

Opportunity Cost of Biodiversity Conservation and Attitudes Towards it in Assam

Ratul Mahanta¹

¹Department of Economics, Gauhati University, Guwahati, Assam, India

Correspondence: Ratul Mahanta, Department of Economics, Gauhati University, Guwahati, Assam, India. E-mail: mahanta_r@yahoo.com

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Abstract

The study assesses the extent of dependence on forest by the dwellers of village forests and encroachers and estimate the opportunity cost of biodiversity conservation in terms of benefits foregone as well as external cost. The study showed the attitudes of dwellers of village forests and encroachers towards biodiversity conservation through *Forest Rights Act 2006*. During the study period, 190 households were surveyed in four village forests and two encroached villages under reserved forests of Sonitpur and Golaghat districts of Assam. It was observed that both village-types earned a significant portion of their total income from forest which demands livelihood diversification to reduce their dependency on forest. The benefits of conservation outweighed opportunity cost of biodiversity conservation for encroached villagers. Though the dwellers of village forests and encroachers had positive attitudes towards biodiversity conservation but they were more concern about their personal rights rather than biodiversity conservation through this *Act*. It is recommended that environmental education program, co-management mechanism by all stakeholders and self monitoring systems by the right-holders on their use of forest resources are necessary for biodiversity conservation.

Keywords: Forest Rights Act 2006, village forest, encroached village, gram sabha, grazing benefit.

1. Introduction

Biodiversity conservation, a part of sustainable development is gaining importance in both international and national policy framework such as international agreements and modernized national legislation (e.g. Global Biodiversity Strategy, 1992) and the Millennium Development Goals of the United Nations (UNDP, 2013). The successful implementation of any policy to conserve biodiversity is based on the participation of all stakeholders including international, national, regional, local and even individual household. Conservation of forest is one of the main agenda of biodiversity conservation policy of most of the developing countries. The co-managed systems through government staff and community or individual who resides in forest fringe are more efficient since they can utilize the information of local forest stocks and ecology available with them (Kumar, 2002; Mehta & Kellert, 1998; Wang et al., 2006; Mahanta and Das, 2013). The perceptions and attitudes of local communities who resides within or near forests areas and depend on forests for their livelihood is very important for biodiversity conservation (Ninan et al., 2007; Mahanta & Das, 2013) and have been used to assist proper conservation management in protected areas (Sekhar, 2003; Cihar & Stankova, 2006; Allendorf et al., 2007). The perceived costs and benefits of biodiversity conservation are crucial factors for framing policies of biodiversity conservation. A proper assessment of the benefits of biodiversity conservation must take into account the opportunity cost of biodiversity conservation in terms of the benefits foregone as well as the external costs of conservation (Ninan et al., 2007). Various studies on benefit-cost analysis has been conducted to assess benefits of conservation with opportunity costs (Kriström, 1990; Mattsson & Chuanzhong, 1993; Van Kooten, 1995; Swanson & Loomis, 1996; Kniivila et al., 2002; Ninan et al. 2007; Wilson et al., 2010). Earlier studies used non-market valuation method such as contingent valuation method (CVM) to quantify social benefits of forest conservation (Macdonald & McKenney, 1996; Rollins & Lyke, 1998; Pouta et al., 2000; Kniivila et al., 2002; Lehtonen et al., 2003; Wilson et al., 2010) while social cost of forest conservation have been quantified by lost producer and consumer surplus (Van Kooten & Wang, 1998) and wood supply models (see Kniivila & Saastamoinen, 2002; Khajuria et al., 2008; Wilson et al., 2010). Several studies have shown that poor people mostly living in rural areas, inside forest or at forest margins are highly dependent on natural resources particularly forest for their livelihood (Gunatilake, 1996;

Hedge et al., 1996; Kanth, 1997; Bista & Webb, 2006; Liu et al., 2010). In India, non-timber forest products collection consists of a significant portion of the total earnings of rural poor (Hegde & Enters, 2000). The deterioration of resources increases the incidence of poverty, as these poor are exclusively dependent on the stock of natural resources (Jodha, 1986; Pasha, 1992; Singh et al., 1996; Gowda & Savadatti, 2004). Sometimes it seems that biodiversity conservation and development of communities are contrary to each other (Maikhuri et al., 2000; Oltremari & Jackson, 2006).

