriculture. The followings findings have been drawn from the study:

6.1) During the colonial period, the forest resources were degraded under the different land settlement in Dooars, viz. the 'Permanent Settlement' introduced with a semi-feudal system of land use in the region. The *zamindars* allocated their land to the *talukdars* and *chukanidars* in Dooars. The *zamindars* enlarged their estate by clearing the forests and wastelands to increase the revenue. In India, the forest land was not regularised under any of the settlement of land allocation by the British. The British showed very less interest in wildlife conservation, rather they killed wildlife in the name of '*shikar'* (Hunting). The thoughtlessness of hunting led to habitat destruction and the total number of some flagship species of wildlife were found to be endangered and near to extinction.

6.2) The development of tea industry followed by the construction of roads and rail network has had a great impact on land use in Dooars. All of the roads and rail network in Dooars pass through the protected forests. In the colonial era, the main motive behind the development of roads and rail network was to supply raw materials

to Britain. After independence (because of the partition of Bengal) the Dooars became the ‘Gateway’ of North-East India and a large scale of developmental activities have been carried throughout the region. All these developmental activities have been adversely affecting the forest resources as well as disturbing the ecological balance of the region. Moreover, the thrust of colonial forestry revolved around revenue generation and it was essentially commercial in nature. The habitats of wildlife got reduced in different parts of the region due to reckless clearance of scrub and pasture forest land during the colonial period.

6.3) The introduction of tea plantation in Dooars changed the whole mechanism of the region, not only for the natural settings but it also changed the socio-economic characteristics of the region. The number of tea estate and area under plantation have been growing in Dooars. The total number of tea garden in Dooars was 191 (15025 hectares) in 1991, which was only 55 in 1881. It is noted that the small tea growers have been playing a vital role as most of the small and marginal farmers converted their agricultural lands into tea garden in Dooars.

6.4) The peopling in the Dooars has also greatly been influenced by plantation agriculture. Therefore, it can be said that tea plantation has brought a paradigm shift in land use pattern of Dooars. The forced emigration of tea labourers by British from the tribal belt of central India led to demographic changes in Dooars, which was augmented by the emergence of small-township and local markets. The subsistence agriculture in the fringe areas of the forest has also been carried out by the tea labourers in Dooars. Thus, the pressure of increasing population has affected the existing natural resources. The places which are located at the nodal point of two or more large tea estates have become market centres. The Banarhat, Madarihat and Birpara are the examples of such market centres in Dooars.

6.5) Rapid destruction of forests in Dooars started with the construction of Bengal Dooars and Coochbehar State Railway in 1870s. The objectives behind the development of railway in Dooars was to create a supply chain for tea industry as well as to extract forest resources. A huge area of Sal forest was felled down to supply sleepers for the construction of railway tracks. Almost all the protected forests in Dooars were disturbed due to the construction of railway. The destruction process has not stopped even after independence. The meter gauge tracks have been renovated into broad gauge which again led destruction of forest land in the heart regions of protected forests in Dooars. The 74 km. of NFR railway tracks between Siliguri junction to Alipurduar junction has been identified as killer track because this stretch of railway track has cut down the biological corridors for wildlife movements and numerous wildlife have been killed by this tracks.

6.6) Most of places of Dooars are well connected with road networks. The NH31- A and different offshoots of state highways makes the region accessible. Almost all the protected areas have degraded due to construction of these roads. The construction of roads in the protected areas for monitoring and management purpose have severely affected the existing ecosystems. The degradation is being aggravated with the ongoing construction of Asian Highway-2 in the very adjacent areas in Dooars. There have been a number of instances of wildlife killing due to the road accidents in Dooars. The Rajabhatkhawa and Nimati region of Buxa Tiger Reserve, Lataguri and Dhupjhora region of Gorumara National Park, Chilapata region of Jaldapara National Park, Northern part of Chapramari Wildlife Sanctuary and Gulma region of Mahananda Wildlife Sanctuary have been suffering the most from such wildlife losses due to the accidents on roads and railways.

6.7) In the post-independence period, due to the reformation of land use regulations (land acquisition Act of West Bengal) during the 1960s and 1970s, several changes in land use have taken place. The evidence of forest cover loss has been very high in the early years of independence in Dooars. Among the three districts (Darjeeling, Jalpaiguri and Coochbehar), Coochbehar shows the largest share of forest cover loss and forest land degradation followed by Jalpaiguri and Darjeeling. Considering the above facts, it is very clear that the wildlife loss is inevitable in Dooars.

