CHAPTER -7

SUMMARY AND CONCLUSION

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7.1 Introduction

The excessive use of forest resources including forest land results in the degradation of forest and ultimately led to the loss of biodiversity. Therefore, it is important to understand the extent of dependence on forest resources and their impact on biodiversity for effective implementation of conservation policy. Dependence on forest resources, change of forest cover and degradation of forest, loss of biological diversity, role of forest dwellers and conservation of forest resources are analysed elaborately in different chapters. The cost and benefit of forest products and non-forest product, socio-economic status and their impact on forest income have been analysed in Chapter 4 and Chapter 5. Finally, forest dwellers' role and attitude toward biodiversity conservation have been elaborately discussed in Chapter 6.

This chapter is devoted to describe the major findings of the forgoing study on "Dependence on Forest Resources and Its Impact on Biodiversity Conservation: A study of Kokrajhar district, Assam", and also to throw some light on the policy conclusion emanated from the whole analysis and finally, some recommendations have also been given based on the findings of the study.

7.2 Summary of Findings

The major findings of the study are given below:

1. The Northeast Indian states have been endowed with rich natural resources. The region, which constitutes only 7.98 per cent of the country's geographical area, accounts for nearly one-fourth of its forest cover. The north-eastern region is a

biodiversity-rich zone and fall in the line of Indo-Burma biodiversity hotspot. Because of its biodiversity richness, the region has been identified as one of the 34 biodiversity hotspot of the world (Pande & Arora, 2014).

Kokrajhar district of Assam is the part of biodiversity hotspot zone due to its rich forest resources and the foot-hill of the Himalayan Mountains. In terms of area, it shares only 4.04 of the total geographical area of Assam, but in terms of the very dense forest, it shares 15.66 per cent of the total dense forest area of Assam, shelter diversity of flora and fauna. It is also part of Manas Tiger Reserve, Ripu-Chirang plant reserve, Manas Biosphere Reserve, butterfly habitats.

2. It is observed that due to diverse range of edaphic, climatic and physiographic, soils and vegetations, the forest in Kokrajhar district has found the following types- 1. Sal forest: Bhabar Sal forest, Terrain Sal forest, Eastern Alluvial Sal forest and Eastern Hill Sal forest, 2. Mixed deciduous forest, 3. Savannah: Dry Savannah and Wet Savannah, and lastly, Riverain forest. This provides a rich natural resource of the study area, including – *Sal timber, Gambari, Sisoo, Segun, Titasap,* etc., and Non-timber products, i.e. firewood, honey, green leave and medicinal herbs roots, gums, resin and fibre etc. Apart from that, grazing and land for agriculture are also provided by the forest resources of the Kokrjhar district.

3. Based on the study of primary data, it is observed that the dwellers of forest villages obtained benefit from both forest and non-forest products. The average total benefit of Rs. 6166.82 were obtained from forest products, out of which Rs. 4200 from firewood, Rs. 788.83 from honey, Rs. 612.66 from green leaves and Rs. 565.33 from medicinal herbs by the average sample households from the three forest divisions. Apart from that, forest dwellers obtained grazing benefit amounting to Rs.16220 per annum.

Benefits of non-forest products were obtained from the three main activities, i.e. agriculture, horticulture and plantations. The total gross benefit of Rs. 21315.33 were obtained from the non-forest activities, out of which Rs. 12827

from agriculture, Rs. 2808 from horticulture and Rs. 5680 from plantations respectively by the average sample households of the district.

Thus, it observed that altogether benefits obtained from both forest and the non-forest product is Rs. 43702.16 per annum, out of which 22,386.83 is from forest product, and rest is from non-forest products.

4. The study also observed that the total cost of both forest and non-forest products is Rs. 11445.27, out of which Rs. 3,396.6 is incurred for the procurement of forest products and Rs. 8048.67 is for the production of non-forest products. This includes the explicit and implicit cost of production of both forest and non-forest products.

5. It is also observed that the net revenue earned by the forest dwellers is Rs. 32256.9, out of which Rs. 18990.17 comes from forest products and Rs. 13266.73 is obtained from non-forest products. So in the percentagewise, more than 58 per cent share comes from forest product, and 41 per cent share comes from non-forest product. Thus this shows the extent of dependence on forest resources is more against the non-forest products in the study area.