Assam, placed in the northeastern side of India is famous for its forest cover. Its flora and fauna is facing a worse situation owing to large-scale extraction of forest products and simultaneous destruction of forests (Bora, 2001; Kushwaha & Hazarika, 2004; Tamuli & Choudhury, 2009). Encroachment is one of the main reasons of forests depletion in Assam, which started in early 1950s. As of 2005, of the 1.4m ha of reserved forestland in Assam, 0.34m ha has been encroached, of which 0.21ha was encroached before 1980 (Govt. of Assam, 2008). In order to curb the huge illegal extraction of forest, Government of Assam has implemented various forest policies since the *Government Forest Act 1865* but almost all policies of the government have failed to protect forest, as they do not take into account the involvement of people who resides at forest margins (Mahanta & Das, 2013). The Forest Rights Act, known as the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 passed by the parliament of India has dual aims. It aims at protecting the right of forest dwellers and tries to procure the involvement of forest dwellers to protect forest. The Act argues to provide ownership of land to forest dwellers, which could be a strong incentive to evolve sustainable land-use practices and conservation (Godoy et al., 1998; Deacon 1999). But problem arises because the tribal bodies are doubtful about the effectiveness of the *Forest Rights Act (FRA) 2006* in protecting the interests of the tribal people. Furthermore, they fear that non-traditional forest dwellers, such as immigrant settlers might take advantage of the *Act* to destroy forest. Government of Assam has not executed the *FRA 2006* till date. Very recently Government of Assam distributed land ownership in three or four villages on trail basis.

It is necessary to know to what extent the forest dwellers depend on forest for their livelihood and it is also essential to make a comparative assessment of the benefits earned from conservation of forest and benefits forgone from other land use option such as agriculture, sericulture and horticulture. Moreover, the study of perceptions and attitudes of dwellers of village forests (Note 1) and encroachers towards biodiversity conservation is important because assessment of such perceptions and attitudes can help policy-makers in the formulation and execution of conservation-related development projects that need support from forests dependent communities (Parry & Campbell 1992; Gillingham & Lee 1999; Liu et al., 2010; Badola et al., 2012). The study has the following objectives: To estimate the opportunity cost, perceptions and attitudes of biodiversity conservation and to assess the extent of dependence on forest for various goods and services by the dwellers of village forests and encroachers. The hypothesis to be tested is that Net Present Value (NPV) of net benefits of forest conservation is positive for encroachers while it is negative for dwellers of village forests.

2. Materials and Method

2.1 Study Area

The study has been conducted in Sonitpur and Golaghat districts of Assam (Figure 1). In Sonitpur district, during 1990 to 2001, the rate of decline of forest cover was about 28.65%, which according to Indian Institute of Remote Sensing was the highest rate of deforestation anywhere in India (Srivastava et al., 2002). In Golaghat district, out of 1,037.9 km² of reserved forest only 167.9 km² (16.2%) remains undisturbed. A huge loss of forest area in Doyang Reserved Forest in the Golaghat district was observed from satellite imagery (Sarma et al., 2008). The encroachers had formed societies and it would have been extremely difficult for the government to evict them (Bora, 2001). Four village forests and two encroached villages (villages are officially considered as encroached by Govt. of Assam) from these two districts were selected. Of the four village forests, two villages were selected from Sonitpur district (Madhupur and Deepa Basti under Chaiduar Reserved Forest) and the other two from Golaghat district (Gamariguri and Kolaigaon under Doyang Reserved Forest). The two encroached villages-Banduguri from Sonitpur District and Navajyoti from Golaghat district were selected.

