

# Socio-Economic and Ecological Implications of Cash Crop Plantation in Community Forest Areas in Meghalaya



Regional Centre  
National Afforestation & Eco-Development Board  
North-Eastern Hill University, Shillong

2010

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The Regional Centre, National Afforestation and Eco-Development Board (RCNAEB), North-Eastern Hill University, Shillong came into existence on 26th October, 1989. Since then Centre has been working in the areas related to afforestation and eco-development in the seven north-eastern states viz., Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura as per the mandate contained in the Memorandum of Understanding (MoU) signed between the National Afforestation and Eco-Development Board (NAEB), Ministry of Environment and Forests, Government of India and North-Eastern Hill University (NEHU), Shillong

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***Coordination:***

Professor. B. K. Tiwari, Coordinator, RCNAEB

***Research Team:***

Dr S. Deb, Dr H. Tynsong, Dr Panna Deb, Ms Dona M Sangma, Ms Marbakor Mary Lynrah, Ms Arupa Chowdhury, Ms Judith Mary Lamo and Etiban Lapasam

***Corresponding address:***

Professor B. K. Tiwari  
Coordinator  
Regional Centre  
National Afforestation and Eco-Development Board  
North-Eastern Hill University  
Shillong-793022  
Email:rcnaebnehu@gmail.com

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Coordinator

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## 1. INTRODUCTION

Agricultural and forestlands have been subjected to unprecedented developmental pressures for the past several decades (Collier et al., 1994; Janzen, 1998). Millions of hectares of primary forest have been degraded by logging (Putz et al., 2000) and millions of hectares converted into intensive agricultural uses (Lenne and Wood, 1999). Besides, traditional agroforestry, perennial and long-fallow shifting cultivation systems (i.e., forest farming) have been displaced by technified monocultures (Collier et al., 1994; Perfecto et al., 1996; Thrupp, 1998). The higher economic returns is the major advantage of the plantation system. Plantations often yield a higher return per hectare and per worker; generate steadier and more regular high-quality produce. These advantages underlie the perception of plantations as a better alternative for agricultural development in the tropics, their long-standing central economic role in several countries, and growing popularity in others (Courtenay, 1965; Hasselman, 1981; Lanyane, 1961; Ruthenberg, 1971; Symons, 1966; Udo, 1982). Thus most of the farmers felt that cash crop plantation was more profitable than traditional agricultural practices. India has a long tradition in cultivation of plantation cash crops. The major plantation crops grown in the country are rubber, tea, coffee, spices, coconut, arecanut, cashew nut, etc. Cash crop plantation in the country plays an important economic role. Several cash crops grown are exported outside the region of their production and to other parts of the world which earn good revenue to the country.

In the state of Meghalaya North-East India, large areas of erstwhile community forests and shifting cultivation lands have been brought under cash crop plantation which mainly comprises broomgrass (*Thysanaleana maxima*), betel leaf (*Piper betle*), arecanut (*Areca catechu*), rubber (*Hevea brassiliensis*), tea (*Thea sinensis*), coffee (*Coffea arabica*), spices, cashew nut (*Anacardium occidentale*), etc. Such land use shift is taking place at a rapid rate. However, the socio-economic and ecological implications of the same have not been studied. The present study is aimed at identifying the drivers of the change and documenting and analyzing the impacts of cash crops on the people and resources of the region. To achieve these objectives two important cash crops of Meghalaya viz., rubber (*Hevea brassiliensis*) and cashew nut (*Anacardium occidentale*) were taken up for the study.

## 2. STUDY AREA AND METHODOLOGY

### 2.1 STUDY AREA

Meghalaya is a hilly state which lies between 20.1' N and 26.5' N latitude and 85.49' E and 92.52' E longitude and covers an area of 22,489 sq. km. It is bounded on the north by Goalpara, Kamrup, Nagoan and Karbi Anglong districts of Assam State, on the east by the districts of Cachar and North Cachar Hills, State of Assam and on the south and west by Bangladesh. According to the 2001 census, the total population of Meghalaya is 2,306,069. The economy of Meghalaya is predominantly **agrarian**. Nearly 10% of the

total geographical area of Meghalaya is under cultivation. 70% of the state's population depend on agriculture, employment and income generation also depend on agricultural developmental activities to a great extent. Agriculture and allied activities engage nearly two-thirds of the total work force in Meghalaya. The main cash crops grown in Meghalaya are areca nut, cashew nut, tea, coffee, rubber, citrus fruits and broom grass.

The study on cashew nut was conducted at Chekwatgre village in West Garo Hills district and the study on rubber was conducted at Khulia village in Ri Bhoi district of Meghalaya. Chekwatgre village falls under the administrative control of the Deputy Commissioner of West Garo Hills district. It falls under the Gambegre community development block. Chekwatgre village lies on the Tura-Baghmara state highway and is 15 km from Tura. Khulia village is 90 km from the state capital of Meghalaya which falls under the administrative control of the Deputy Commissioner of Ri Bhoi district. The average elevation of the area is about 500 meters above sea level (Fig.1). The National Highway 40 is 38 km from the village. The village is inhabited by the people belonging to the Karbi tribe.