6. The family size of the sample household was observed 5.38 members in the sample households. Similarly, the age group between 15-59 years was 63 per cent, and above the age of 60 years are 37 per cent in the area. In terms of gender, 99 per cent of households are male-headed, and only 1 per cent of respondents are female-headed households. This shows that area of the study is follows the fraternity line of inheritance. Lastly, in the caste system, 68 per cent of sample households are Schedule tribe, and only 32 percent is another caste in the study area. It shows more than 60 per cent of populations of forest-dweller were schedule tribe people. It is observed that 58.36 per cent of respondents were literate, and 41.64 per cent of respondents were illiterate in the area. The literacy rate of the forest villages is below the district as well as that of the state of Assam, which is 66.63 and 73.18 per cent, respectively (Census of India, 2011).

7. In terms of occupation, more than 80 percent of households are engaged in agriculture, followed by 13.69 percent is based on wage labourer and merely 3.83 percent in service and 2.74 percent is engaged in business activities in the district.

It is also observed that the majority (97 %) of the sample families live in the Kutcha house and only a small fraction (3%) of them live in the Pucca house. Again, in case of energy used, it is observed that 98 per cent of the sampled households' population were used fuel wood for their daily energy requirement. The main reasons for using firewood are the easy access in the nearby forest and the availability of firewood.

8. Result from the regression; it is observed that the family size and caste system has a positive and significant association with income from forest resources. Family size had a significant and positive influence (< .05) on forest income, which implied that the level of dependency on forest income increased with household's family size. This may be related to the fact that more and more added to the family members needs more collection of forest resources, which leads to increased forest income. The caste system had a significant and positive influence (< .05) on forest income, which implied that forest income would increase with an increase of the Scheduled Tribe category of sample households.

9. From the estimated result it is observed that the distances from nearest forest are significantly negative (- < .01) association with the forest income. It is also observed that the distance of villagers from nearest forest adversely affect the income from forest resources as more distance required more time to collect the forest resources. But, it does not mean that the households do not earn income from forest resources.

10. In terms of age, the respondents' old age had negative influence, while its effect on forest income was not statistically significant. It is observed that the younger age of the household has extracted more forest resources and earned more income as against the older age of household. All other explanatory variables such

as occupation, sex and literacy have not found statistically significant association with the forest incomes in the study area.

11. It is also observed that the forest cover of the Kokrajhar district had changed to 472 sq. km. (28.96%) out of total forest cover 1630 of Kokrkjahar district from the period of 1999 to 2017 as per Indian State Forest Report (ISFR). This change has been recorded as biotic pressure, encroachment in forest land, illegal logging, and clear-felling for agriculture and other development activities. This change of forest cover affects not only the diversity of flora and fauna but also the age-old tradition of dependence on forest resources and their uses.

12. The general perception and attitudes of forest dwellers towards biodiversity conservation are important for the assessment for the implementation of different conservation policy of the government. In order to study the difference in attitudes and involvement of forest villages towards biodiversity conservation, nine socio-economic variables, namely, age, caste, sex, family size, occupation, literacy, house type, landholding and use of fuel wood, were used.

The study observed that occupation, age, landholding, caste, family size, sex, literacy, and house type of respondents have no significant association with attitude towards environmental issues or problems. Fuel wood is the only variable having a significant association with attitude toward environmental issues. The occupation, landholding, caste and house type were found to be significantly associated with attitude toward biodiversity loss. However, age, family size, sex, literacy and fuel wood were not significant associated with attitude towards biodiversity loss. In the case of conservation of biodiversity, occupation, age, landholding, family size, sex, literacy, house type, and fuel wood were not significantly associated with biodiversity conservation. But caste system is the only attribute having a positive and significant association with attitudes towards the conservation of biodiversity.

13.From results of individual participation and involvement towards environmental and biodiversity conservation, it is observed that occupation, age, family size, sex, literacy and house type and fuel wood were not significantly associated with awareness programme, social organisations and involvement with community participation in biodiversity conservation. However, both the landholding and caste system of respondents were only two variables that have positively significantly associated with individual participation in awareness programmes, connection with social organisations, and community involvement for biodiversity conservation.