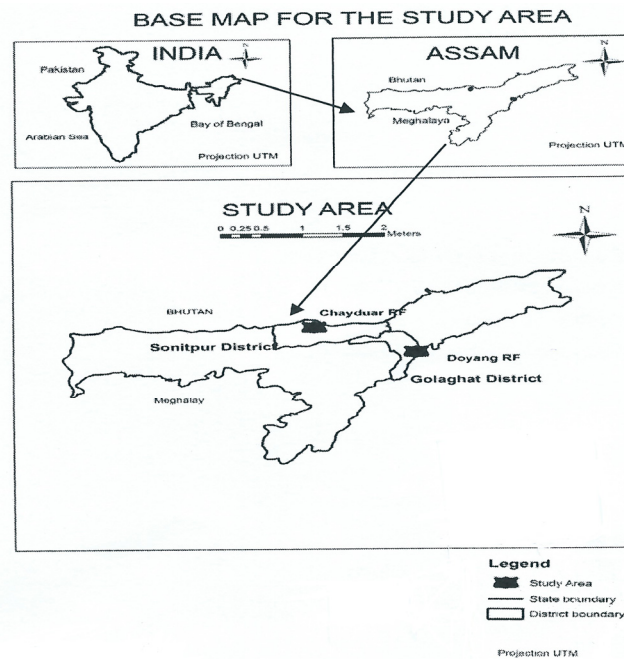


Figure 1. Study area

Source: LISS III, GIST, 2008.

2.2 Data Collection and Method

Both primary and secondary data were collected during the study period. Secondary data regarding geographical location and demographic pattern were collected from Government-department and other published and unpublished report by Government of Assam. Primary data were collected from dwellers of village forest and forest encroachers. Multi-stage sampling has been conducted during the study. In the first stage, two districts were selected. In the second stage, four village forests and two villages created by encroachers were selected from reserved forests under the jurisdiction of these two districts. In the third stage, a number of representative families, 10 % of total households were selected randomly from each village. The unit of survey was households and only one respondent was taken from each family, preferably the head of the family. Data were collected using a structured questionnaire. Before going to the field to collect primary information, Focus Group Discussions (FGDs) with villagers in the presence of village headman and forest officials were conducted. These FGDs helped to have information regarding total population size, number of households, whether they were aboriginal or had migrated.

Primary data was collected during April and May 2010. In Sonitpur district, 100 households from Charduar Reserved Forest were selected for interview, out of which 35 households were from Madhupur village forest, 25 households from Deepa Basti village forest and remaining 40 households were from Banduguri encroached village. Similarly, for Golaghat district, 90 households from Doyang Reserved Forest were selected, out of which 55 households were from Gamariguri and Kolaigaon village forests and 35 households were from Navajyoti village which is inhabited by encroachers. Thus, altogether 190 households were interviewed from both these two districts.

Seven variables namely occupation, land use pattern, sex, age, family size, total land holdings and educational qualification were selected to see socio-economic and demographic conditions of villager's of both village types. Out of seven variables, responses of three variables (family size, age of the respondent and total land holdings) were divided into two categories based on mean score (Wang et al., 2006) as they were captured in absolute figure in the survey. In the family size category, respondents were divided into two categories-less than 5 and 5 or more (mean of family size is 4.92). To capture age, respondents were divided into two classes-respondents less than 48 years and 48 years or more in age (mean of respondent age is 47.58 years). The variable 'total land holdings' was divided into two classes- less than 9 ha and 9 ha or more (mean of land holdings is 9.43). A literate respondent was defined as having at least one full year of schooling and illiteracy was defined as less than one full year (Srivastava & Heinen, 2007). Percentages and frequencies were calculated for each socio-economic and demographic condition. Opportunity cost of biodiversity conservation has been analyzed using net present value (NPV) of

non-forest resources. Sensitivity analysis has also been done to calculate the net present value of forest conservation benefits at 8, 10 and 12 percent discount rate. Revenue from forest products (FP) includes revenue earned from non-timber forest products (NTFP) like firewood, bamboo, honey, wild edible green leaves and grazing benefit. In order to calculate the revenue of NTFP, total quantity collected by the households was multiplied by the ongoing market prices. The grazing benefit was calculated on the basis of the following procedure:

First from each household, the available number of livestock's were collected and then converted into standardized animal units using the standard cattle equivalent units (Misra & Sharma, 1990). An adult cattle was represented as 1 unit while a young one as 0.6 units. In the same way, an adult buffalo was represented as 1.25 units and a young one as 0.6 units. Goats, sheep and pigs were represented as 0.25, 0.2 and 0.10 units respectively. The required quantity of green fodder needed by the animals was calculated on the basis of guideline mentioned in the Report on Fodder and Grasses published by Government of India (1987) (see Chopra et al., 1999) According to this report an adult cattle or buffalo (above 3 years) consumes 10-16kg of green fodder and 5-8 kg of dry fodder per day, while a calf requires 1-3kg of green and dry fodder per day. On this basis, the total quantity of green and dry fodder required by adult cattle was estimated at 13 kg on an average per day. Depending on the standardized number of animal units, total quantity of fodder requirement was estimated and multiplied with the ongoing market prices of fodder to have an idea about grazing benefit.