## 2.2 METHODS

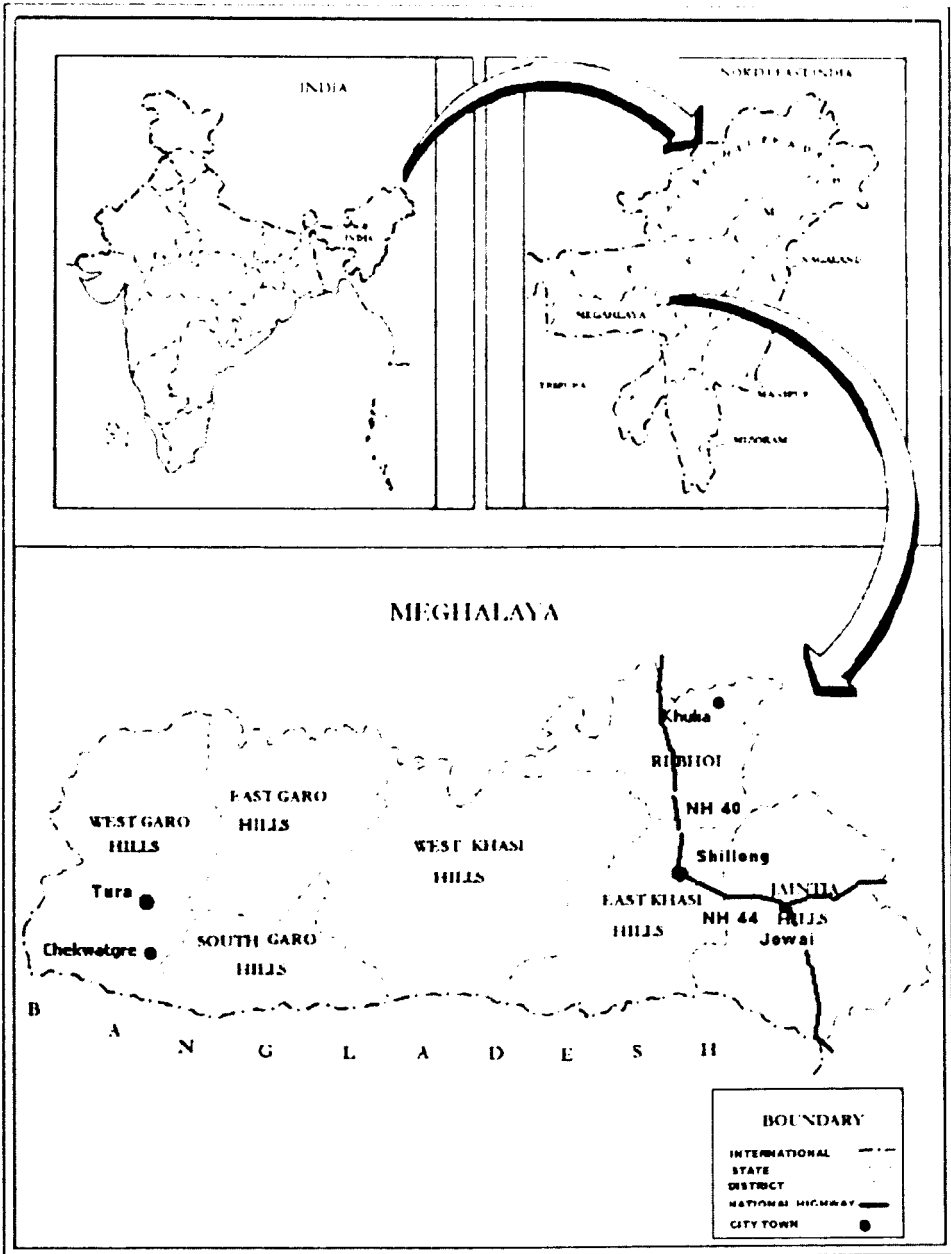
In this study both secondary and primary data were used. Secondary data on area under cashew nut and rubber plantation were collected from Soil and Water Conservation Department, Government of Meghalaya both from its Tura and Shillong offices. Primary data were collected through interviews, transect walks and informal discussions. To know about the socio-economic and ecological implications of these cash crops, two types of questionnaires were used in this study. PRA exercises were conducted in these villages to know the different landuses, and income, education etc. of the villages. A resource map showing the various landmarks and the landuse and land cover of this village was prepared with the help of the villagers. This map was based on the existing maps, villager's guidance and self-validation by the study team. Land use categories and different land cover types were incorporated in the map with the help of the villagers.

Vegetation characteristics were determined within 100 m<sup>2</sup> plots (10 × 10 m) for trees; 25 m<sup>2</sup> plots (5 × 5 m) for shrubs and climbers and 1 m<sup>2</sup> plots (1 × 1 m) for herbs both in plantations and natural forest. The total sampled area for each study site was 0.1 ha for trees; 0.012 ha for shrubs and 0.001 ha for herbs.

## 3. RESULTS

### 3.1 STUDY ON CASHEW NUT PLANTATION AT CHEKWATGRE VILLAGE

Cashew (*Anacardium occidentale* L.) is a dicotyledonous evergreen tree crop belonging to family Anacardiaceae. The cashew tree is native to north-eastern Brazil and its English name derives from the Portuguese name for the fruit of the cashew tree that is known as "caju", which in turn is derived from the Tupi name, acaju (Rosengarten, 1984;



**Fig. 1 : Location of two study sites in the state of Meghalaya**

Davis, 1999; Maia *et al.*, 2000). The cashew plant is a tropical tree with a number of stout primary and secondary branches. The plant is resistant to drought and generally prefers deep and sandy soils (Callado, 2008). The tree is very sensitive to cold when young but becomes fairly hardy with age and can withstand light frost for short periods (Nair *et al.*, 1979). The cashew tree is a sun-plant and does not grow well under conditions of excessive shade (Callado, 2008). The cashew tree should preferably be cultivated in deep soils, no less than 1.5 m (Oliveira, 2004). The appropriate texture of soil should be loam or sandy with a slightly acidic or neutral reaction (pH = 6.3–7.3). The actual fruit is the cashew nut, to which a thickened stem is attached, the cashew apple. It is well known for its nuts that are consumed worldwide and are traded as an important commodity (Alvim and Kozlowski, 1977).

Cashew was introduced into India by Portuguese travellers during the 16th century. Since its introduction, cashew has very well adapted to Indian climatic conditions and is grown in the east and west coastal regions and north-east India (Science Tech, January 2006). India and Brazil are the major cashew exporters, with 60% and 31%, respectively, of the world market share (ITC, 2002; FAO, 2007). The five main cashew-producing countries are: India, Brazil, Vietnam, Nigeria, and Indonesia, totaling 79% of total world production and covering up to 73% of the harvest area (FAO, 2008). In India, cashew ranks second among farm exports. India started to export cashew nut in the early 20th Century with a small quantity, which has increased substantially over the years (ITC, 2002). In 2005, India produced more than 400,000 tons of cashew, which was twice the amount produced by Brazil.

Cashew as a marketable commodity has a very important role to play in the liberalized Indian economy. Cashew ranks as one of the top agricultural export commodities. In India, cashew is grown mainly in Maharashtra, Goa, Karnataka and Kerala along the West Coast and Tamil Nadu, Andhra Pradesh, Orissa and West Bengal along the East Coast. It is also grown in Manipur, Meghalaya, Tripura, Andaman and Nicobar Islands and Chhattisgarh. Currently, the area under cashew is around 634,900 ha with a total production of 417,000 tons. With 118,000 ha and a production of 140,000 tons, Kerala accounts for 18.6% of the plantation area and 33.5% of the production in India respectively. The highest productivity is observed in Kerala and Maharashtra with over one ton per ha (Rao, 1998). The total area for cashew nut plantation in Meghalaya is 6823 ha.