6.8) The distribution of forest cover under different canopy density in Darjeeling, Jalpaiguri and Coochbehar show an increase during the year 2001 to 2015. Prior to the year 2001, the total forest under different canopy density (very dense, moderate dense, dense and open forest) was 1455 sq. km., 1582 sq. km. and 32 sq. km in Darjeeling, Jalpaiguri and Coochbehar district respectively. In 2001, the total forest in the Darjeeling, Jalpaiguri and Coochbehar increased to 2196 sq. km., 2344 sq. km. and 38 sq. km. respectively. It further increased to 1004 sq. km. in Darjeeling, 2863 sq. km. in Jalpaiguri and 348 sq. km in Coochbehar during 2015. The unexpected increase of forest cover under different canopy density could be the results of satellite imagery analysis, which was earlier conducted through real ground survey of forests. It is very difficult to delineate a proper boundary between forests and tea areas in Dooars from the satellite imageries as the signature value overlaps each other which might resulted in increase of forest density. Therefore, an extensive field survey is needed to be carried out to assess the actual forest cover in Dooars.

6.9) The encroachment and degradation of forest land in every protected areas of Dooars are very high. In Dooars the total forest area encroached in 2008 was 1437.66 hectares. The encroachments of forest area in Jalpaiguri district was 293.54 hectares. The encroachments of forest area in Darjeeling district was 148.16 hectares. The forests

of Buxa and Baikunthapur in Jalpaiguri district has been impacted by encroachments. The Buxa region and Baikunthapur forest lost 98.5 hectares and 56.75 hectares respectively during 2008. Although, there was a decrease in encroachment of forest, the total area encroached during 2010 was 1291.14 hectares. During 2013, the total encroachment of forest was 1454.25 hectares in Dooars. The encroachments of forests leads to degradation in forest cover and thereby the wildlife become more vulnerable in protected areas of Dooars. The comparative assessment of forest cover in three district show an uneven trend of growth. During 1988 to 2006, Darjeeling district lost more than seven percent of forest land. On the other hand, the forest land in Jalpaiguri and Coochbehar show an increase. The total percentage of forest land in Jalpaiguri was 25.72 (1602 sq. km) in 1988. With an increase it reached 29.93 percent (1864 sq. km) in 2006. Similarly, in the district of Coochbehar the forest cover percentage was 1.03 (35 sq. km) in 1988 which increased to 1.3 percent (44 sq. km) in 2006. Though in the forest report increasing trends of forest cover has been showed, the question whether the quality of the forest remain same even after yearly increase in forest cover, remains unaddressed.

6.10) The natural agents of forest degradation like fluvial system and floods of different rivers have adverse effects on forest land. The region is endowed with different swift flowing river like Teesta, Torsa, Jaldhaka, Dima, Rydak, Sankosh, Jainti etc. Due to the river flooding, 1596 hectares of forest land has been degraded in Buxa region.

6.11) The results of satellite imagery analysis of three time periods prove the changes in forest cover and tea plantation areas in Dooars. As discussed earlier, the introduction of plantation agriculture has changed the whole scenario of the region. Initially, the forests of highlands foothills of the Himalaya was cleared for the plantation

purpose by colonial ruler and gradually the wastelands, scrub forests etc. have also been altered in the nearby plain areas. The relationship between the forest cover and tea plantation areas contrast with each other. The growth in tea plantation areas resulted in a decrease in the forest cover in Dooars. The analysis of forest cover in the protected areas of Dooars through the satellite imageries show a continuous decline in forest cover. During the year 1972-73, the total forest cover in the protected areas of Dooars was 1923 sq. km which subsequently decreased in the following years and become 1596 sq. km in 1990-91. With a further decline in 2016-17, the forest cover in protected areas of Dooars turned into 1518 sq. km.

6.12) The distribution of wildlife species are region specific in Dooars. The Gorumara and Jaldapara National Park are well known for their one-horned rhino population. The major wildlife species in Buxa Tiger Reserves are bison and deer. The Royal Bengal Tiger has been sighted in the Neora Valley National Park recently. The Mahananda Wildlife Sanctuary is well known for several species of birds. The other common wildlife which have been extensively found in all the protected areas of Dooars are elephant and leopards. The influence zone of elephant and leopard have been increasing and now they stray or migrate long distance in search of food and habitat.

6.13) Evidence of the media reports of The Telegraph and *Uttarbanga Sambad* ascertain the deterioration of Human-Animal Relationship in Dooars. The Human-Animal interfaces have been reported on a regular basis. Some reports of The Telegraph reveal that the human deaths and casualty have been increasing in recent years. The average number of human death due to wildlife attacks was less than 25 prior to the year 2009 but it has increased to death of 38 people per year especially after 2015. The railway tracks and roads are the main hotspot zones of wildlife deaths in Dooars. The

leopard attacks have been reported mostly from the tea garden areas. The crop and hut damages are the common casualty caused by wildlife. Elephant attacks are the main sources of Human-Wildlife Interfaces in Dooars. The places which have been occasionally reported for Human-Animal Interactions are Nimati, Rajabhatkhawa, Rydak, Hamiltonganj, Bhutiabusti, Kumargram of BTR; Salkumarhat, Jaigaon, Binnaguri of Jaldapara National park; Sukna, Sevoke, Naxalbari, Garidhura of Mahananda Wildlife Sanctuary and Malbazar, odlabari, lataguri, maynaguri, Tondu of Gorumara and Chapramari region.

