

**A TALE OF FIVE VILLAGERS' LIVELIHOOD STRATEGY AND COMMON
PROPERTY RESOURCES: AN EMPIRICAL STUDY OF RURAL HOUSEHOLDS
IN EASTERN HIMALAYAS**

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Abstract

In Arunachal Pradesh the eastern Himalaya state of India, there are three types of property rights structure on land and forests viz., Government (public), private and community which influence the quality and richness in terms of forest coverage among the Indian States. It is being done through multiple channels of influences. Now, it is being widely recognized that participatory, decentralized and local level managements of natural resources through long-enduring community-based institutional arrangements may have some advantages over state-controlled and market-based alternatives. This is because, the survival of the communities living on forest fringes or within forests depend their daily needs on the community forests. However, institutional arrangements evolve along with changes in the structure of socio-economic and political economy. During transitions from common or community property rights regime to private property regime the institutional structures of community-based institution for natural resource management are expected to change as well. The implications of these changes will not be uniform across the different rural classes, primarily because as theoretical and empirical evidences suggest, privatization of commons is often accompanied by increasing inequality in the distribution of resources.

Keywords: Common Property Rights, natural resource management, institutional arrangements, participatory, decentralized.

Introduction

Arunachal Pradesh has witnessed large-scale changes in the property rights structure as well as natural resource base. Therefore, community forests offer a unique opportunity to study these enquiries in greater detail. The results are not only expected to clarify the theoretical issues of relationship between Common Property Resource (CPR) management and its distributional aspects in rural settings but also may contribute towards developing more sophisticated policy responses towards better participatory resource management. In fact, there have been a number of theoretical and empirical studies on the successes and failures of CPR management. However, there are a few studies that have paid attention to

equity, equality and its distributional implications of common property institutions as well as rural livelihood strategies.

Hence, the present study is an attempt to fill this gap in knowledge and to highlight some of these aspects, which have been ignored so far.

Objectives of the Study:

The present study is guided by the following objectives:

- (i) To study the degree and nature of forest dependency among the rural households having different asset holding and income or consumption level.
- (ii) To analyse the relationship between household's socio-economic characteristics and forest dependency.
- (iii) To analyse the different sources of livelihood for rural households in the study area.

Hypothesis:

In the light of the above mentioned objectives, the hypotheses to be tested in the present study are as follows:

- i. The households belonging to relatively poor group may have a higher dependency over forests in terms of share of consumption generated from forest resources.
- ii. The socio-economic heterogeneity in rural community is expected to determine the different level of consumption from the community forests.
- iii. Access to market may reduce the dependency of households on the community forest since the community members may have some exit options in terms of outside earning opportunities.

Data Base and Methodology of the Study:

The present study is mainly empirical in nature. The data which are used and incorporated in different chapters of the study were collected from primary as well as secondary sources. The State level information has been collected from Arunachal Pradesh Government offices like, Directorate of Economics and Statistics, Directorate of Agriculture, Arunachal Pradesh Remote Sensing and Application Centre, Directorate of Rural Development, Directorate of Environment and Forests and Reports and Publications such as National Sample Survey Organisation, Central Statistical Organisation, Directorate of Census, North Eastern Council, Human Development Report of Arunachal Pradesh, etc. These data have

been used for describing the State level picture of CPRs of Arunachal Pradesh. Moreover, the data from the same survey have been incorporated to deal the general background of the State as well as Papum Pare which are taken up for detailed investigation. In order to complete the district level background such data have been supplemented by information collected from the office of Economics and Statistics and Basic Statistics of NER.