### **3.1.1 DEMOGRAPHY OF THE VILLAGE**

Chekawatgre village is inhabited by the people belonging to Garo tribe. Chekwatgre village has 33 households with a total population of 278 with a sex ratio of one female to 1:1.7 males. The average household size is 8 (Table 1).

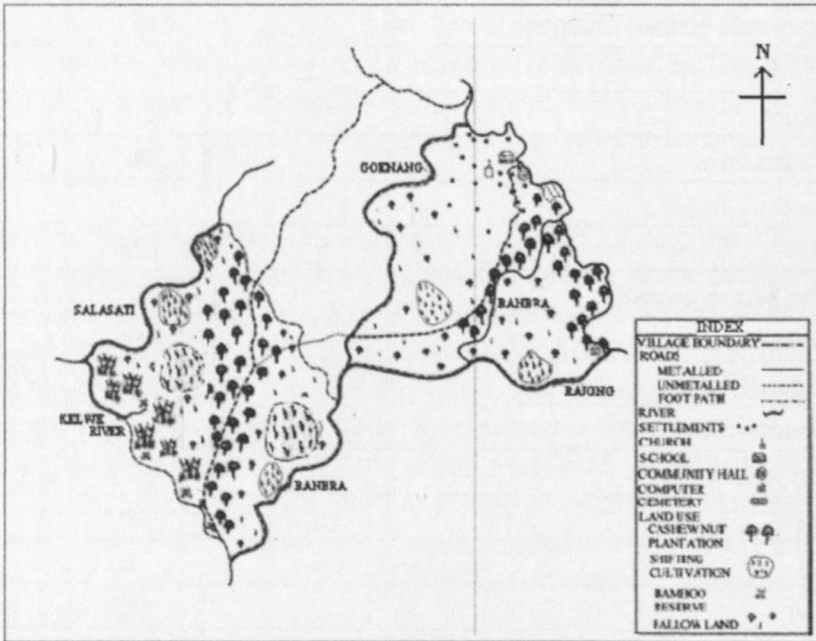
Table 1. Selected features of Chekwatgre village

<b>Demography</b>	
Number of households	33
Total population	278
Family size	6
Sex ratio (female to male)	1:1.7
<b>Land use (ha)</b>	
Forest cover	350
Shifting agriculture	50
Settled agriculture	0
Plantation	150
Habitation & home gardens	150
Total geographical area	700
<b>Occupation (%)</b>	
Government services	3
Daily wage labour	27
Agriculture	56
Business	3
Plantation	12
<b>Educational status (Number)</b>	
Postgraduates	1
Graduates	4
Higher Secondary	3
Secondary	80
Primary	171
<b>Amenities</b>	
Road connectivity	✓
Electricity	✓
Drinking water	✓
Telephone connection	✓
Primary School	✓(1)

Note: Figures in bracket indicate number of a particular type of amenity in the village; ✓ =Present

### 3.1.2 LAND USE PATTERN

The total area of Chekwatgre village is 700 ha (Table 1). Forest cover in the village is 350 ha and constitutes 50% of the total area. Land available for agriculture is 200 ha, out of which 50 ha is used for shifting cultivation and 150 ha for plantation. Habitation and home gardens occupy 150 ha of the total geographical area (Fig. 2).



*Fig. 2 : Landscape elements at Chekwatgre village*

### 3.1.3 OCCUPATIONAL STRUCTURE

The people of Chekwatgre village are engaged in different types of occupation like Government services, daily wage labourers, agriculture and business (Table 1). From the PRA exercise carried out at village level it was found that 56 % of people are involved in agriculture, 27% are daily wage labourers, 12% work in plantations and 3% are in government jobs and businesses.

### 3.1.4 EDUCATIONAL STATUS AND BASIC AMENITIES

In Chekwatgre village there are 1 postgraduate and 4 graduates. Three persons have passed higher secondary, 80 secondary and 171 persons have completed primary level education (Table 1). The various amenities available in the village have been listed in Table 1. Basic amenities like road connectivity, electricity, drinking water, telephone connection and school are present in the village but there is no healthcare facility and no veterinary service.

### 3.1.5 CASHEW PLANTATION

In this village the people are largely dependent on agriculture for their livelihood. The main agricultural practice they follow is shifting cultivation. Area under shifting cultivation has declined during recent years. When cashew plantation was introduced 25 years ago in the village just 1 or 2 households started the plantation. They bought the seeds from the people from the other villages at the rate of Rs. 30/kg. They found that it was profitable except for the first three years where there was no income generation from the plantation. Cashew nut is easy to grow and to manage. The planters get the cashew nut after 3 years of plantation. It was found that these people were getting profits and the income accrued from the plantation site is substantial. Seeing that the economic condition of these households has improved after taking up cashew nut plantation, other people also took up cashew nut plantation. With the introduction of cashew nut plantation 25 years ago in the village, most of the shifting cultivation areas are being converted to plantation areas. The villagers are free to carry out plantation in any area that they want to plant but have to inform the *Nokma* i.e. *village headman*. The plantation area of the 15 surveyed households varies from 0.05–6 ha depending on the size of the family as can be seen from the land holding the households as presented in Table 2.

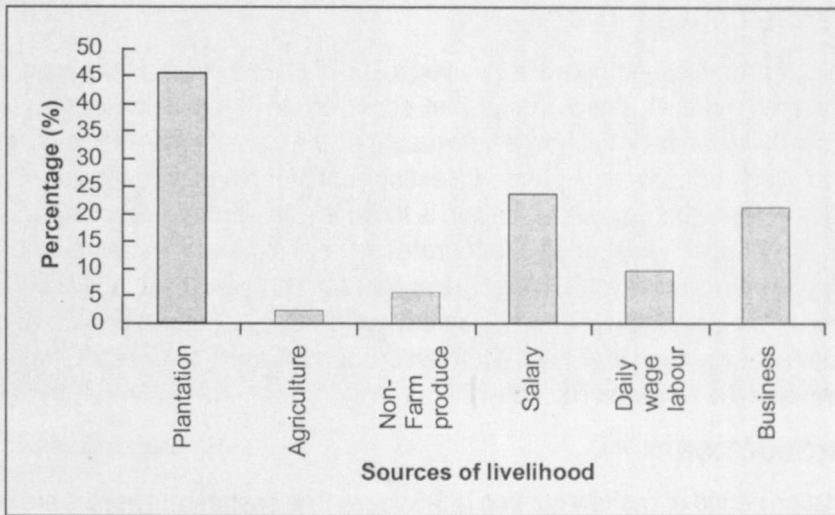
**Table 2. Total land holdings of the surveyed households**

