

Research article

Rubber Plantation as a supplementary mechanism for degrading forest resources in Arunachal Pradesh – with reference to Siang Belt Region

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Abstract: Arunachal Pradesh, popularly known as ‘The Land of the Rising Sun’ is embodied with varied flora and fauna species. The state having the largest area (83,743 sq.km.) among the states of north east region has vast forest coverage accounting for almost eighty percent of the total. Moreover, it is agro-climatically feasible for undertaking various agricultural as well as horticultural activities though area under plain is very few due to mountainous terrain. As a matter of fact, major portion of state’s overall revenues belonged from forest-based resources prior to the Hon’ble Supreme Court order of 1996. This court ordinance banning the operation of sawmills and other forest-based industries within the state had somehow restricted the over-exploitation of forest resources mainly timber and logwood. However, the rising population of the indigenous tribal community and their growing needs for the very livelihood are inflicting high pressure on the existing forest resources. On the other hand, Rubber Plantation is one of the most popular commercial plantation activities undertaken by the tribal community of the state in the very recent time. This plantation activity is found to be pulling the interest of the tribal populace in great extent due to its socio-economic viability and ecological benevolence thereby minimizing the burden of forest. By considering this development, the present study had emerged wherein attempt has been made to establish the reason (s) as to why rubber plantation is a supplementary mechanism for the degrading forest-based resources in the state. In the present paper, 150 indigenous rubber growers were selected by applying snowball sampling and they were thoroughly interviewed. Both primary and secondary data have been employed and the data so collected have been processed for building meaningful conclusions.

Keywords: Rubber Plantation, Arunachal Pradesh, forest, resources, tribal, mechanism.

Introduction

Arunachal Pradesh is the eastern most state of India located between 26° 35’ North Latitude and 91° 35’ to 97° 27’ East Longitude and the elevation ranges from 250 to 7090 meters above sea level. The total geographical area is 83,743 sq. km. Almost 80 percent of the total geographical area of the state is under forest coverage. Forest plays a very important role in socio-economic set up of the tribal communities since their customs, traditions and cultures are closely linked with nature. 90 percent of the state’s direct revenue is generated by its forests besides indirect revenue in form of allocable excise duty available mainly through the plywood industry (APFC, 1988, as cited in Roychowdhury, 2015). “The forest in Arunachal Pradesh is primary by large

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and there is a vast wealth of plants, grasses, herbs, orchids and others of immense economic, commercial and medicinal values which may not be available in other parts of the country” (Bhattacharjee, 2000).

However, due to lack of avenues of earning, the tribal community, especially those living in rural areas, inflicts heavy pressure on forest resources. They overexploit the natural forest by resorting to different means such as *jhum* cultivation, reckless felling of trees for timber and firewood purposes, etc. solely to earn for their living. On the other hand, rubber (*Hevea Brasiliensis*) is an important agricultural plantation in the tropics (Chattopadhyay, 2015). Since its inception in the year 1996 at *Ngorlung* village of East Siang District, the popularity of plantation crop is spreading like a wild inferno especially in the foothill regions of the state which are classified apparently feasible for carrying out this plantation crop. The socio-economic viability of the crop in one hand and the ecological benefits derived from it on the other had attracted the tribal folks to prefer for this plantation crop over others. The introduction of rubber has not only affected the clearing of forest by *Dayak* farmers but also their reforestation activities (De Jong, 2001). Approximately, the annual money flow goes up to the tune of rupees 1 crore almost every financial year in the foothill regions where it is undertaken on a large scale. Notably, such development has lessened the over-dependence of the people on forest resources and also, it significantly brought down the practices of *jhum* cultivation in the region. Hence, this paper is a humble attempt where efforts have been made to bring forth the positive aspects of rubber plantation in respect of the degrading forest resources.

Review of Literature

Roniya Karam (2010) had mentioned that northeast region is suitable for the flourishing growth of rubber and he referred *Dhoopcherra* village in Tripura and Karbi Anglong and Goalpara Districts of Assam where farmers are enthusiastically taking up rubber plantation in large scale. He also mentioned the economic and ecological benefits arise out of rubber plantation. Similarly, **Vicky Saroh (2017)** had also discussed the positive aspects of rubber plantation towards ecology. He categorically mentioned the ecological benefits derived from rubber plantation. In a more precise manner, **Wile de Jong (2001)** had concluded that the introduction of rubber in West Kalimantan contributed little to encroachment into primary forest and it also significantly favoured the restoration of forest in areas where land use became less intensive.