In the field study the preliminary unit of observation is the household of a village. A multi-stage sampling design is used for selection of households of the selected villages. The different stages under the technique are as follows:

- Stage I : Selection of district
- Stage II : Selection of Circles
- Stage III : Selection of villages
- Stage IV: Selection of households

At stage I, Papum Pare district was selected by purposive sampling on the basis of forest coverage as well as to represent the two important forms of property rights structure i.e., community and private ownership of forests. At stage II, four out of nine Circles, namely, Doimukh, Itanagar, Balijan and Tarasso circles were considered to represent the entire area depending on the distance from the urban area. At stage III, five villages were selected on the basis of purposive sampling. The selected villages are Midpu I from Doimukh Circle, Ganga Village from Itanagar Circle, Poma and Jote from Balijan Circle and Pempla from Tarasso Circle of Papum Pare district of Arunachal Pradesh.

And the main reasons for selecting these villages were based on the distance of villages from the urban centres i.e., Itanagar and Naharlagun so as find the degree of dependency on community forest resources. The selection of these villages was taken into consideration on the assumption that the villages nearer to the urban centres may have less dependency on forests because of market access and some exit options in terms of outside earning opportunities in non-farm sector.

In the next stage, altogether 225 sample households were selected by a stratified random sampling technique from the district at least 35 per cent of the total households in large villages. However in the later stage, 12 samples were discarded as the information provided by the respondents were beyond the limits of the criteria made for the study¹. Hence, the total number of households was restricted to 213 sample households for the study. These sampled households were further divided into the relatively poor and non-poor households. This was done by compiling a census of village households with Participatory Rural

Appraisal (PRA) techniques. The participants in the PRA exercise were asked to categorise all households into two different household groups namely poor and non-poor based on the criteria as to what the villagers consider as important for assessing an individual's socio-economic position in the village. Fox (1983), Richards et. al., (1999), and Adhikari (2001) used the similar criteria for categorising households into different groups. This categorisation should be understood in relative terms since all the households in the study area are subsistence *jhumias* and farmers with few households having earning opportunities outside agriculture and CPRs. The details are shown in Table 1.

Table: 1
 Sample Households in the Surveyed Villages
 Papum Pare District, Arunachal Pradesh

Name of Village	Distance from urban centres (in km.)	Total Number of Households (As per the record of Gaon Burah)*	Number of Households Surveyed		
			Poor	Non-poor	Total
Midpu I	23	98	18	10	28
Ganga Village	7	324	52	23	75
Poma	18	166	36	14	50
Jote	20	104	23	17	40
Pempla	32	20	17	3	20
Total		712	146	67	213

Note: * The village level household data for 2001 and 2011 are not available till date hence the information from Gaon Burah was taken into consideration.

The sample size consisted of 35 per cent of the total households in the large villages while all households are canvassed in small villages. The main tools of the study were two sets of questionnaire namely: (i) household schedule and (ii) village schedule. Both household schedule and village schedule were canvassed in the sampled villages. The household schedule seeks to gather information regarding demography as well as socio-economic characteristics of household, occupational pattern and sources of livelihood, landholdings, tenure and production system, collection and use of forest products from community forests, consumption expenditure and household management system etc. In case of stock variables, the position on the day of survey was collected, but in case of flow variables, the information of varying periods was taken into account. The data on production, consumption, income etc. were collected for the year preceding the day of survey. On the other hand, the village schedule also seeks to gather information regarding identification of sampled village, village history, availability of infrastructural facilities, particulars of the quality of forests near the village, role of village

institutions and institutional framework of resource management and use. The questionnaires were designed in English for the sake of convenience but were translated into local dialect with the help of interpreters who were part of the survey team at the time of survey wherever necessary. The data collected through the household schedule and village schedule were tabulated in coding sheets to have a clear view of the replies of the respondents and the facts and figures were translated for analytical purposes. Further, the data collected from the field study were also supplemented by the field study notes maintained by the researcher. A number of tables, diagrams and maps were used to facilitate an easy understanding of the subject under consideration. The quantitative and statistical techniques were also incorporated for analytical purposes through an econometric model.

Limitations of the Study:

There are certain limitations while collecting data in the study area. The limitations which we faced during the survey were mainly due to the problems of measurement and problems of eliciting information which are given as follows:

- (i) There is no traditional standard measure of land, the most important productive asset of rural Arunachal Pradesh.
- (ii) Many people in the villages, especially in the remote areas are not well acquainted with the modern quantitative measurements.