Sl. No.	Land holdings (ha)				Total land holdings
	Plantation	Shifting cultivation	Homestead	Forests	
1	1	0.4	0.27	0	1.67
2	6	0.13	0.4	0	6.53
3	0.8	0.4	0.4	0	1.6
4	0.05	0.06	0.67	0	0.78
5	1.07	0.27	0.4	0	1.73
6	0.47	0.13	0.4	0	1
7	0.33	0.13	0.4	0	0.86
8	0.53	0.27	0.4	0	1.2
9	2	0.27	0.4	0	2.67
10	0.33	0.13	0.27	0	0.73
11	0.13	0.27	2	0	2.4
12	0.8	0.27	0.13	0	1.2
13	0.8	0.4	0.2	0	1.4
14	0.4	0.4	0.13	0	0.93
15	0.8	0.4	0.27	0	1.47
<b>Total</b>	<b>15.51</b>	<b>3.93</b>	<b>6.74</b>	<b>0</b>	<b>26.17</b>
<b>Average</b>	<b>1.03</b>	<b>0.26</b>	<b>0.45</b>	<b>0.00</b>	<b>1.74</b>

### 3.1.6 DISTRIBUTION OF ANNUAL HOUSEHOLD INCOME PATTERN

The broad occupational pattern in the village is given in Table 3. The main sources of income in the village are plantation, agriculture, non-farm produce, salary, daily wage labour and business. The details of total annual income among the 15 surveyed households are also presented in Table 3. There is considerable inter-household variation in the annual income. The annual income varies from Rs. 4758–Rs. 112000. Further analysis of the data shows that cashew nut plantation contributes maximum (46%) to the annual income. Salary also contributes significantly (23%) to the total annual income followed by business (21%), daily wages (10%) and non farm produce (6%). Agriculture contributes only 2% to the total annual income (Fig. 3).

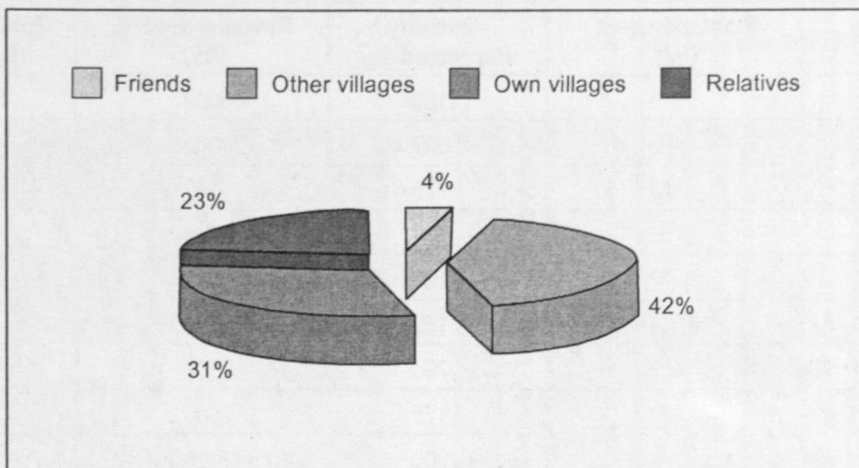
Sl. No.	Annual household income pattern						Total
	Plantation	Agriculture	Non-Farm produce	Salary	Daily wage labour	Business	
1	45000	6400	0	0	0	0	51400
2	24000	0	0	0	0	0	24000
3	7000	0	0	0	0	0	7000
4	1050	0	0	24000	0	0	25050
5	3500	0	30000	0	12000	48000	93500
6	4758	0	0	0	0	0	4758
7	8000	0	0	0	0	0	8000
8	7000	0	0	0	0	0	7000
9	42000	0	0	0	0	0	42000
10	12000	0	0	0	0	0	12000
11	16000	0	0	96000	0	0	112000
12	1400	0	0	0	1300	8400	11100
13	4000	0	0	0	36000	3000	43000
14	1000	3000	0	0	0	50000	54000
15	60000	1800	0	0	0	0	61800
<b>Total</b>	<b>236708</b>	<b>11200</b>	<b>30000</b>	<b>120000</b>	<b>49300</b>	<b>109400</b>	<b>556608</b>



**Fig. 3 : Relative contributions of different sources of livelihood to total annual income**

### 3.1.7 INPUTS

When the people of the village first planted cashew nuts the input invested in the plantation were seeds. The cashew nut seeds were bought from relatives, neighbours, friends or from other villages. The people bought them at the rate of Rs. 20–35/kg. The seed input varied from one household to the other. The data present in Figure 4 shows that from the total seed input of the 15 surveyed households 42% of the seeds were bought from other villages, 31% from their own village, 23% from relatives and 4% from friends. The contribution of seeds from the other villages is more since they had more seed reserve as they have started cashew plantation much earlier.



**Fig. 4 : Contribution of seed inputs from different sources**

### 3.1.8 GENDER ROLE

Both male and female members are involved in the plantation work. From the households questionnaires exercise it was found that some of the households employ seasonal labourers in their plantation field but others managed the plantation on their own. Labourers were employed during weeding and harvesting. Both men and women were involved in weeding and harvesting, whereas fencing is the sole duty of men. Out of the 15 surveyed households, 5 households employ labourers for weeding and harvesting and only one family employed labourers for fencing. The number of workers employed varies according to the size of the plantation. The wage rate was generally different for men and women but in some cases they were paid equal amount. Men were paid Rs. 70–100 per day and for women the rate was Rs. 50–70.

### 3.1.9 PRODUCTION

The gestation period of cashew nut tree is 3-5 years. The cashew nut apples are harvested in the month of April-June. After harvesting, the cashew nut seeds were separated from the cashew nut apple where the raw cashew nut seeds are sold and the cashew nut apples are disposed away. The raw cashew nut seeds are sold at the rate of Rs. 30–40 per kg. The production of the 15 sampled households carried out during the survey is presented in Table 13. The quantity of cashew nut seeds harvested varied from 25kg-1500 kg with an average of 396.4 kg and the revenue earned from the plantation varies from Rs.1000-60000 with an average of Rs. 15781. The productivity per household varied from 63 kg/ha–3077 kg/ha (Table 4). There is a considerable inter-household variation in the productivity with a coefficient variation of 80%, since the quantity of cashew nut apple harvested depends on the area and the age of the plantation.