Revenue from non-forest products (NFP) includes earnings from agriculture, horticulture and sericulture. The revenue from NFP also includes earnings of self-employed labourers. For example, if a person works for some days in his/her field then earnings of that person were calculated by multiplying his or her labour days with ongoing market prices. Besides, earnings from working in other fields were also included in the revenue account of NFP. To have an idea about net revenue from forest and non-forest products, cost incurred with these activities was deducted from the revenue. Cost includes mainly opportunity cost of collecting forest products, cost incurred for hired human labour and other than human inputs such as rent for using of animal labour, equipments, fertilizer, seeds and pesticides. Cost category also includes factors like damage to crops, livestock by wildlife and cost incurred for defensive measures e.g. fencings, lighting by torchlight used by the households to protect their property from wildlife attack.

3. Results

3.1 Socio-Economic and Demographic Profiles

Data showed that majority of the respondents were cultivators in the both village-types. It was 90.7% in encroached villages while 80.9% in village forests. It has been observed that in village forests, 52% of total lands were titled land while it was only 4% in encroached villages. It means 48% of total lands in village forests and 96% of total lands in encroached villages were illegally occupied from forest area. Out of total land available, about 50% of total land has been used for agricultural activities in both village-types. It means that villagers were using the remaining land for other activities such as sericulture, horticulture farming. It is interesting to note that not a single respondent in both village-types was using irrigation facility for agricultural activities. Above 90% respondents were male in both village-types due to the fact that almost all households were male headed. In some cases, it has been observed that head of the households were female, but as they were reluctant to be interviewed, so the next senior male members were interviewed. About 15.7% of the respondents in village forests and 6.7% of respondents in encroached villages earned their livelihood as labourers in other farmer's paddy fields because they did not have any land for cultivation. Due to this reason, cost of hired human labour is high in village forests (Rs. 1038.00) then in encroached villages (Rs. 208.00). Unlike the encroached villages, only 3.5% respondents in village forests were engaged in service sector. The possible reason might be that there were more literate persons in village forests (60.9%) than encroached villages (49.3%). On the other hand, 2.7% respondents of the encroached villages were engaged in business while no one was in business in encroached villages. When asked about the type of business they were doing they replied that they were mostly engaged in selling of timber although it was illegal. In encroached villages, almost 65.3% respondents had landholdings 9 ha or more where as in village forests 52.2% of respondents had landholdings less than 9 ha.

3.2 Benefits From Forest Products

It was observed from survey that average time taken for collecting forest products was higher for forest dwellers than encroachers (2.89 hours for forest dwellers while it was 1.57 hours for encroachers). More hours of time were taken by the dwellers of village forests, as they had to travel more distances (2.07 km.) than encroachers (1.07 km.) to collect forest products for which dwellers of village forests collect lesser quantities of forest products than encroachers. The collection of firewood by dwellers of village forests and encroachers were 130.00 and 240.50 bundles respectively per annum. In order to estimate the value of firewood, each bundle of firewood was

multiplied by Rs. 15, which was observed in the local market. Bamboo was another major item collected by the villagers from forest. Dwellers of village forests had to travel 1.20 km to collect bamboo while it was 1 km. for encroachers. The value of bamboo was calculated by multiplying Rs.35 (local market price) to each bamboo piece collected by the villagers. The average quantity of honey collected by encroachers (3.80 kg) was about 2.5 times higher than that of dwellers of village forests (1.50 kg) and the monetary value of collected honey was calculated by multiplying its local market price which was Rs. 300 per kg. Wild edible green leaves were the most common items collected by the villagers from forest. Dwellers of village forests and encroachers had to travel same distance on an average to collect wild edible green leaves. In order to estimate value from the collected edible green leaves Rs 50 has been taken as a representative value of per kg of wild edible green leaves though villagers collected different varieties of wild edible green leaves. This amount had been fixed on the basis of the opinion gathered from villagers based on FGD. Accordingly encroachers earned higher amount from wild edible green leaves, which accounts Rs. 600 while dwellers of village forests earned Rs. 450.