For example, in the measurement of agricultural output, the volume and not the standard weights are used. Still today the common practice at the surveyed villages is the measurement of agricultural output such as paddy, millets, maize, soyabin, etc. by baskets while fruits, eatable roots, pumpkin, gourds etc. by numbers and size of the items and firewood by bundles. In case of the domesticated animal like *Mithun*, they determined the price on the size of the animal.

In the study area, the method of measurement in land-use is locally called as dibbling system where a local basket containing approximately 15 to 20 kilograms of millet can plant with a dibble to an area of around 20 *Kathas* or a *Bigha* and 22 *Kathas* are equivalent to an acre of land. On the basis of this information, land-in-use is calculated in hectare. To avoid publicity biases, local academicians and administrators were consulted and necessary rectifications were also made wherever possible.

As a result of these contextual problems, the study is restricted the use of standard metrology to estimate the variables such as production, income, consumption etc. For

example, the estimate of household income in the study area is a complex problem since the production is meant for home consumption and the level of monetisation is very low. Even after intensive survey the income data suffers from a lot of errors. This is because the respondents normally hesitated in reporting his/her income. The level of literacy is very low in the study area. It is not possible to get the reliable income data at the household level. Hence, we have no other alternative but to take a proxy variable of household level consumption value from community forest as well as total consumption expenditure of households. For consumption purpose again edibles, fuels, house building materials etc. gathered from the CPRs which are not marketed and their valuation is a problem. We have taken their imputed value in estimation of consumption. The data on quantities of different items gathered from forests are dependable but the problem is the non-existence of their village level prices. Some of these forest products are, no doubt, locally bartered, but the exchange rate in barter does not reveal the absolute prices which are necessary to arrive at the value. In these circumstances, we used the prices of these products obtaining in the nearest market.

Design Principles for Successful Collective Action:

The success or failure of any property rights structure to protect natural resources is more a feature of the ability to regulate access and use of the property than whether the property is private, commons or state property (Feeny *et al.*, 1990). Ostrom (1986; 1990) proposes eight principles for successful collection action found in studying common property management regimes. These principles include:

- (i) Clearly defined boundaries of access and use
- (ii) Relevance of rules to local resource conditions
- (iii) Collective choice arrangement for decision making
- (iv) Effective monitoring of access and uses of the CPR
- (v) Graduated sanctions for violators of rules
- (vi) Conflict resolution mechanisms
- (vii) Minimal recognition of rights to organize by external authorities and
- (viii) Nested management of larger common property systems

These principles expand the attributes of CPR management including self government at the local level of a commonly used resource in a way to exclude outsiders, and involve the recognition, monitoring and enforcing rules to use the common resource.

Ostrom’s work strongly influenced subsequent works on CPRs. Ostrom’s framework has been used in both theoretical and empirical research on the commons to extend her analysis. In fact, the level of design principles identified by her has been further extended by later scholars. Table 2.1 gives an overview of these principles.

Table: 2

Design Principles for Successful Collective Action

Wade’s Condition for Successful CPR Management (1987)	
i	Nature of the resource
ii	Costs of exclusion technology
iii	Relationship between resources and user groups
iv	Characteristics of user groups
v	Notice ability of cheating
vi	Relationship between user and State
Hanna, Folck & Maler’s Design Principles of Property Rights Regimes (1996)	
i	Definition of legitimate interests in the CPRs
ii	Articulation of rules for user participation
iii	Congruence of rights and responsibilities
iv	Incentive structure of rules reflect long run sustainability of CPRs
v	Congruence of boundaries
vi	Distribution of decision making boundaries
vii	Provisioning of monitoring, sanction and enforcement mechanism
Pinkerton and Weinstein’s Basic Criteria for Fruitful Collective Action (1995)	
i	Accountability
ii	Effectiveness
iii	Representativeness
iv	Adaptability

Source: Edwards, V. M. and N. A. Steins (1998), p.16.