Sl. No.	Plantation area (ha)	Quantity Harvested (kg)	Revenue earned (Rs)	Productivity (kg/ ha)
1	1	1125	45000	1125
2	6	607	24000	101
3	0.8	175	7000	219
4	0.05	30	1050	600
5	1.07	100	3500	93
6	0.47	159	4758	338
7	0.33	200	8000	606
8	0.53	175	7000	330
9	2	1000	42000	500
10	0.33	300	12000	909

**PLATE 1: CASHEW NUT PLANTATION IN CHEKWATGRE VILLAGE**



Natural vegetation



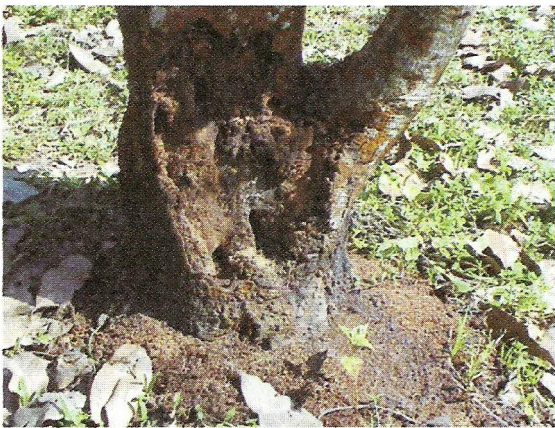
Cashew nut plantation



Cashew nut plantation



Infected cashew nut tree



Stem borer



PRA exercise

**PLATE 2: RUBBER PLANTATION IN KHULIA VILLAGE**



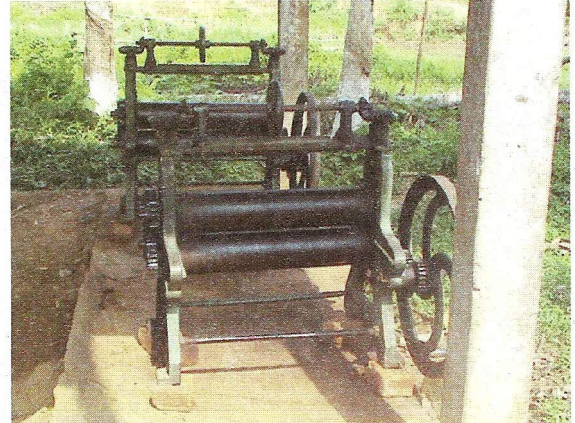
Rubber plantation



Rubber tapping



Processing of rubber latex



Machines use for processing of the rubber latex to rubber sheet



Drying of rubber sheets



Dried rubber sheets

11	0.13	400	16000	3077
12	0.8	50	1400	63
13	0.8	100	4000	125
14	0.4	25	1000	63
15	0.8	1500	60000	1875
<b>Total</b>	<b>15.51</b>	<b>5946</b>	<b>236708</b>	<b>10024</b>
<b>Average</b>	<b>1.034</b>	<b>396.4</b>	<b>15781</b>	<b>668</b>

### 3.1.10 PEST INFESTATION

At Chekwatgre village it was found that the production of cashew nut decreased mostly due to the problems associated with insect pest infestation. According to the observation of the people stem borer is a pest which seriously affects the plant. This pest makes holes on the bark of the tree from inside and eventually the tree dies. Cashew plantation is also affected by another disease which infects the floral shoot hampering the production of cashew nut apples. During the survey of the plantation sites lots of ants were also seen.

### 3.1.11 POTENTIAL MARKET

Out of the 15 households involved in cashew nut plantation, 11 households sell the raw cashew nut seeds in the local market which is 1 km away from the village, 2 households sell it at Mangkachor market in Assam, 1 household sells it at Naumile market and in case of 1 household the middleman comes to collect the cashew nut seeds from his place.

## 3.2 STUDY ON RUBBER PLANTATION AT KHULIA VILLAGE

Natural rubber is obtained from the latex of *Hevea brasiliensis*. It is a native plant of Brazil and it was introduced in India in 1873. The rubber tree flourishes and yields well in warm and humid tropical conditions. An annual rainfall ranging from 2000-3000mm spread evenly, and the copious sunshine are conducive for the growth of rubber plant. Well drained soil and a pH range of 4.0 to 6.5 are favourable for the growth of rubber tree (Borthakur, 1992). The gestation period is 6-7 years with an economic life of around 25 years. India is one of the major producers of natural rubber and ranks second in productivity of natural rubber. In terms of production it ranks 4th and ranks 5th in area of plantation. Ideally rubber grows between 10° north and south of the equator where the rainfall, humidity, and temperature are high and the elevation is below 450 meters. In India rubber is traditionally grown in Kerela and Kanyakumari district of Tamil Nadu. Later, it was introduced to other parts of the country. In northeastern region rubber was introduced into the undivided state of Assam in 1955 (Borthakur, 1992).

In India, Kerela has the highest rubber-growing area of 494400 ha, followed by northeast region with an area of 58432 ha (Table 5). In northeastern region, Tripura is the largest rubber growing state, followed by Assam, Meghalaya and so on (Table 6).

<b>State</b>	<b>Area (ha)</b>
Kerela	494400
North-East	58432
Karnataka	23153
Tamil Nadu	18715
Others	2710
<b>Total</b>	<b>597410</b>

Source : Rubber Board: [www.mdoner.gov.in](http://www.mdoner.gov.in)

<b>State</b>	<b>Potential area (ha)</b>	<b>Area planted (ha)</b>
Tripura	100000	33689
Assam	200000	14648
Meghalaya	50000	5060
Nagaland	15000	2274
Manipur	10000	1829
Mizoram	50000	507
Arunachal Pradesh	25000	425
<b>Total</b>	<b>450000</b>	<b>58432</b>

Source : Rubber Board: [www.mdoner.gov.in](http://www.mdoner.gov.in)

### **3.2.1 DEMOGRAPHY OF KHULIA VILLAGE**

Khulia village is 90 km from the state capital of Meghalaya which falls under the administrative control of the Deputy Commissioner of Ri Bhoi district. The average elevation of the area is about 500 meters above sea level. The National Highway 40 is 38 km from the village. The village is inhabited by the people belonging to the Karbi tribe. The total number of households at Khulia village is 49 with a total population of 300. The average household size in the village is 6. The sex ratio is 1:1.3 (male: female) which is rather skewed in favor of females (Table 7).