6.14) The dynamics of Human-Animal Relationship in Dooars are region specific. The Buxa Tiger Reserves is the largest protected area in Dooars. The reserves contains a huge human population as well as shares an international boundary with Bhutan. There are numerous rivers which flow across the region. Human population living in the protected areas have always been a threat to the wildlife. Therefore, the B.T.R has been suffering the most in terms of wildlife loss and human casualties. Though the reserve is named as a tiger reserve, the last incidents of tiger sighted in Buxa was the early 1990s. Animal Census Report 2013-2014 and 2014-15 declare that there are tigers in Buxa but recent scientific study denies the fact as there was no evidence to reveal the existence of tiger in Buxa Reserve. The depredation of wildlife is very high in the BTR East. Most of the times, the major Human-wildlife Interfaces in Buxa region are Human-Elephant, Human-Leopard and Human-Bison. The number of crop damage cases are increasing day by day. There are some issues with Bhutan regarding the wildlife management in Dooars. The places which are very common for wildlife deaths in Buxa Tiger Reserve are Nimati, Hamiltonganj, Hatipota, Rydak, Dima, Poro and Jayanti.

6.15) The Jaldapara National Park has been very successful in terms of one-horned rhino conservation in India. There were only 75 rhinoceroses in the years 1969 in Jaldapara which subsequently rose to 189 in 2014. The main reason behind such success was the promotion of Wildlife Sanctuary into a full-fledged National Park and the enactment of WPA, 1972. The Human-Rhinoceros Interfaces are the main challenges at Jaldapara National Park. There was a poaching of 56 rhinoceros prior to the 1970s. The Khaibari, Dhumchi and Chilapata region of the Park constitutes important biological corridors for elephant movement but forest cover in those areas degraded at an alarming rate. The forest villagers have planted betel nut gardens and *simul* trees to combat wildlife attacks and prevent crop damages. In spite of various measures adopted by Forest Department, the casualty has been increasing day by day. Salkumarhat, Chilapata, Khaibari, Nilpara and Madarihat-Birpara (the NH31) are the places where levels of Human-Animal Interaction is very high in Jaldapara National Park.

6.16) Like Jaldapara National Park, the Gorumara National Park is also well known for its one-horned rhino population. The number of rhinos in Gorumara National Park has increased from 12 in 1969 to 50 in 2014. The density of human population is very high in the Gorumara region. The NH-31 between the Lataguri and Malbazar is the main threat to the wildlife at Gorumara. The highest number of human injuries (843) have been reported from Gorumara region only.

The major animal which are involved in Human-Animal Interactions at Gorumara is leopard, elephant, rhino and monkey. The intensity of crop damage is increasing. The livestock loss (39) is also very high for tea villages near to the Gorumara National Park. Lataguri, Matiali and Dhupjhora of Gorumara National Park show very high levels of Human-Animal Interactions.

The Chapramari Wildlife Sanctuary and Neora Valley National Park which are administered under the same wildlife zone of Jalpaiguri show very few incidents of Human-Animal Interactions. In the Chapramari region, the deaths of elephant by trains is a major threat. Recently, The Royal Bengal Tiger has been sighted in Neora Valley National Park.

6.17) The Mahananda Wildlife Sanctuary acts as important biological corridor for elephant migration in between India and Nepal through Mechi river region. The NFR railway tracks which passes through Gulma-Sevoke region and NH (31A, 10) are the major threats to wildlife at Mahananda Wildlife Sanctuary. The close vicinity of Siliguri city and huge traffic through the protected region aggravate the existing interactions between human and animal. Among different types of Human-Animal Interactions, the Human-Leopard and Human-Elephant interactions are dominated by Mahananda WLS. The high levels of HAI have been reported from Gulma, Sevoke and Sukna region of Mahananda Wildlife Sanctuary.

6.18) All the protected areas have high intensity of wildlife deaths in Dooars. The total number of wildlife death in Dooars during 1991 to 2017 was 1121 with an average death of 42 wildlife every year. The total number of natural death of wildlife and death due to HAI was 594 and 416 with an average rate of 22 and 15 wildlife death every year respectively.

The Gorumara, Chapramari and Neora Valley region has the highest number of wildlife deaths in between 2003 to 2017. The total number of wildlife deaths in Gorumara region was 475. The average death of wildlife in this region is 34 wildlife every year. Out of which the natural death of wildlife was 335 and HAI death was 127 every year with the average rate of 24 animals and 10 animals respectively.

The number and intensity of human casualty have been increasing in the protected areas of Dooars. The total number of human death and injury during the time period of 2002 to 2017 was 343 person and 1045 person with an average rate of 26 human death and 70 human injuries per year respectively caused mainly by wild animal attacks. The highest cases of human death and injury occurred in BTR. The total number of human death in BTR was 158 and total injured was 47 which comprises an average rate of eight death and one injury per year during the period 2002 to 2017.