Studies of CPRs in India:

Consistent with the growing theoretical issues, there are enough empirical studies with regional variations in India dealing with common property and community-based natural resource management. Campbell, J.G. (1980) in his study on the issues of forestry in Madhya Pradesh found that a large percentage of rural poor has usufruct rights on state land. Revenue lands are freely available for unlimited grazing unless claimed by the Government or Panchayat (local council) for some particular project. Traditional access rights (nistar) give unlimited grazing and minor forest collection rights to rural residents in forests classified as protected and even in the remaining forests classified as reserved. The government reserves to itself the right of cutting any of the most valuable tree and bamboo species existing on

private lands. Management of public lands almost exclusively consists in protecting the division of harvesting rights within the same lands between the government and the people. There is a high degree of ambiguity about the ownership rights on uncultivated revenue land, illegally occupied revenue land and illegally operated forest land.

Basu, N.G. (1984) in his case study on the importance of non-governmental or private voluntary organizations (NGOs, PVOs) in the successful development of community forestry in Bihar had found that some 120 villages there are inhabited mostly by tribal people, where deforestation has reduced the land still under forest to 12-15 per cent. Some villages have independently initiated schemes for protecting and developing the remaining natural forest. The catalytic role of local NGOs in stimulating further development of communal forest management is noted.

Shiva, V. (1986) in his study on CPRs management observed that the government action to privatize common land accentuates rural poverty and increases ecological instability. Only a few marginal and landless farmers will gain at the cost of the majority who derive a wealth of benefits from these lands. Singh, Ch. (1986) considered the exact legal position concerning the current rights of forest dwellers in India and ascertained what could be done for them in future legislation. Further he observed that most rural Indians depend on CPRs for their energy and housing needs; the dependency being the greatest in tribal areas. One conclusion is that the Indian Forest Lands Acts should be repealed and that new acts should be created, in order to reach a point of equal distribution and use of natural resources.

Ballabh, V. and Singh, K. (1988) in their study of institutions of forest management in Uttar Pradesh had found that Forest Councils have the authority to levy fines for misuse of forest resources and collect fees from users. They are responsible for internal management and grazing, the collection of fuelwood, fodder and for protection. Forest Council members are informally elected and produce is distributed fairly among the members of the village community. Although the authority to levy fees and fines and to punish offenders has been reduced because of rule changes, this method of forest management is considered promising.

Brokensha, D. (1988) discussed CPRs and considered a wide range of socio-economic and biophysical factors. The common lands of Karnataka include *gomal* lands, tank foreshores and "wastelands". Most common lands are degraded. He observed that CPRs cannot be examined in isolation. Without participation in decision making and management of social forestry projects there is no social forestry.

Arnold, J.E.M. and Stewart, W.C. (1989) in their study in social forestry in Tamil Nadu had observed that conflicts over the use of CPRs were handled too easily, and the complexities of changing use of the common lands and resources were over-estimated. The study has found that in the 19th century, up to two thirds of the land in India was under community control but privatization and government appropriation have reduced this share. Many traditional and indigenous forms of CPRs management have weakened or collapsed. They observed that, despite the erosion of CPRs, they still play a very important role in agricultural systems and in the livelihoods of the poor. In order to make progress towards sustainable CPRs management it will be necessary to give high priority to correcting policy, legal anomalies, and weaknesses which undermine CPRs management arrangements or which encourage further privatization.

Iyengar, S. (1989), in his case study in 25 villages located in five different geographical regions in Gujarat found that the development of infrastructure facilities, such as roads and transport networks, has opened up markets for some natural resources. While this is a healthy development, it has also resulted in far too rapid growth in the rate of exploitation of the resources. Since independence, the population, including that of rural areas, has grown at a very rapid rate. This has increased pressure on available land. The area under CPR land in villages has decreased and continues to do so because of privatization. Over-use and over-exploitation of land has also led to deterioration in its quality. As a result, the status and area of CPR land has changed considerably.