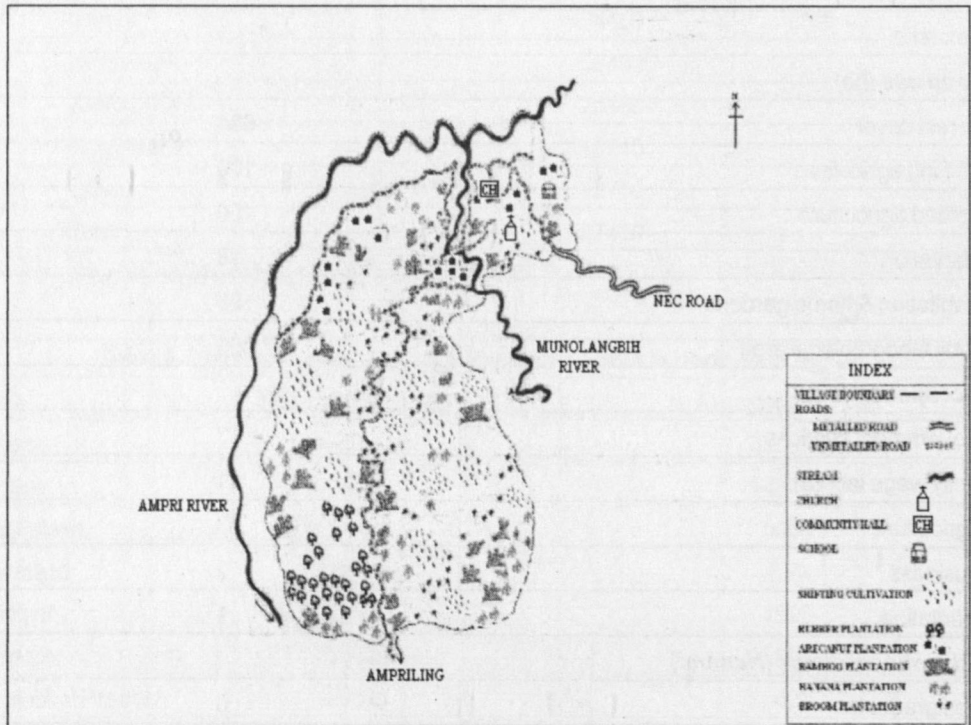
**Table 7. Selected features of Khulia village**

<b>Demography</b>	
Number of households	49
Total population	300
Average family size	7
Sex ratio	1:1.3
<b>Land use (ha)</b>	
Forest cover	694
Shifting agriculture	100
Settled agriculture	50
Plantation	18
Habitation & home gardens	28
Total Geographical area	890
<b>Occupation (%)</b>	
Government services	3
Daily wage labour	11
Agriculture	83
Business	2
Plantation	1
<b>Educational status (Number)</b>	
Postgraduates	0
Graduates	2
Higher Secondary	4
Secondary	30
Primary	100
<b>Amenities</b>	
Road connectivity	✓
Electricity	✓
Drinking water	✓
Telephone connection	✓
School	✓ (3)

*Note : Figures in bracket indicate number of a particular type of amenity in the village; ✓ = Present*

### 3.2.2 LAND USE PATTERN

The total geographical area of Khulia village is 890 ha out of which 694 ha is under forests. Land available for agriculture is 168 ha which is divided into shifting cultivation (100 ha), settled agriculture (50 ha) and rubber plantation (18 ha). Habitation and homegardens occupy 28 ha of the village area (Fig. 5).



**Fig. 5 : Landscape elements in Khulia village**

### 3.2.3 OCCUPATIONAL STRUCTURE

The results of the PRA exercise showed that the people at Khulia village are engaged in different types of jobs, both in primary and secondary service sectors (Table 7). Agriculture (83%) is the main occupation followed by daily wage labour (11%), government services (3%) business (2 %) and plantation (1%).

### 3.2.4 EDUCATIONAL STATUS AND BASIC AMENITIES

The educational status at Khulia village is presented in Table 7. Out of the total population of the village 100 persons have completed primary level education. Only 4 and 30 persons have passed higher secondary and secondary level education, respectively. Two persons have completed graduation and no person has post graduate degree. The village is connected by a kuccha road. The distance of the headquarters of the Community

Development Block from the village is 48 km. Electricity, telephone and radio have reached the village. However, the village lacks amenities like health care and veterinary services. There is one fair price shop, two grocery shops and 3 schools in the village (Table 7).

### **3.2.5 RUBBER PLANTATION**

Like any other village in Meghalaya, at Khulia too, agriculture is the main source of livelihood of the people. Agricultural land in the village is privately owned, and the people practice jhum and settled agriculture on these plots. The forest lands in the village belong to the *Raid*, a local community traditional institution. The people of the village are allowed to collect firewood and other products from the forest. Some of the forest areas have been degraded and are left as such with no management. Seeing that the area has become a waste land, an Officer from the Soil and Water Conservation Department with the permission from the *Raid* introduced rubber plantation in this area in the year 1988, with an objective that the village will be benefited. The project was then undertaken by the Soil and Water Conservation Department and a contract was signed between the *Raid* and the Soil and Water Conservation Department to plant rubber in the *Raid* forest for a period of 15 years. The Soil and Water Conservation Department employed some of the villagers in the rubber plantation work. At that time, the daily wages of the workers was Rs. 5/day/head for females and Rs. 6/day/head for males. At the end of the contract period, the rubber plantation was given back to the *Raid*, who then leased the same to some people from Assam on a contract basis. At present, the rubber plantation is given on a contract basis to people residing in this village. The contract made between the two is for a period of 7 years. As per the term of the contract, the contractor has to make a yearly payment of Rs. 20000 to the *Raid*. After the contract period ends and if the contractor still wishes to continue with the plantation, he/she has to give an application to the *Raid*. The *Raid* will take a decision on the basis of whether the contractor is capable of looking after the plantation. Thus the contract between the *Raid* and the contractor could be extended. The community land is leased to private individuals in many places in Khasi Hills where the benefits are shared among all the people in the village indirectly through the village institution called *Dorbar* which looks after the welfare of the people. This type of leasing of community lands to private individual was observed at Mawpran village of East Khasi Hills district where clan forests were leased to a private individual for strawberry cultivation.

### **3.2.6 INCOME**

The annual income of the surveyed households involved in rubber plantation was around Rs. 3.00 lakh per household.