The average rate of property loss in term of crop damage, hut damage and livestock lifting in the protected areas of Dooars shows the recent status of Human-Animal Interactions in Dooars. During the last fifteen years (2002-2015), the total number of crop damage cases was 36478 with an average rate of 2433 cases of crop damage per year.

The highest number of crop damage cases have been reported from Buxa Tiger Reserves. In BTR, the total number of crop damage cases during 2002 to 2017 was 10814 (includes 4656 in BTR West div. and 6158 in BTR East div.) with an average rate of 3698 times in a year. Followed by BTR, the Jaldapara National Park was reported for 9599 times for crop damage cases due to wildlife attacks.

The hut damage cases have been significantly increasing in Dooars. Hut damage occurs mainly due to the elephant attacks. The total number of hut damage in Dooars during 2002-2017 was 11948 with an average damage of 799 huts in a year. The highest number of hut damage has been reported once again from the BTR region. The HAI has been intensified with a rapid pace in Dooars and it is high time to adopt or implement different measure to minimise HAI, failing which, the extinction rates of wildlife will increase.

6.19) The promotion of some Wildlife Sanctuaries and Forest Reserves into National Park was not the solution of the complexities of Human-Animal Relationship in Dooars. The Jaldapara and Gorumara Wildlife Sanctuaries were upgraded into National Park, the game sanctuary of Mahananda was also promoted to full-fledged Wildlife Sanctuary. Both the Jaldapara and Gorumara National Park have been given priority on some flagship species i.e., one-horned rhinoceros and thereby, making other species of wildlife vulnerable. Therefore, it can be said that the success in rhino conservation eventually failed to produce a wholesome or all-round development and conservation of biodiversity in these National Parks.

6.20) The idea of 'Touristic Urbanisation' and the recent development of eco-tourism, jungle safari (cab and elephant safari in Dooars), home-stay and other related activities have brought several adverse impacts on forests and wildlife. The ecotourism has led to the establishment of hotels, tourist lodges in the close proximity of protected areas. Most of the time the rules and regulations and environmental impact assessments are not followed by the investors. Wildlife attacks on tourist lodges are reported several times by the newspaper reports of The Telegraph and *Uttarbanga Sambad*. The recent trends of picnic party with loudspeaker during the breeding season (winter) of the animals in the forest fringes have been disturbing the wildlife which leads straying of wildlife or attack on humans.

6.21) In India under the programme of 'Project Tiger' crores of rupees have been spent to strengthen tiger protection and habitat restoration in 28 forest reserves and the funds have been increasing with time but it has failed to bring fruitful results. Moreover, the protected areas where funds have been invested are not necessarily best-protected areas in the country (Tiger Task Force, 2005). The Buxa Tiger Reserve (BTR) is one of the best examples of failure story of a tiger reserve in India. Though some of

the wildlife reports have stated about the existence of Tiger in Buxa, the recent scientific investigation (information and images of trap camera) proved that there is no tiger in Buxa.

6.22) The acquisition of lands near the protected forests for the purpose of restoration and improvement of habitat has been done without proper assessment and most of the time they do not produce assumed results. The afforestation done in the acquisition areas disturb the natural characteristics of the forests, as most of the time, the afforestation is done with alien or similar species of trees which doesn't allow canopy covers. The protected areas in Dooars are being affected by such types of afforestation processes.

6.23) The tea estates play a crucial role as a green corridor for the uninterrupted (some degree) movement of the wildlife in Dooars. The leopards are very common in the tea estates of Dooars as the tea estates provide dense bush cover in the form of tea leaves and sufficient prey base like cattle reared by tea labourers as a source of subsidiary income. The leopard belongs to the forest, not to the tea estates which has been the general notions of the tea labours. Whereas, the tea estates have traditionally been home to leopards since the colonial time. Therefore, the chances of an encounter between leopard and human results in human injuries or some time death of humans as well as the death of leopard due to retaliatory killings by humans.

In these different ways, the Human-Animal Relationship has reached to such a deteriorated situation in Dooars. The Human-Animal interface cases have been intensified day by day and the forest management has been failing to reduce the Human-Animal interfaces in Dooars. The forests in Dooars are the home of a large population of wild jumbo i.e., the Asian elephant. Among the different types of Human-Animal interfaces, the Human-Elephant interfaces are dominated in Dooars. This wild Jumbo

needs a massive area of their existence and they are migratory in nature. The other animals involved in Human-Animal Interactions are leopard, bison (gaur) and rhino. The agriculture in the forest fringes and the alteration of forest cover makes a Human-Animal battlefield in Dooars.

In India, different aspects of the people residing beside the forests have been ignored at the time of the implementation of forest rules and regulations. Many times certain projects are planned by outside agencies without consulting with the local. There are many examples which can be drawn from such types of plan implementation in Dooars too.