14. The anthropogenic disturbance in the forest is not only affecting species, flora and fauna but also affecting the age-old dependence on livelihoods of the tribal and marginal section of communities. Traditionally, the forest dwellers in the general and tribal community, in particular, seemed to be having a culture that kept a balance between human and ecological needs. It is observed that Bodo tribes of Kokrajhar district have a tradition of *Sauri Janai* (group work) in their agricultural and other domestic activities, preserve '*Sijou*' (Euphorbia splendens) plant from time immemorial through a religious worship of *Bathow* religion, and preserve sacred trees through *Garjhashali* the outdoor worship place of Bodo community, surname " *Mwchahary*" of Bodo community is regarded them as the race of *Mwsa* (Tiger) in Bodo and get purified their homestead on the news of the death of Tigers, but presently this practice is abandoned due to influences of modernization and science and technology. Apart from that, it is also observed that during the last day of *Choitra*, the Bodo community observed as *Sankranti*, one day before the New Year or *Rongjali Bwisagu* in Bodo word. Each and every household of Bodo community traditionally collect all sorts of edible leaf, herb and stumps of plants and medicinal values of different taste from the forest. The Bodo community was still believed in traditional herbal medicine, healing and curing of various ailments and they are culturally and socially intertwined with the forest around them. Thus, the revival of tribal customs, art and belief, and practice will help preserve the diversity of flora and fauna with support from government and non-government organisations.

7.3 Limitation of the study

The study is undertaken to see the extent of uses of forest resources by the forest dwellers of Kokrajhar district and its subsequent effect on biodiversity conservation. For this, primary and secondary data have been used. Data from secondary sources such as the Working plan of Reserve Forest from the Forest Department, Government of Assam, Census of India Publication, District Census Handbook of Assam, Indian State Forest Reports, Agriculture statistic, and other important documents prepared by state and Central Government were collected and consulted. The researcher tried to do level best in all, but it has some limitation. Again, while collecting primary data, the researcher faced difficulties in obtaining information from respondents in the interior place of the study areas due to misconception of the people on data collection thinking that they may be evicted from the forest villages. In spite of that, with the help of the village headman and forest department officials, the sample data has been collected.

7.4 Conclusion

This study shows that the extent of dependence on forest resources is very high in the Kokrajhar district; forest dwellers obtained benefit from forest products like firewood, honey, edible green leaves, medicines, grazing, and other tools appliance etc. But excessive exploitation of forest resources and large scale encroachment on forest land has dwindled the vast tract of forest areas of Kokrajhar district. Thus the deforestation and depletion of the forest, the encroachment for forest land, illegal logging and clear felling for agriculture, biotic pressure, and development activities lead to loss of habitat for wild birds and animals etc., lead to loss of biodiversity. The excessive exploitation of forest resources is not only affecting flora and fauna, but also affecting the age-old dependence on forest resources by the forest dwellers.

Thus, forest dwellers' positive perception and attitude towards forest and biodiversity conservation were needed for the sustainable use of forest resources.

The traditional art, culture, and beliefs of tribal community also to some extent, help in the conservation of forest and biodiversity in the study area. Thus, forest dwellers' concerted effort along with government and non-government organization can help restore the forest and biodiversity into their former glory.

7.5 Recommendations

To manage forest and wildlife's rapid shrinkages and growing anthropogenic disturbance in the three forest division, namely Kachugaon, Haltugaon and Parbathjhora division of Kokrajhar district, the researcher suggests the following recommendations for biodiversity conservation.

1. Like other parts of the districts of Assam, the Kokrajhar district is also witnessing large scale encroachment in its forest land. As a result of that, so far, 472 sq. km. of forest areas of Kokrajhar district has been lost during 1999-2017, as per the Indian State Forest Report (ISFR). In such a situation, the concerned authority must take strict action as per the law of the land and clear the encroachment areas from the encroachers without further delay.

2. Most of the encroachers return their encroached land two to three months later of eviction due to a lack of follow up action by the concerned authority. As a result, that leads to the degradation of forest ecology, loss of habitat of wildlife and loss of biodiversity. In the study, it is observed that Haltugaon forest division was recorded the highest area of encroachment with 154.4 sq. km which is 13.49 per cent of total forest areas of the district, followed by the Kachugaon division with 2.11 per cent, as per the working plan office (forest), Kokrajhar, 2012. So, the authority should come forward with full proof follow up action plan for the protection of encroached forest land from encroachers not only by adopting plantation and natural growth of forest but also by resettling the encroachers' in other wastelands areas.