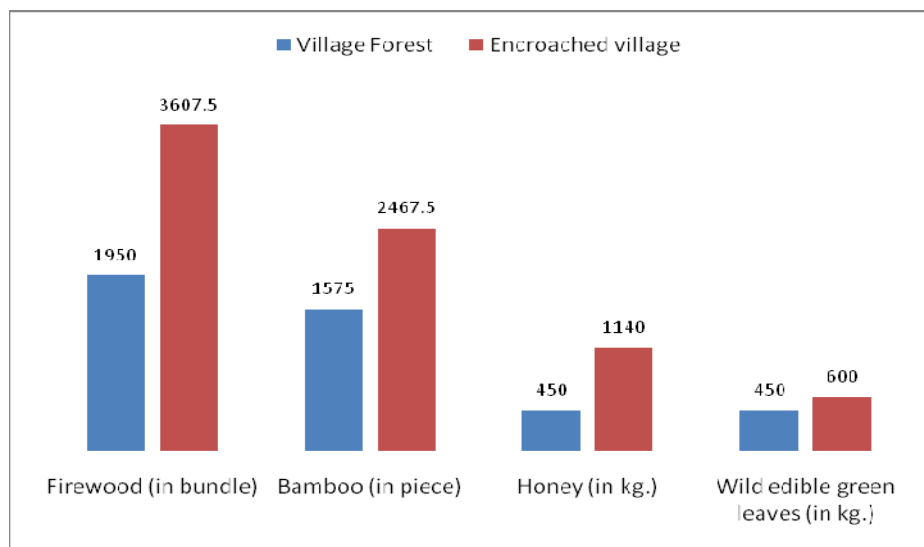


Figure 2. Benefits from forest products

3.2.1 Grazing Benefit

The value of grazing benefit was calculated by multiplying prevailing local market price of per kg of fodder with the average quantity of fodder required by total number of livestock. It has been seen that on average dwellers of village forests had highest number of livestock animal, which accounted for 3.13 units while it was 2.56 units for encroached villagers. To estimate the value of green fodder earned by the villagers from grazing their animals, local market price Rs. 0.50 per kg was multiplied with the total amount of green fodder required by the standardized animal units per day. Dwellers of village forests earned Rs. 7425.93 as grazing benefits while encroached villagers earned Rs. 6073.60 per annum.

3.3 Benefits From Non-Forest Products

In order to estimate the opportunity cost of biodiversity conservation, it was necessary to estimate the benefits earned from non-forest products i.e. from agriculture and allied activities in both village-types. The study reveals that dwellers of both village-types practiced agriculture and horticulture in large scale and sericulture in small amount. Agriculture is mainly mono cropping. Rice was the main crop of agriculture and fruits and vegetables were the main crops of horticulture that were in both village-types. The average value of per moon (40 kg.) of rice was estimated as Rs. 250.00 and accordingly average revenue from rice was estimated. It was found that dwellers of village forests cultivated more fruits and vegetables than encroachers. The same is true for sericulture activities also.