### 3.2.7 INPUTS

The contractor makes some investments in the rubber plantation. The investment payment is used for buying the required materials like fertilizers, pesticides for tool for maintenance of plantation for wages of the labourers working in the plantation and for meeting transportation cost. The major inputs provided by the contractor along with their cost are given in Table 8. Fertilizers are required in the rubber plantation and are applied on the soil before planting the rubber trees. A pesticide called 'rubber coat' is applied on the rubber tree, two months before tapping. It is applied once a year before tapping to prevent infections of the rubber trees. The total investment made by the contractor is Rs.6578/ ha annually.

Table 8. Inputs made by the contractor for the 18 hectares plantation					
Input	Source	Quantity (kg/ha)	No.	Unit cost (Rs)	Total cost per annum (Rs/ha)
<b>Fertilizers</b>	Soil and Water Conservation Department	5.50	-	500	2750
<b>Pesticides</b>					
Rubber coat	Soil and Water Conservation Department	1.10	-	120	132
Formic acid	Soil and Water Conservation Department	0.66	-	250	165
Manure	Market	0.16	-	320	51
<b>Tools</b>					
Knife	Market	-	6	120	40
Cup		-	2500	3	417
Spark		-	2000	2	222
Tray		-	100	110	611
Rope		-	6	120	40
Hinger		2.80	-	-	150
<b>Maintenance</b>					
Smoke house	-	-	-	-	167
Others	-	-	-	-	1000
<b>Labour cost</b>	-	-	-	-	1033
<b>Transportation cost</b>	-	-	-	-	833
<b>Total Expenditure</b>	-	-	-	-	6578

- indicates not applicable

### 3.2.8 LABOUR INPUT

The contractor employs both seasonal and permanent labourers. The seasonal labourers are employed for weeding. Weeding is done twice a year (in the months of July and November). In this activity both male and female are involved. The plantation care and production of rubber need skilled labourers during the whole lifetime existence of the plantation. Hence, the contractor employs permanent workers who are trained with basic skills and have gained experience (Table 9). The skilled labourers are mostly men and they are involved in tapping of rubber as well as in the processing of the rubber latex. Both men and women are paid equally. The seasonal labours are paid Rs.80/day and the permanent workers are paid Rs. 3000/month.

Activity	Number	Gender	Permanent	Seasonal	Skilled/Unskilled	Price per unit (Rs/head)	Total (Rs.)
Weeding	120	Both	x	✓	Unskilled	80	9600
Tapping & Processing	3	Male	✓	x	Skilled	3000	9000

### 3.2.9 PRODUCTION

When the plantation was first started it was done in an area of 10 ha which was later increased to 18 ha. Tapping of rubber trees is labour intensive and requires skilled labourers. Tapping is normally continued for 20-27 years. The rubber latex is obtained almost throughout the year. Tapping is carried out during April-December. Generally, tapping is done every day except on rainy days and Sundays. The rubber tree is tapped early in the morning from 5 am-9 am. The rubber latex collected is then mixed with formic acid and processed. The processed latex is sold in the form of rubber sheet. Rubber scraps are also sold. The yield of rubber latex depends on the age of the tree, fertility of the soil, climatic condition and skill of the tapper. The average quantity of rubber sheet produced 2400 kg/annum and sold at the rate of Rs. 75/kg whereas the rubber scrap collected is 120 kg/annum and its selling price is Rs. 40/kg (Table 10). The rubber sheet and rubber scrap are sold to the 'Rubber Board in Assam'.

Products	Plantation area (ha)	Quantity harvested(kg)	Quantity sold (kg)	Rate (Rs./kg)	Revenue earned (Rs.)
Rubber sheet	18	2400	2400	75	180000
Scrap		120	120	40	4800
<b>Total</b>					<b>184800</b>

### 3.2.10 SUBSIDY

The contractor also received subsidy from the Soil Department in terms of cash and seedlings of rubber tree. A total number of 4500 saplings of rubber was given to the contractor and also a cash amount of Rs 9000/annum for weeding. The contractor has his own nursery for raising the rubber saplings.

### 3.2.11 PEST INFESTATION

Rubber trees are prone to pest infestation. Green caterpillars are the common pest found in the plantation site as observed by the villagers. They feed on the leaves of rubber, plant infection of the rubber tree due to progressive tapping also hampers the production of rubber latex.

## 4. ECOLOGICAL : BIODIVERSITY LOSS, SOIL FERTILITY, DEPLETION AND EROSION, WATER SCARCITY/HYDROLOGY

Many studies of land use history have shown that the conversion of forest to cash crops or other commercially important types is widespread in developing countries (Roa and Pant, 2001). Although plantation do provide some benefits to the environment, like soil and water conservation, oxygen generation, etc., and also improve the economy of the region as a whole, they cannot be equated to natural forests. Natural vegetations are characterized by abundant primary and secondary forest vegetation, closed canopy complex, vegetation structure, large tree biomass and high floristic diversity (Siebert, 2002). The high tree species diversity and complex structure of natural forest ecosystems maintain many of the ecosystem functions and processes which are not found in monoculture plantation.

The phytosociological studies carried out in the study area at Chekwatgre and Khulia villages (both in natural forest and plantation site) revealed that natural forest had three tier structure, contained different canopy trees species, a number of shrubs, herbaceous species, climbers and liana whereas In the plantation sites, only cashew trees in case of cashew plantation and rubber trees in the rubber plantation site with only 2-3 species of herbs like grasses, ferns etc. and shrubs were totally absent (Table 11).

Site	Number of plant species				
	Tree	Climber	Liana	Shrub	Herb
Natural forest at Khulia	9	1	-	4	5
Rubber plantation at Khulia	1	-	-	-	2
Natural forest at Chekwatgre	9	1	1	7	5
Cashew nut plantation at Chekwatgre	1	-	-	-	1

'-' indicates absent

Both the study areas witnessed serious depletion of its biological resources. It resulted in the loss of biodiversity, wildlife, a gradual drying of springs and problems of soil erosion in some areas. It was found that in rubber plantation of Khulia, 37 numbers of rubber trees were uprooted due to storms. Plantation is more susceptible to drought, disease outbreaks and requires more capital and labour (e.g. fertilizer, insecticides and weeding.) Monoculture use of the land for cashew/rubber plantation had left the soil unsuitable for other crops. Possibly due to constant and overuse of the land (Turkey, 2005). The sampled households, irrespective of their land holding size have not shown any interest on soil and water conservation work. Without soil conservation work, cultivation on this field not only degrades the quality of land but also reduces the profitability in due course. Widespread establishment of monoculture plantation in former shifting cultivation farms may adversely affect soil fertility and long term agricultural production. When a short cultivation period (1-2 years) is followed by a long fallow (10-20 years), shifting cultivation can be productive and sustainable. The fallow restores soil fertility and suppresses weed infestation (Nye and Greenland 1960). The shifting cultivation areas are being converted to intensive cashew nut plantation in Chekwatgre village. The widespread transformation may adversely affect long term agricultural productivity, increase habitat fragmentation, simplify forest ecosystem, favour exotic weed species invasions and may isolate primary forest in protected areas and remnant fragments (Seibert, 2002). The relatively low canopy height of the cashew plantation found in Chekwatgre showed that the diversity and abundance of wildlife (insects and birds) were very much low in the cashew compared to primary and secondary forests in the same area. This was also observed in the rubber plantation site of Khulia village.