P.S. Roy and P.K. Joshi (2010) had noted that forest and forest ecosystems of north-east India are under severe pressure owing to population explosion, encroachments on forest lands, and loss of forest cover for non-forest uses, shifting cultivation practices, forest fires and illegal felling of trees. **Tame Ramya (2012)**, suggested that people who resort to *jhum* or shifting cultivation should be encouraged to adopt more environment-friendly methods and techniques. He also advocated non-timber forest produce (NTFP) cultivation to meet the living expenses as well as to attain economic growth.

Significance of the Study

The present study has been maneuvered in such a manner that it could yield dual benefits for both rubbers growing society and the policy makers. On one hand, it will benefit the rubber growers by enabling them to explore more knowledge about the socio-economic and ecological contribution of rubber which will further ease them in choosing their future course of action i.e. whether to prefer rubber plantation over *jhum* cultivation or vice-versa. On the other hand, it will act as a knowledge base for policy makers in understanding the positive effects of rubber plantation towards forest and ecology in a better way. Besides, the present paper is believed to be quite helpful for the academicians and scholars who wish to explore deeper in the same field.

Objectives of the Study

Following are the major objectives of the present study;

1. To unearth the cause (s) of degrading forest-based resources of the state keeping Siang belt in focus
2. To highlight the reason (s) as to how rubber plantation can be a supplementary mechanism for the degrading forest resources

Research Methodologies

In the present study, a total of 150 (One Hundred Fifty) indigenous rubber growers have been selected from Siang Belt Region where rubber plantation is widely undertaken. Snowball sampling technique has been applied in selecting the sample respondents. The selected sample respondents and officials of the rubber board were thoroughly quizzed and their opinions were recorded. Moreover, a well-designed questionnaire (both open and closed ended) has been administered upon the sample respondents in order to derive meaningful information. The data so obtained were carefully processed and meaningful findings have been drawn by considering the framed objectives. Tables and Graphs have also been used to represent the statistical facts and figures. The present study is descriptive in nature.

Sources of Data

Both primary and secondary data have been extensively used in the present study. Data elicited from personal interaction with the rubber growers and rubber board officials, group discussions with the community, etc. comprised the primary data. On the other hand, official records, journals, periodicals, articles, etc. formed the secondary data.

Forest Resources in Arunachal Pradesh

Bhattacharjee (2000) noted that forest wealth is one of the important natural aids to mankind which should be utilized judiciously. The state, due to diverse geographical and climatic conditions, is bestowed with rich floral diversity with 5000 seed plants out of 15000 found in India, many flowering plants, about 550 exotic orchids,

about 452 pteridophytes, 60 bryophytes, 80 lichens, more than 500 plants with medicinal properties, 35 varieties of bamboo, 20 species of canes, etc. (SFRI, 2002, APHDR, 2005 as cited in Ramya, 2012). In order to provide more insight view, a table has been constructed below which depicts the out turn of non-timber forest produce of the previous five years.

Table 1: Showing Out turn of Non-Timber Forest Produce of previous five years

Sl. No	Name of NTFPs	Unit	2013-14		2014-15		2015-16		2016-17		2017-18	
			Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
1	Firewood	Mt/m3/ TL	5131.0 2	347038	4327.2 4	248847	3584.9 3	531132	5075.83	239940	15061.5 9	109998 2
2	Charcoal	Qtl	269	25473	-	-	64.05	4007	4	200	8.05	1285
3	Cane	Kap	46988. 4	190513 1	54379	128808 5	39437	117402 2	8837	208218	33785	388426
4	Bamboo	Nos	38553	91403	19482	37635	25235	81456	48036	88695	32905	58062
5	Sands	Cum	21344. 1	198622 2	52602	317759 7	33653. 6	202952 4	33307.2 5	210749 6	1200.07	761852

Source: Forest Statistics of Arunachal Pradesh 2017, p.31

The above table reveals quantity and economic value of few selective non-timber forest produce of the state from the year 2013-14 to 2017-18. Among the five products, Sands found to be generating more economic values followed by Cane and Firewood. However, it is apparently shown in the table that irrespective of being highest in the economic hierarchy, the marginal quantity and value derived from all the five products are in diminishing state. This diminishing trend both in terms of quantity and value clearly indicates the degrading forest resources in the state.

Moreover, the share of revenue contributed by forest towards the state's overall revenue is shown in a table constructed below.