The nexus between development and environment brought several impacts on Human-Animal Relationship in Dooars. The strategic location of Dooars is unescapable for the government to develop the region. The Dooars is part of the so-called 'Chicken Neck' of India and acts as a gateway to the North-Eastern part of the country. The expansion of roads and railway networks is one of the benchmarks for the regional development. The National Highways (NH31A, 31B) with several branches and the North-Eastern Frontier Railway track (see fig. 5.1) have passages through the core region of some of the protected areas in Dooars and have often reported for wildlife deaths and injuries. The scientific operation of roads and railway traffic may check wildlife death and further complexities of land use alteration, but it has never been exercised in Dooars.

The depredation of wildlife in Dooars are highly seasonal in nature. Each year, the harvesting season of paddy (October-January) register highest incidents of animal straying, crop and house damages, and attacks on human beings and vis-à-vis. It has been increasing as the fodder-base within the protected areas are not sufficient to hold the large herbivores (elephant, gaur, rhino etc.). In the recent years, the growth in the

elephant, gaur and rhino population and decrease in carnivore's population (tiger, hyena etc.) interrupted the food-chain in protected areas of Dooars which has diversified the challenges of Human-Animal co-existence in Dooars.

There is evidence that most of the biodiversity loss observed in the protected areas resulted from the activities of the local people. The subsistence economy has changed to a market economy in Dooars. The people often get involved with different types of illegal activities in Dooars like the felling of trees, cutting fodder grass for their cattle, etc. from the protected areas.

A lot of evidence that has been reported by the different newspapers indicate poaching of the animals from different parts of Dooars and North Bengal. People with the poor economic background cannot deny the offer of a good amount of money from different poachers which are very active in Dooars.

The natural calamities like floods, forest fire and droughts lead to soil erosion as well as substantial damage to vegetation. The victims of agricultural land loss due to the floods have been compensated with land close to the outskirt of protected forests. Evidence of holding more lands beyond their actual recorded lands have also been found in the forest villages. Rearing of cattle population has been increasing the pressure on natural habitat and fodder-base available to wildlife. The electric fencing and high drains along the forest villages and agricultural crops to safeguard from wild animal attacks often cause injuries or deaths of wildlife. The payment process or the assessments of ex-gratia due to the losses from wildlife attacks have been accused of a bureaucratic hierarchy which helps to develop psychological pressure on victims to take revenge towards the wildlife and most of the retaliatory killings of wild animals occur due to this feeling.

Above all, the exclusion of local people in forest and wildlife management, especially after the enactment of Wildlife Protection Act, 1972 multiply the existing situation of wildlife management in Dooars. Historically, the people of the Dooars have been heavily depending upon the forests resources and sudden curtailment and prohibition from forest resources deprived the local people. Considering the above facts, the management of protected areas should aim at providing livelihood to the local community, which will, in turn, assure the protection of wildlife and forests resources and its effective regulations.

In the dynamic world, all the things are changed with the passage of time and with the technological advancement and cultural transformation. The land use in every part of the Earth has been changing which may have a negative effect on the environment as well as socio-economic characteristics of a particular region. In the Dooars, changes in land use pattern obviously increased production but it has an adverse effect on ecology and environment. Land use change like encroachment and degradation of forest cover brings humans closer to the wildlife. The large scale of forest cover encroached for the enhancement of tea plantation has been causing harm to both the human and wildlife.

This study has confirmed the prevalence of Human-Animal Interfaces in Dooars and that despite different measures being taken, the situation is worsening. The problem has been intensifying as the local people complain that their lives are being considered of less value than that of animals. There is a need of the scientific investigation of the present status of Human-Animal Relationship and people friendly rules and regulation through joint wildlife management can improve the existing relationship. Followings recommendations or measures may help to the improvements of Human-Animal Relationship in Dooars:

a) Problem identification related to forest and people interfaces

There are specific problems in different protected areas of Dooars. Some parts of the protected areas are highly prone to the Human-Animal Interactions. Therefore, region-specific problem identification should be initiated through surveys with the help of local communities and accordingly measures should be taken to reduce Human-Animal Interactions.

b) Habitat Restoration

Degradation of forests covers due to the encroachments and other developmental processes led to fragmentation of the habitat in Dooars. There is need to prevent further degradation of their habitat and establishment of corridors for migration of animals from one habitat to another. Afforestation should be carried out on a huge scale on ruined habitats. Forest cover increase may lead to fodder base increase in the protected areas. Habitat fragmentation due to land use changes, building up of roads and railways and other so-called developmental activities obstruct the natural corridors of wildlife. The increased competition for food, space and other natural risks isolated the wildlife population into different fragmented areas. Wild animals get killed in roads and railway accidents almost regularly in Dooars, which needs to be checked.

Plate 6.1 **A Notice by forest department at Gorumara National Park trying to create awareness and questioning on behalf of wildlife that 'why do we (wildlife) killed by vehicle's hits?' please drive slow to survive predecessor**

Source: Captured by Researcher during the field survey, Gorumara National Park. November, 2017.