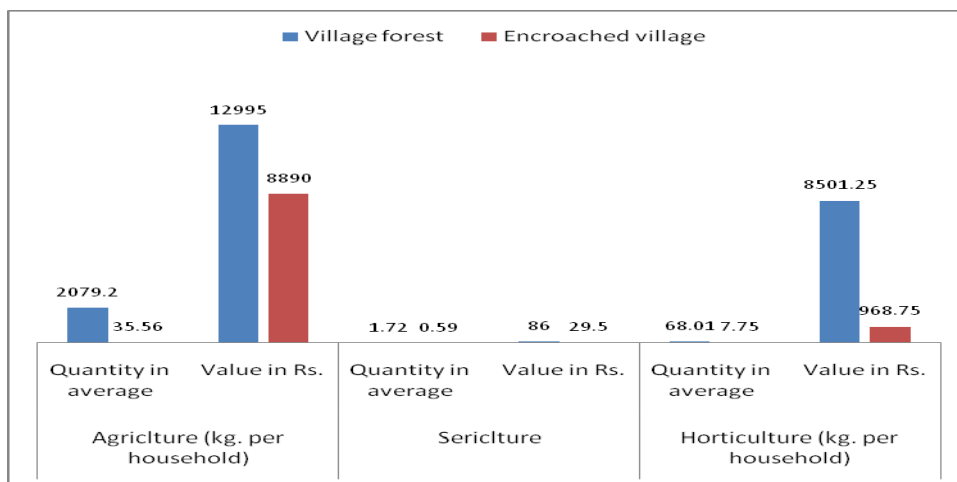


Figure 3. Benefits from non-forest products

3.4 Costs for Both Forest and Non-Forest Products

Total cost includes opportunity cost of collecting forest products, production cost and external cost. To calculate opportunity cost of collecting forest products, time spent for collecting various forest products, which was transformed into man-days, has been multiplied by the ongoing market wage rate. On the basis of FGDs, it was understood that on an average villagers collected firewood about half of the year, which was sufficient for their own use and commercial purpose. Moreover, it was not possible to collect firewood during the entire year due to rainy and winter season. On the other hand, other forest products such as honey and bamboo was available only for 2/3 months while villagers of both village-types collected wild edible vegetables in 3/4 days per week for 9 months on an average, as it was not possible for them in the remaining three months due to occurrence of flood. Accordingly, opportunity cost of collecting forest products has been calculated. It was estimated that opportunity cost of collecting forest products was Rs. 2500.00 and Rs. 1320.00 for village forests and encroached villages respectively.

Production cost includes cost of hired human labour days, animal labour days (both owned and hired), pesticides, seeds, tools used, fertilizer and others. It has been observed that male members in village forests on an average engaged 175 hours while it was 55 hours for female members in their own agriculture and allied activities. In case of encroached villages, this figure comes out as 93 hours for male members and 25 hours for female members. In order to capture the revenue from own family’s labour hour, the labour hours spent by each category has been transformed into days by dividing 8 and then were multiplied by the prevailing local market wage rate which was Rs. 100 for men and Rs. 80 for women. Accordingly, it was estimated that Rs. 2900.00 and Rs. 853.75 were the revenue from own family’s man-days for producing agriculture and allied activities in village forests and encroached villages. The figure was quite low for encroached villages as the prevailing wage rate in encroached villages was only Rs. 60 for men and Rs. 50 for women. This wage rate was about half of the prevailing wage rate under Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) (Note 2). While asked about their willingness to work under such low wage rate than that of under MGNREGS, encroachers replied that they were hesitant to work under this scheme as they felt that it would create threat to their existence. On an average Rs. 3828.85 and Rs. 920.75 were the production cost incurred by the dwellers of village forests and encroachers respectively. External cost includes damage to crops and livestock by wildlife and cost to prevent the same. It was noticed from the field study that one or two villagers used fencing to protect from and prevent damage caused by wildlife. Generally people used fire and torchlight to scare away animals in order to prevent damage by wildlife. Therefore, cost of kerosene and batteries for torchlight were taken to estimate cost of preventing damage caused by wildlife. The external cost for encroached and forest villages were estimated at Rs. 387.15 and Rs. 200.10 respectively.

3.5 Net Present Values (NPVs) of Opportunity Cost for Biodiversity Conservation

The net benefits earned from non-forest products are used to assess the opportunity cost of biodiversity conservation. Net present value of net benefits from forest and non-forest products earned by households in both village-types at 8, 10 and 12 percent discount rates for cash flows summed up over 20 years at 2010-11 prices are

presented in table 7. It has been seen that NPVs of net benefits of forest conservation earned by dwellers of village forest for cash flows summed up over 20 years ranges from Rs. 91,808.81 at 8 percent to Rs. 69,846.24 at 12 percent while these varies from Rs. 1,23,400.40 to Rs. 93,880.45 for dwellers of encroached villages at 8 and 12 percent discount rates respectively. Similarly, NPVs of opportunity cost of forest conservation in terms of benefits from non-forest products earned by the dwellers of village forest for cash flows summed up over 20 years varies from Rs. 1,72,339.40 at 8 percent discount rates to Rs. 1,31,112.30 at 12 percent discount rates and for encroached villagers this figure varies from Rs. 87,188.09 to Rs. 66,330.90 at the respective discount rates.