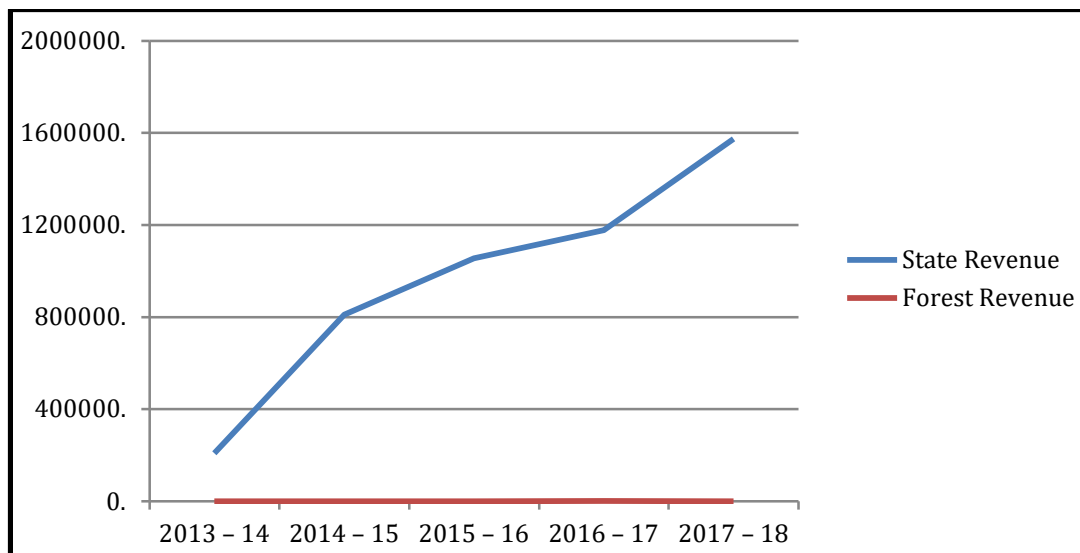
**Table 2: Showing Forest Revenue and State Revenue of last five years
(Rs in Lakhs)**

Year	State Revenue	Forest Revenue	% of State Revenue
2013 – 14	208570	1189.24	0.57
2014 – 15	812308	927.95	0.114
2015 – 16	1055314	1376.00	0.13
2016 – 17	1177957	1386.00	0.12
2017 – 18	1573832	1344.07	0.085

Source: *Forest Statistics of Arunachal Pradesh, 2017*

The above table depicts the annual state revenue and the share of annual forest revenue of the state from the year 2013-14 to 2017-18. It can be seen from the table that there has been consistent upright surge in state revenue during the last five-year periods. On the other hand, the state forest revenue is neither consistent nor uniformly increasing or decreasing. It has experienced downfall in the year 2014-15 but consistently increased in the next two successive years. However, it again fell from 1386 lakhs in 2016-17 to 1344.07 lakhs in 2017-18. Moreover, the percentage of forest revenue towards state revenue is also experiencing a similar downfall. It consistently fell from 0.57 percent in the 2013-14 to 0.085 percent in the year 2017-18. The above table has further been plotted in a line graph for easy understanding where state revenue is represented by the blue line and the reddish line portrays forest revenue.

Figure 1: Showing Forest Revenue and State Revenue of Previous Five Years



By considering the above statistical facts, it will not be wrong to state that the principal cause of falling forest revenue is owing to the sinking forest coverage. According to the latest assessment by the government, there has been a substantial decrease in Arunachal Pradesh Forest cover in two years since 2015. With 190 sq. km decrease in forest cover, Arunachal Pradesh is among the five northeastern states where forest cover has decreased the most (The Arunachal Times, February 13, 2018). This fact is substantiated in the table drawn below.

Table 3: Showing percentage change of forest coverage in between 2015 and 2017

Geographical Area	Very Dense	Moderately dense	Open Forest	Total Forest Area	% of forested area	% change since 2015
83,743	20,721	30,955	15,288	66,964	79.96%	-0.23%

Source: *India State of Forest Report, 2017*

It can be seen from the above table (Table 3) that there has been a substantial decrease of 0.23 percent (190 sq. km.) in the area under forest coverage in Arunachal Pradesh in between 2015 and 2017. Such reduction of forest area in the state is not a good sign for a healthy ecosystem. The Table further shows that major portion of the forested area is moderately dense accounting 30,955 sq. km. The state has a sufficient area which is classified very dense covering 20,721 sq. km.