Conservation biologists have recommended maintaining biological corridors at the landscape level (*Banbithi Banyapran Sankhya*, 2014-15. p- 12). In Dooars, the underpasses have been constructed by the forest department for free movements of elephants across the railway tracks in the protected areas to stop elephant death but the elephant hardly uses such underpasses for their migration. Therefore, the problem needs further investigation and reviews.

Plate 6.2 **The scientific development in Protected Areas/wildlife corridors**

Source: *Banbithi, Banyapran Sankhya*, 2014-15. Directorate of Forests, Govt. of W.B

c) Create awareness and improve public relations

There should be awareness programme and wildlife education to promote the importance of the biodiversity as locales are one of the stakeholders of forests management. Forest villagers and tea plantation labourers should be educated through seminars, workshops. These will enable them to encounter Human-Animal Interactions and to live peacefully with wildlife.

d) Inter-departmental cooperation

There are many loopholes between the inter-departmental co-operation in Dooars. Without the forest, we cannot think about the existence of wildlife. The forest and wildlife department has their different aims and objectives and works

independently. Such gaps in the forest and wildlife management fail to bring the fruitful results.

Lack of coordination of wildlife department with local administration (panchayat functionaries, police), railways, and PWD, BSF and forest department of neighbouring states cause further impoverishments of wildlife management and thereby worsening the Human-Animal Relationship in Dooars. The deaths of wild animals on roads and railway tracks are the results of such non-cooperation. Therefore, the interdepartmental cooperation between different agencies should be robust and should be joint handily works for the management of wildlife in Dooars.

e) International co-operation

The strategic location of Dooars enables poachers to illicit traffic of wildlife articles. The closeness of Bhutan, Nepal, Bangladesh and China makes the protected areas more vulnerable. There are a lot of trans-migratory issues of wildlife between neighbouring countries. The bilateral or multilateral dialogue, talks and frameworks with different neighbouring countries will enable better management of forest and wildlife management.

f) Ecological footprint and population control (Through EIA)

The environmental impact assessment should be carried out before any developmental works in the protected areas. With the population growth and increase resource consumption, it is necessary to evaluate the carrying capacity and maintain a healthy population in the forest fringe areas. The tourism and other forest-related activities need to be regulated and reviewed time to time.

g) Prevent feeding wild animals

Human feeding wild animals may change the digestive systems of the wildlife and they become dependent on human beings. Gradually they become fully reliant on

human-provided foods. In the initial stage, it looks good but it may change the internal instinct of wild animals and at the time of crises of foods they attack humans. Therefore, feedings wild animal needs to be banned strictly.

h) Creation of anti-depredation squad and voluntary squad in the tea and forest villages

Anti-depredation and quick response team should be there in the forest and tea villages in Dooars where straying of wild animals is severe and recurrent. Young population of every forest villages should be provided training and requisite equipment by the forest department for wildlife management. The '*Banyasathi Prakalpa'* is an example of such initiation by wildlife department.

i) Timely payment of ex-gratia

The payments of ex-gratia in time has been one of the problems which often leads clash between the forest department and locals which needs to be solved. The proper payments of ex-gratia for damages done by wildlife in a timely manner will encourage people to involve in wildlife management and moral obligation to report the cases of wildlife offences.

j) Use of modern technology

The use modern technology may be one of the milestones in wildlife and forest management especially for the prevention of Human-Animal Interactions and monitoring of forest land. The use of GIS and remote sensing, as well as radio collaring of flagship species, have been successfully implanted in different parts of the world. This technology may be used in the Dooars. The trap cameras have been installed in different protected areas of Dooars to protect illegal activities and capture imageries of wildlife varieties in the protected areas.

At last, it can be said that the Human-Animal Relationship has its roots in the evolution and development of human civilisation and dates back to the time

immemorial. In recent centuries it has become one of the debatable issues in the different parts of the world.

The Human-Animal Interactions due to the changes in land use have reached its highest level. Therefore, the reduction of Human-Animal Interaction and conservation of wildlife depends largely upon the attitude of forest management practitioners as well as policymakers with the collaboration of different stakeholder's beliefs, interest and active participation of local communities through community-based wildlife management by acknowledging rights and equitable sharing of forest resources.

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Appendix-I

Land use Change and its Impact on Human-Animal Relationship in Dooars of North Bengal (For Officials)

Name…… **Date**……..

Place…… ……

Gender……..

4. Effects of National Highways and Railway Tracks on forest and wildlife management?

…….

5. How Tea Gardens has been contributes in Human-Animal Conflicts? As tea most of the tea gardens act as a buffer zone or situated near the forest fringe and often reported for Human-Animal conflict? If yes, what manner?

……

1. Types of Human-Animal Conflict you have been witnessed? If yes, what is the nature of the conflict?

…….....

2. How often the case of animal depredation are occurs in this area?

……

3. What are major causes for animal depredation, and which has needed to be sort out in near future?

……

4. Which are the animals often straying out from the protected areas?

……

1. Are the WPA Act promulgated by Government to help to the upgrade of Human-Animal relationship?

……

2. What are the agencies or organisations engaged in the Wildlife managements in Dooars?

……

3. How often do you receive complaints about Wildlife from residents of your forest circle?

……

4. How often you meet with the community to discuss the value of Wildlife or any matter of concern that might arise?

.....…

5. Are there any wildlife management strategies involved in the mitigation of Human-Animal conflict?

…….