To have an idea whether the positive benefits will continue in the long run, a sensitivity analysis has been used over a period of 20 years using three alternative assumptions at different discount rates: increasing cost by 20 percent, decreasing benefits by 20 percent and increasing cost by 20 percent as well as decreasing benefits by 20 percent simultaneously. Table 1 show that when both cost increases by 20 percent and benefits decreases by 20 percent then NPVs of net benefits from forest products earned by the encroachers were negative. This indicates that unsustainable extraction of forest products will have more negative effect on the net benefits of forest conservation for encroached villagers as it will attributes to deforestation (Davidar et al., 2008).

Table 1. Sensitivity analysis of net present value of forest conservation benefits

Village type	Assumptions	With 8% discount rate (in Rs.)	With 10% discount rate (in Rs.)	With 12% discount rate (in Rs.)
Encroached Village	Cost of collecting forest products increases by 20 percent	56,882.43	56,219.43	54,663.59
	Benefits from forest products decreases by 20 percent	36,519.49	34,978.09	33,490.34
	Cost of collecting forest products increases by 20 percent and benefits from forest products decreases by 20 percent	-29,998.40	-15,806.10	-5,726.53

Source: Calculated by author from field data.

4. Discussion

4.1 Extent of Dependence on Forest and Opportunity Cost of Biodiversity Conservation

It has been noticed that dwellers of village forests earned Rs. 33,433.08 while encroachers earned Rs. 23,776.85 per annum on an average from both forest and non-forest products. Dwellers of village forests earned Rs.11,850.93 only from forest products, which was 35.45% of total earnings while encroachers earned 58.41% (Rs. 13,888.60) of their total earnings from forest products. If cost is incorporated with this revenue, even then the same pattern can be seen for both the two villages. This showed that encroachers were more dependent on forest for their livelihood. Grazing benefit earned by the villagers was one of the major benefits from forest. But it should be noted that intensive grazing has negative effect on ecosystems (Evans, 1997; Lennon, 1999; Marriott, 2010) and since forests were treated as open access resources, over grazing leads to forest degradation. The NPVs of biodiversity conservation are quite high as well as significant for both two village-types and match with the findings of earlier researchers who have also shown high and positive value of opportunity cost of biodiversity conservation (e.g. Pearce & Moran, 1995; SCBD, 2001; Ninan & Sathyapalan, 2005; Wilson et al., 2010).

It is important to note that for encroached villages, benefits of conservation outweighed opportunity cost of biodiversity conservation that can be seen from the fact that NPVs of benefits over costs from forest conservation are positive. Kniivila et al. (2002) have also found the same conclusion in Finland. But this has not been true in case of British Columbia, where researchers has shown that further forest conservation may be a poor allocation of resources (Van Kooten, 1995; Van Kooten & Wang, 1998; Van Kooten & Bulte, 1999). Though the study shows that the benefits over costs from forest conservation are positive and significant in encroached villages, but the positive benefits are based on the sustainable extraction of forest products because unsustainable extractions of forest products will result in increase in extraction cost and decrease benefits from it.

4.2 Attitudes Towards Biodiversity Conservation

Dwellers of village forests belonging to non-tribal community expressed that they were very much interested in conservation of bio diversity. They came to know about the *FRA 2006* from Zila Panchayat (ZP) representative who distributed a book to them translated in local language. Community members were adequately aware about this *Act* including the requirement of 75 years of land occupation and provision of recognizing non-tribal community forest protection. They also knew the strength of Gram Sabha (Note 3) and they informed that Gram Sabha meet 2 to 3 times till the survey was conducted. When asked about their possible benefits from *FRA 2006* they replied that this act would immensely help them because now they can apply for bank loan, which was not possible for them earlier, as they did not have permanent land papers before this. This showed that people were more concerned about their land rather than biodiversity conservation. Households of tribal dominated village forests informed that they were made aware about the *FRA 2006* by members of the Integrated Tribal Development Programme and accordingly some of them constituted a Forest Rights Committee and arranged for an office in the villages. When asked about the possible benefits of the *FRA 2006* they also gave the same answer that it would help them to get loan through which they can start business. But households were not happy about the distinction made in the Act between tribal and non-tribal for claiming their rights. According to them this would leads to conflict between tribal and non-tribal people. When villagers were asked about their perceptions towards biodiversity conservation, it has been revealed that they were interested to conserve biodiversity.