On the other hand, the reason (s) for diminishing forest coverage in the state can be attributed to many factors such as the outcome of *jhum* cultivation undertaken by the tribal folks, population pressure, logging, wanton felling of trees, expansion of farming land, etc.

Causes of degrading forest resources

It has been observed from the past few years that forest resources of the study area in particular and the state in general is degrading at a rapid pace due to the act of human beings and other naturally occurring factors. The very causes of degrading forest resources are identified and highlighted below in the following manner:

A) Humans inflicted

- i) *Jhum* Cultivation – *Jhum* or Shifting cultivation is one of the most popular and commonly practiced economic activities in the study region in particular and the state in general. This activity is very much prevalent in almost every nook and corner of the state. It is the easiest means of sustenance for the people living in rural and remote places. This activity involves slashing and burning of the natural forest land which has a negative impact on both the environment and ecology. The degradational activities viz. shifting cultivation clear felling of forests for timber and mining has altered the natural landscape to a great extent (Roy and Joshi, 2010). *Jhum* cultivation is believed to be the main reason for forest degradation in the study region.
- ii) Illegal felling of trees – Yet another severely affecting factor causing degradation of forest found to be the wanton felling of trees by illegal means. Due to the existence of saw mills in some pockets of the study area, some sections of the indigenous people engage in timber business which is considered a short-cut way of earning handsome money.
- iii) Population pressure – The increased population pressure is another factor causing forest degradation. It multiplies the dependency ratio of people on forest resources. When there is population explosion in the village, more trees are cut down for building houses, firewood, etc. which ultimately brings down the percentage of forest coverage. Such activity is commonly seen in every pocket of the study area as there is no other option left for the villagers to substitute their growing demands.

- iv) Expansions of agricultural land – In order to meet the increasing demand for food grains, the villagers expand their agricultural lands by clearing more forest area. Such action, though non remunerative, causes negative impact on both the environment and forest.
- v) Deforestation – Arunachal Pradesh is one of the greenest states in India, yet today, despite having only seven persons to a square kilometer and about 8.4 million ha of rich vegetation, the state is gravely threatened by deforestation (Roychowdhury, 2015). Deforestation is generally done with a view to bring in various developmental activities into a particular region e.g., expansion of administrative centre, expansion of market, construction of roads, bridges, dams, telecommunication office, sports centre, commercial hub, railway platforms, airport, etc. The study area has also witnessed large scale deforestation in the pretext of development thereby inflicting huge burden on forest.
- vi) Forest Fire – At present, the severest threat for the flora community is forest fire. The state has already witnessed numerous incidences of forest fires in the past. Tame Ramya (2012) has noted that one of the major factors behind the diminishing in forest cover could be the unprecedented forest fires, which is very frequent in the state. Maximum number of incidences i.e. 88 percent occurred in areas of low elevation i.e. less than 1500 m (Ahmad et. al, 2018). They further noted that all districts showed high fire incidences, therefore, an urgent intervention is greatly required by the policy maker towards conservation and management of forest fire prevention and control by adopting focused intervention, strategic allocation of limited resources in potent areas in order to safeguard Himalayan region of highest biodiversity.

B) Non-human inflicted

- i) Flood – One of the naturally occurring hazardous calamities causing great damages to both environment and forest is the flash flood. It usually occurs during rainy season mostly affecting the low lying areas. Several cases of flash floods causing irreparable damages to both the forest and environment had already been experienced in the study area.
- ii) Landslides and Soil Erosion – Landslide and soil erosion also contribute considerable share in degrading forest covers. Landslide usually occurs in the uphill region during heavy rainfall due to mass destruction of trees for *jhum* cultivation. On the other hand, soil erosion is the result of flash flood water where the forest lands situated nearby the river are eroded slowly but gradually. It is a common phenomenon in the study region.

Rubber Plantation as a supplementary mechanism

Natural Rubber is considered as an economically viable plantation crops which is highly demanded across the globe. Since its inception in the study area, it not only filled the bank account of the growers but also reduces the number of damages inflicted by the indigenous people towards forest. One of the respondents admitted that people from his locality, after undertaking rubber plantation, started giving up *jhum* cultivation. Rubber crop, in

fact, has many positive effects towards forest and environment. The latex from the lower part of the trunk has a high commercial value which can assist rural communities in socio-economic development; the trunk is a source of timber and wood while its branches are now being used for firewood and pegs (Vongkhamheng et. al., 2016). Following are some of the positive impacts of rubber which are believed to be helpful in supplementing forest resources up to some extent thereby minimizing its degradation.