6. What is your view about the existing Govt. Policies? Are they could encounter the contemporary issues of Human-Animal conflict or Forests management?

……

7. What is your view about the impact of land use change on Human-Animal relationship in Dooars?

……

2. Do you have any suggestions related to the Human-Animal relationship or better way of forests management that you thought of?

……

Appendix-II

Banarhat (Railway Track Passage Through)

A) HISTORY OF LAND USE

1. What are major changes in land use pattern in your village?

……

2. Are there any changes in cropping pattern as a preventive tool to minimise the crop damage?

……

3. What are the major development projects that have been commissioned or going on in an around the village?

……

4. Effects of Railway Tracks on forest and wildlife management?

……

B) FOREST MANAGEMENT/ GOVERNANCE

1. What is your view about the Human-Animal relationship? Is the forest Dept. come forth at the time of Animal attacks or any information about the straying of wild animals you provides to forest Dept. and at that time how was their actions?

……

2. Do you have any suggestions related to the Human-Animal relationship or better way of forests management that you thought of?

……

3. What are the problems that you have been faced in the recent time due to the deterioration of Human-Animal relationship?

……

4. Do you think that the forests department is well efficient to the forest and wildlife management? Yes/No. If yes, in what manner?

……

5. Are you satisfy with the ex-gratia that you have been given for the damages?

……

C) OCCURRENCES/FREQUENCIES OF HAC

1. How often the wild animal attacks on human beings?

.....

2. How often wild animals damage your crops fields or houses/properties?

……

3. What are the major wild animals often come across to the villages or damages the properties?

……

4. Have you been directly/indirectly affected by the Wild animals? Yes/No. if yes, in what manner?

…….....

5. Have you been witnessed any Human-Animal conflict? if yes, When was the last time?

…….....

D) Types and Nature of HAC

1. Types of Human-Animal Conflict you have been witnessed? If yes, what is the nature of the conflict?

…….....

2. How often the case of animal depredation are occurs in this area?

……

3. What are major causes for animal depredation, and which measures are needed to sort out in near future?

……

4. Which are the animals often straying/prone to the accident on Railway track?

……

E) Others Information

……
……
……
……

Appendix-III

Baradighi (Plantation Village)

A) HISTORY OF LAND USE

1. What are major changes in land use pattern in your village?

……

2. Is there any changes in cropping pattern as a preventive tools to minimise the crop damage?

……

3. What are the major developmental projects that have been commissioned or going on in an around the village?

……

4. How Tea Gardens has been contributes in Human-Animal Conflicts? As the most of the tea gardens act as a buffer zone or situated near the forest fringe and often reported for Human-Animal conflict? If yes, what manner?

……

5. Most of the Human-Leopard conflict have been reported from tea gardens, what is your view about such cases?

……

B) FOREST MANAGEMENT/ GOVERNANCE

1. What is your view on the Human-Animal relationship? Is the forest Dept. come forth at the time of Animal attacks or any information about the straying of wild animals you provides to forest Dept. and at that time how was their actions?

……

2. Do you have any suggestions related to the Human-Animal relationship or better way of forests management that you thought of?

……

3. What is the problem that you have been faced in the recent time due to the deterioration of Human-Animal relationship?

……

4. Do you think that the forests department is well efficient to the forest and wildlife management? Yes/No. If yes, in what manner?

……

5. Are you satisfy with the ex-gratia that you have been given for the damages?

……

C) OCCURRENCES/FREQUENCIES OF HAC

1. How often the wild animal attacks on human beings?

.....

2. How often wild animals damage your crops fields or houses/properties?

……

3. What are the major wild animals often come across to the villages or damages the properties?

……

4. Have you been directly/indirectly affected by the Wild animals? Yes/No. if yes, in what manner?

…….....

5. Have you been witnessed any Human-Animal conflict? When was the last time if yes?

…….....

D) Types and Nature of HAC

1. Types of Human-Animal Conflict you have been witnessed? If yes, what is the nature of the conflict?

…….....

2. How often the case of animal depredation occur in this area?

……
…….

3. What are major causes for animal depredation, and which has needed to sort out in near future?

……

4. Which are the animals often straying out from the protected areas?

……

E) Others

Appendix-IV

Bhutiabasti (Agriculture in Forest Fringe)

A) HISTORY OF LAND USE

1. What are major changes in land use pattern in your village?

……

2. Are there any changes in cropping pattern as a preventive tool to minimise the crop damage?

……

3. What are the major development projects that have been commissioned or going on in an around the village?

……

4. Are there any effects of dolomite mining in your village?

……

B) FOREST MANAGEMENT/ GOVERNANCE

1. What is your view on the Human-Animal relationship? Is the forest Dept. come forth at the time of Animal attacks or any information about the straying of wild animals you provides to forest Dept. and at that time how was their actions?