Encroached villagers were also informed about the *FRA 2006* by their village leader who arranged land for them. When encroachers were asked about their opinion on *FRA 2006*, they revealed that this was an *Act* to give land patta (Note 4) to forests-dwelling communities. The main reason behind such revelation was the wrong interpretation made by their leader (Note 5) who often instigated these people by saying that the *FRA 2006* was merely an instrument to give land pattas. Such a kind of belief might prove harmful in the future. As a result, the people overlook other important environmental and conservation issues of the *Act* such as conservation of forests and role of Gram Sabha's in biodiversity protection. The majority of the respondent (85.7 %) have emphasized on the importance of biodiversity while a negligible portion (1.3 %) gave the opposite view. On the other hand, 13.0 % of total respondent have been found to be indifferent to it, which can be converted to positive attitudes through involvement of NGOs and media such as radio, television etc. (Stone et al., 2008). Therefore, it could be said that majority of respondent had positive attitude towards biodiversity conservation (Liu et al., 2010; Badola et al., 2012) and dwellers of both village-types revealed that persuasion of forest officials, tribal sangha as well as NGOs about the link between forest and survival of mankind are effective in maintaining such positive attitudes (Badola et al., 2012; Mahanta & Das, 2013).

5. Conclusion

The research findings showed that encroachers were more dependent on forest than dwellers of village forests. Though the net benefits from forest products earned by both village-types were positive and significant but the benefits over opportunity costs of forest conservation earned by village forests were negative while it was positive for encroachers which show the acceptability of hypothesis. The negative net benefits of forest conservation encourage dwellers of village forests to use more lands for non-forest products, as they do not have land ownership. From this point of view, the reason for failure of Government of Assam's Joint Forest Management scheme (JFMs) to conserve forest-involving people residing within or nearby forest can be inferred. It has been noticed that there has been lack of support from people for the JFM scheme because the scheme was found to ignore the issue of ownership of land and forest products. On the other hand though the net benefits of forest conservation were positive for encroachers, sensitivity analysis shows that unsustainable extraction of forest products makes the net benefits negative. Thus it can be argued that conservation strategies should focus more on reducing forest dependence through livelihood diversification than promoting sustainable forest extraction. It has been observed that the leader of the encroachers have been preaching from time to time that the *FRA 2006* is a "law for land patta". As a result other important elements of this act such as conservation of forest, strength of Gram Sabha in conservation of biodiversity have been ignored. In this respect, the role of environmental education program, community co-management mechanisms are justified for better implementation of forest management scheme.

One interesting point that the study unearths is that the encroachers have been found to be aware of biodiversity conservation. Therefore, policies can be more effective if they are convinced about their duties by repeated perusal. Although they are aware of importance of biodiversity conservation, respondents do not seem to understand the very objectives behind the *FRA 2006*. Encroachers have conceived this act as the right to that land which they were occupying. Therefore, major steps to be taken are to correct this wrong notion. Though it is essential to recognize the rights of forests-dwelling communities for their involvement in forest conservation program, it is also desirable on the part of the rights- holder to monitor their own activity and its impact on forests areas to check unsustainable

forest extraction. The successful implementation of the *FRA 2006* needs combined efforts of every individual concerned ranging from forest officials to the beneficiaries.

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Notes

Note 1. The three-fold classification of forests, as reserve, protected and village forest, were proposed in the Government of India's Forest Act of 1927-(Section 28). Village forests are to be managed through the village community and guidelines for such management have been laid down in the Act.

Note 2. The Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) is an Indian job guarantee scheme, enacted by legislation on August 25, 2005. The scheme provides a legal guarantee for one hundred days of employment in every financial year to adult members of any rural household willing to do public work-related unskilled manual work at the statutory minimum wage of 120 (US\$2.66) per day in 2009 prices.

Note 3. Gram Sabha means a village assembly which consists of all adult members including women of a village and in case of states having no panchayats, padas, tolas and other traditional village institutions and elected committees, with full and unrestricted participation of women (Government of India 2007).

Note 4. Patta is a document, which gives legal ownership of land.

Note 5. It is not clear whom they considered as a leader. Sometimes they referred to a leader as an influential man among themselves or sometimes to an agent of political parties.

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