Firstly, the high-income yielding potential of a rubber crop can enable the indigenous grower to make themselves economically self-sufficient. Saroh (2017) asserted that 1 (One) hectare of rubber plants which contains nearly 500 rubber plants is expected to yield net amount of Rs.3,00,000 per annum at the given price level (p.135). This will encourage the prospective farmers to opt for rubber plantation than non-remunerative *jhum* cultivation and other environmentally deleterious activities.

Secondly, rubber trees can be an effective source of timber. Although rubber wood is not considered to be of as premium quality as teak and rose wood it can help in decreasing the pressure of logging of natural forest (Bhowmik, 2006). In fact, the economic life of a rubber tree limits up to 25 to 30 years. At 25 years, rubber trees normally have a clear bole of 3 to 10 m depending on the clones and the location of growth (Lim, et. al, 2003). It ceases to yield latex after reaching the upper age and logging is possible only thereafter. To keep the environment intact, new saplings are planted.

Thirdly, rubber trees can also be used as firewood. It has been observed that considerable numbers of trees are annually cut down for firewood purposes. With the advent of rubber plantation in the study region, the necessity for firewood can be supplemented by rubber trees once they achieve expiry period.

Fourthly, rubber trees are believed to be good in conserving the soil. It helps in improving the soil texture and also in controlling soil erosion. The root concentration in rubber plantations occurs in the top 18 cm of the soil and horizontally they spread up to 2 metres from the plant base (Philip et al., 1996, as cited in Bhowmik, 2006). The reduced soil temperature leads to reduced oxidation of soil organic matter and favor its build up (Joseph, 2000, as cited in Bhowmik, 2006).

Fifthly, rubber plantation areas are generally termed as 'Man made forest' and indeed they are. The only difference is the absence of sound biodiversity in rubber plantation areas. According to Jacob (2000), lack of light inside the plantation makes it tough for other plants to survive in matured rubber plantations but shade loving crops like orchids and certain medical crops are often present in rubber plantation (As cited in Bhowmik, 2006). Bhowmik (2006) had concluded that it is true that rubber plantations being monoculture offers lower biodiversity but it is more appropriate to say that rubber plantations offer limited biodiversity.

Conclusions

Conserving forest is indeed a challenging task for the incumbent authority especially in the tribal dominated areas because of the prevailing traditions, customs and cultural activities which are directly or

indirectly associated with the forest. As a matter of fact, the idea of commercialization of forest products by the tribal people of the region has incorporated few decades before only. In the olden days, they were exploiting forest resources for the sake of their very survival only thereby affecting sustainable development. The impact on forest resources was thus not very disastrous. However, the mindset of the community had changed with the passage of time and began exploiting forest resources recklessly for their individual benefit and hence, inflict heavy pressure on forest resources.

Off late, rubber plantation arrived into the Himalayan state and managed to attract many prospective farmers. This plantation activity has been found economically lucrative and environmental-friendly by the indigenous rubber growers. Bhowmik (2006) asserted that rubber plantation has not only helped these tribal people find a viable source of living but has also helped in the restoration of degraded forest lands. Similarly, one of the forest officials has shared that rubber plantation is one of the very effective afforestation measures for the degrading forest in the state. He also added that forest department is putting its best effort to motivate and encourage people to plant more trees in their locality besides undertaking rubber plantation. According to Suratman (2013), due to shrinking area of natural forest and environmental conditions in its management, the future trend in global wood production will be towards output from planted trees rather than managed forests.

De Jong (2001) opined that tree-technologies should be preferred when trying to improve local agriculture and policy-makers should consider the degree of government presence and negotiated agreements concerning forest conservation before promoting new technologies in forested region. He also added that incorporation of local resource management technologies, especially tree-planting or forest-management technologies may enhance positive outcomes in terms of increased income and forest preservation. A carefully formulated payment for ecosystem services programme, and a certification scheme for 'environmental friendly rubber' have the potential to reduce the environment impact of rubber expansion while ensuring the supply (Vongkhamheng et. al., 2016).

It is therefore the duty of all the stakeholders to motivate, guide, and regulate the activity of the people so that the win-win situation is achieved while pursuing any sort of economic activity(s) in the study region in particular and state in general. In other words, ecological balance should not be disturbed while earning for the living. To conclude, there is a strong reason to believe that rubber plantation is the most suitable bridge of the two at present.

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