……

2. Do you have any suggestions related to the Human-Animal relationship or better way of forests management that you thought of?

……

3. What is the problem that you have been faced in the recent time due to the deterioration of Human-Animal relationship?

……

4. Do you think that the forests department is well efficient to the forest and wildlife management? Yes/No. If yes, in what manner?

……

5. Are you satisfy with the ex-gratia that you have been given for the damages?

……

C) OCCURRENCES/FREQUENCIES OF HAC

1. How often the wild animal attacks on human beings?

.....

2. How often wild animals damage your crops fields or houses/properties?

……

3. What are the major wild animals often come across to the villages or damages the properties?

……

4. Have you been directly/indirectly affected by the Wild animals? Yes/No. if yes, in what manner?

…….....

5. Have you been witnessed any Human-Animal conflict? When was the last time if yes?

…….....

D) Types and Nature of HAC

1. Types of Human-Animal Conflict you have been witnessed? If yes, what is the nature of the conflict?

…….....

2. How often the case of animal depredation occurs in this area?

……

3. What are major causes for animal depredation, and which has needed to sort out in near future?

……

4. Which are the animals often straying out from the protected areas?

……

E) Others Information

Appendix-V

Nimati (NH Passage Through)

A) HISTORY OF LAND USE

1. What are major changes in land use pattern in your village?

……

2. Are there any changes in cropping pattern as a preventive tool to minimise the crop damage?

……

3. What are the major development projects that have been commissioned or going on in an around the village?

……

4. Effects of National Highways on forest and wildlife management?

……

5. What are the measures do you think of to be adopted for wildlife management in your area?

……

B) FOREST MANAGEMENT/ GOVERNANCE

1. What is your view on the Human-Animal relationship? Is the forest Dept. come forth at the time of Animal attacks or any information about the straying of wild animals you provides to forest Dept. and at that time how was their actions?

……

2. Do you have any suggestions related to the Human-Animal relationship or better way of forests management that you thought of?

……

3. What is the problem that you have been faced in the recent time due to the deterioration of Human-Animal relationship?

……

4. Do you think that the forests department is well efficient to the forest and wildlife management? Yes/No. If yes, in what manner?

……

5. Are you satisfy with the ex-gratia that you have been given for the damages?

……

C) OCCURRENCES/FREQUENCIES OF HAC

1. How often the wild animal attacks on human beings?

.....

2. How often wild animals damage your crops fields or houses/properties?

……

3. What are the major wild animals often come across to the villages or damages the properties?

……

4. Have you been directly/indirectly affected by the Wild animals? Yes/No. if yes, in what manner?

…….....

5. Have you been witnessed any Human-Animal conflict? When was the last time if yes?

…….....

D) Types and Nature of HAC

1. Types of Human-Animal Conflict you have been witnessed? If yes, what is the nature of the conflict?

…….....

2. How often the case of animal depredation occur in this area?

……

3. What are major causes for animal depredation, and which has needed to sort out in near future?

……

4. Which are the animals often straying out or prone to the accident in NH?

……

E) Others Information

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Appendix-VI

Salkumarhat (Forest Livelihood)

A) HISTORY OF LAND USE

1. What are major changes in land use pattern in your village?

……2.

Are there any changes in cropping pattern as a preventive tool to minimise the crop damage?

……

3. What are the major development projects that have been commissioned or going on in an around the village?

……

B) FOREST MANAGEMENT/ GOVERNANCE

1. What is your view on the Human-Animal relationship? Is the forest Dept. come forth at the time of Animal attacks or any information about the straying of wild animals you provides to forest Dept. and at that time how was their actions?

……

2. What are the activities that the villagers are involved with near the forest or in the forest?

……

3. Do you have any suggestions related to the Human-Animal relationship or better way of forests management that you thought of?

……4.

What is the problem that you have been faced in the recent time due to the deterioration of Human-Animal relationship?

……

5. Do you think that the forests department is well efficient to the forest and wildlife management? Yes/No. If yes, in what manner?

……

6. Are you satisfy with the ex-gratia that you have been given for the damages?

……

C) OCCURRENCES/FREQUENCIES OF HAC

1. How often the wild animal attacks on human beings?

.....

2. How often wild animals damage your crops fields or houses/properties?

……

3. What are the major wild animals often come across to the villages or damages the properties?

……

4. Have you been directly/indirectly affected by the Wild animals? Yes/No. if yes, in what manner?

…….....

5. Have you been witnessed any Human-Animal conflict? When was the last time if yes?

…….....

D) Types and Nature of HAC

---

1. Types of Human-Animal Conflict you have been witnessed? If yes, what is the nature of the conflict?

…….....

2. How often the case of animal depredation occur in this area?

……

3. What are major causes for animal depredation, and which has needed to sort out in near future?

……

4. Which are the animals often straying out from the protected areas?

……

E) Others Information

……

……

……

……