Most of the farmers felt that cash crop plantation was more profitable than jhum cultivation. Most of them have taken up cash crop plantation while few continue to practice jhum. It is important to note that once the cropping pattern has changed in accordance with market price/demand, it is difficult to come back to the earlier crop when the price of the latter decreases. Along with the change in cropping pattern the agro-climatic conditions which provide a suitable natural environment for the cultivation of earlier crops have also been altered. In addition to the loss of natural forestlands, the expansion of monocultures which dominates the spaces that were over occupied by the mixed forests and agricultural systems will significantly reduce agro-biodiversity and livelihood flexibility. The loss of fallow and mixed farming can be directly attributed to their replacement by cash crop plantation; moreover, this trend is continuing. (Wenjun diu, *et. al.*, 2006) The process of expansion of plantation lands at the cost of forests reveals that the changes in the agrarian economy resulted in an increase of area under plantations.

Marketing aspects comprise outlet, mode of transportation and pricing. Existing market outlets include the local market, agent/middlemen and the Rubber Board for rubber. Agents/middlemen are the most common buyers for cashew nut. Pricing is a big issue in the cashew sector but not in the rubber sector. The raw cashew nut is the main product of the cashew tree. Cashew apples are not sold. It is used as fodder in some areas. From the study conducted the recent prices for cashew vary from Rs 30-42/kg among the sampled households. The price also varies from year to year. It is important to know that cashew growers do not receive a fair price for their nuts. Marketing of raw cashew nuts is not organized, as there are no viable farmers groups with ample bargaining power. The producers of cashew nut are entirely dependent on private collectors since there is no market available in these areas. Consequently, there is a lot of uncertainty in the market. The number of buyers and their areas of operation are unknown and the prices offered are variable and unpredictable. Lack of information and a lack of know-how on the international quality is one of the major drawbacks with the cashew nut producers.

Forests provide means of sustenance such as food, fuel and fodder to the local people and wood for agricultural implements, green manure etc., to the farmers who live near the forests. The loss of forest to cash crop plantation has sharply increased the travelling distance to collect forest products, loss of medicinal herbs which were available in the past, loss of raw materials such as bamboo reeds etc. Moreover, raising of plantations reduces the complexity and diversity of natural forests and prevents the access of local people to the forest usufruct and biomass which they enjoyed from the natural forests. Once the land become a commodity in the market, the rights of local people over the forest resources such as free grazing, collection of green manures, small timbers minor forest produces etc., are vanished. Crop plantations provide an opportunity to earn more income thus increasing the family's ability to purchase a better quality food resulting in improved nutrition. But prior to cash crop plantation the farmers were mostly involved in shifting cultivation. They grew rice, pulses, vegetables, etc., on their field and apart from meeting their consumption needs or they earned money from the surplus by selling them in local market. Switching over to cash crop plantation may increase the vulnerability by hampering the food security. Extensive cash crop plantation is going to have an adverse impact on the already fragile agriculture biodiversity. Agrobiodiversity being the only support for an equally fragile food security of the people, its loss is going to erode the food security of the people in general and farmers in particular.

Since cash crop plantation is labour-intensive, it generated local labour demand and thus employment. These economic interactions generate income for the hired labourers and thus the in access to food has improved. In cashew plantation of Chekwatgre village both men and women were equally involved in every aspects of production though the frequency and level of involvement varies by the task in some cases. In the case of rubber plantation in Khulia village all the works involved in the plantation are usually done by hired male members except at the time of weeding where women and children are hired. The bulk of benefits emanating from the cultivation of cash crop on community land are accrued to the individual families. Only a small part goes to the community institution viz. the *Raid* to be used for the welfare of the people living in the nine villages that constitute the territory of the *Raid*, Marmain at Khulia village.

## **5. CONCLUSION**

This study revealed that cash crops are more profitable in term of cash income to farmers as compared to shifting cultivation. It was found that the driving forces that lead to cash crop plantation are the influence of the schemes of Government Departments of Soil and Water Conservation and Horticulture and the market. However, from the ecological point of view cashew and rubber plantation are monoculture types of plantation and may adversely affect long term agricultural productivity, soil fertility and biodiversity. Constant and overuse of land for cashew and rubber plantation leaves the soil unsuitable for other crops to grow. Loss of forest to cash crop plantation not only destroys the complexity and diversity of natural forests but also prevents the access of local people to the forest usufruct and biomass which they used to enjoy from the forest. Cash crop plantation being labour-intensive generates local labour demand and thus creates employment. Both men and women are equally involved in cash crop plantation, and management and production, marketing etc. of the product. Based on our findings it may be concluded that cash crop plantation has brought about socio-economic upliftment of the people in the study villages.

## 6. RECOMMENDATIONS

The study suggests that there is a need for immediate interventions by the government on following counts :

1. To train and motivate the villagers to prepare a village level land use plan to retain a certain percentage of forest cover.
2. To promote scientific land management with emphasis on soil and water conservation.
3. To maintain equity and discourage privatization.
4. To provide the growers with credit and storage facilities to avoid distress sales.
5. To fix a minimum floor price. It works as a strong incentive for growers as they can rest assured of a certain level of income through the sale of their produce. In the current marketing scenario there is a lack of transparency, equal opportunity and incentive. Also, powerful middlemen have distorted the markets in their favour as was observed in the case of cashew nut.
6. To provide Information on price and markets to the collectors and small scale producers to make appropriate decisions.
7. To establish of local institutions like 'growers' cooperatives'. This would help increase the bargaining power of growers.
8. To develop communication network which is desirable for market information. As of now most produce is used as raw spice or it is used by the spice industries located out side the region.
9. To encourage the cultivation of other important cash crops like litchi, plum, pine apple, arecanut etc., in these plantations in order to increase the biodiversity of these plantations.

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