3. Majority of forest dwellers are small and marginal cultivators having below 20 bighas of non mortgage-able forest land, and more than 80 per cent of the

household depends on agriculture. In such a subsistence economy, the forest is the only alternative source of income for most of the family in the district. They collect forest products like firewood, honey, edible green leaves, medicines etc. and sometimes involve illegal logging for the contractors. In such a situation, the government must come forward with alternative livelihood schemes to enhance the forest dwellers' economic condition in the study area.

4. To generate employment opportunity for the educated youths of the forest fringe village of the three forest divisions of Kokrahar district, the government can open and develop Ecotourism centre in the fringe forest villages. Such sites having rich biodiversity in the district are, Jamduar, Bamba Block, Pekua Block, Kachugaon Tramline etc. in Kachugaon Forest division, Saralbhanga, Chiknajhar, Nou Nwgwr, Mash Bhandar, Dholpani, Laopani, Chakrachila, etc. in Haltugaon Forest Division and Mahamaya Temple, Florican Park, Rupshi AirPort, Deeplai Beel, Sareswar Beel, Atharokota, Rajapara Recreation Park etc. in Prabathjora Forest Division.

5. Kachugaon Tramline is a well-known forest-based Tramline constructed during British colonial rule in 1901-1902. The main motives of the construction of Tramway line were for rapid transportation of hard and durable *Sal* timber from Kachugaon forest division to Fakiragram railway station, transportation of water and labourer into the plantation site and for extraction of *Sal* timber from the forest (Handique, 2004). So, Kachugaon forest Tramline is not only important from the historical point of view, but it may also be the central point of attraction for tourist from national as well as international level. It can be popularized by connecting all the biodiversity-rich Ecotourism site of the foothills of Bhutan, such as Jamduar, Bamba & Pekua Block, in the Kachugaon Forest division, Saralbhanga, Chiknajhar, Nou Nwgwr, Mash Bhandar, Dholpani, Laopani, Chakrachila, etc. in Haltugaon forest division. Therefore, the government must revive the Tramway line to generate employment opportunity for the people of the area and improve the overall economic condition of the Bodoland Territorial Council (BTC) as a whole.

6. Due to the lack of marketing facilities for forest products, the actual price of products is undervalued. So, the government must facilitate proper marketing facilities of minor forest products extracted by the forest dwellers.

7. More than 98 per cent of households used firewood as their main sources of energy in the area. Thus, households are directly or indirectly dependent on the forest for their energy requirement. So, alternative sources of energy such as bio-natural gas should be encouraged by the government to the forest dwellers as a substitute for firewood.

8. The traditional knowledge, practice, art and culture, and beliefs are important for the preservation of biodiversity. So step must be taken for the restoration of Bodo traditional art, culture and belief for the conservation of forest and Biodiversity.

9. Grazing in the reserve forest hamper the growth of shoot, hardened soils and deplete the forest's natural growth. So the government must check the excessive grazing in the forest for regeneration and growth of plants in the forest.

10. Reserve forest areas of the Kokrajhar district is known for their *Sal* Forest. The physical setting of the region, coupled with the excellent climatic condition of Bhutan's foothills and its alluvial soil, is providing different species of *Sal* tree and its associates. Due to this speciality of *Sal* Forest of Kokrajhar district, the then British empire has established Forest Tramline in Kachugaon forest division to transport hard *Sal* log for the construction of Railways. They have also made some forestry work by planting Sal and other commercially valuable trees in the reserve forest of Kokrjhar district. Though the importance of the *Sal* forest of Kokrajhar district was recognised during the British rule, however, presently, no forestry work relating to *Sal* re-plantation on the foothills of Bhutan is undertaken by the concerned department. So the government must take appropriate measures for in-situ conservation of the *Sal* forest of the study area.

11. Most of flora and fauna of the Kachugaon and Haltugaon forest division is now disappearing without any proper recognition on them in the forest due to

encroachment and deforestation of the vast tract of forest area in the district. So, the government should encourage ex-situ conservation in case of rare and extinction species of flora and fauna.

12. Reserve forest of Kachugaon and Hatugaon forest division should be kept as encroachment free in the core forest areas to maintain ecological balance. This is also an important elephant's corridor comprising the foothills of Bhutan, Kachugaon Ripu-Reserve forest and Chiang reserve forest. So the government of Assam, along with the Bodoland Territorial Council (BTC) government, must maintain in-situ conservation of forest cover in the district to maintain smooth passes of wild elephants.