On the present status of the management of CPRs such as water, grazing lands and forests, Chopra *et al.*, (1989) in their study of participatory management of CPRs in Haryana had observed that the strategy to control the degradation of CPRs lies on

- (i) A group of people
- (ii) Adherence to certain set of rules, customs, tradition and
- (iii) Empowerment and adjustments between individual behaviour and group behaviour.

They argued that the intervention of government in the management of CPRs led to excessive overexploitation of the resource.

Jodha, N.S. (1986; 1987; 1990) analysed the extent of the dependence of various user groups on these CPRs and their management characteristics. According to him, the decline in CPR area, as well as the physical degradation and deterioration of the management

arrangements is caused by effects of public interventions, commercialization, technological change and demographic factors. The demographic factors which he mentioned are

- (i) Physical loss of the natural resource system (due to submersion of grazing land in a newly constructed dam or area of CPR covered by roads and buildings)
- (ii) Deterioration of physical productivity of resources (such as degradation of pastures and forest lands) and
- (iii) Reassignment of usage and property rights as indicated by transfer of CPR lands to private ownership.

Non-poor and poor people respond in different ways to the changing status of the CPRs. While Non-poor people tend to withdraw from CPR use and increasingly rely on alternative land use options (including CPR privatization), the poor tend to continue to rely on CPRs for sustenance; they attempt to maximize the complementary relations between CPRs and private resources. Although there are various factors constraining the present and future management and proper utilization of CPRs, there are three important reasons to improve prospects for future CPRs management: ecological imperatives to keep fragile lands under low-intensity use, the complementary nature of CPRs to private property resources, and sustenance of the rural poor who lack alternative options for resource utilization. Factors to consider in strengthening CPRs management are positive CPRs policies, increased productivity through higher investments and new technology, improved management regulations and formation of well-defined user groups. He also attempted to quantify the extent to which the rural poor benefit from CPRs, based on data from over 80 villages in 21 districts of Western dry-land states. The study reveals the significant contribution of CPRs towards the employment and income generation of the rural poor; i.e., labour and small farm households. Despite the contributions of CPRs, their area and productivity are declining in all of the regions. Large scale privatization of CPRs has taken place during the last three decades, in an effort to help the poor. He further, perceived that the privatization of CPRs as a strategy to help rural poor yielded a negative results and also reduce the productivity of the commons. The 49 per cent to 86 per cent of the privatized CPRs ended up in the hands of non-poor. Furthermore, most of the land received by the poor households was also given up by them because they did not have complementary resources with which to develop and use it. He calls for greater attention to CPRs as a part of the anti-poverty strategy. In the village

level, there is a gender dimension in CPR based activities like firewood collection (Jodha, 1985).

Chen, M. (1991) in his study of a single village of 59 poor households in Ahmedabad district of Gujarat also found that conflict over privatization of CPRs increases over time. Pasha, S. A. (1992) in his study of 14 villages in Karnataka observed that community-based use and management of CPRs with the active participation of all the rural households is an essential factor for protection of these resources. Similarly, Beck, T. (1994) in his study of three villages in West Bengal observed that conflicts over CPRs are central to poor household's experience of poverty. On the similar lines, Singh, *et al.*, (1996) in their study of eight villages in Punjab also found that the main factors for the decline of CPRs were the mismanagement and encroachment problems. Thus, the authors stressed on the need for effective people's participation in preventing over exploitation of CPRs by the better off households and in protecting the forests in particular.

Most of these literatures emphasized efficient collective action and participation in CPRs management system so as to ensure equity and sustainability of resource management at the local level.

Determinants of Consumption Expenditure from Commons: An Econometric Analysis:

An econometric model is developed to understand the relationship between forest dependency and socio-economic determinants so as to explain the diverse intricacies of the dependency of rural community on community forests (Yanggen and Reardon, 2001 also adopted the same procedures). The extent of forest dependency is measured on the basis of the CPR based collections like timber, firewood, bamboo, leaf litter, herbs and medicinal plants, vegetables, eatable roots and wild animals hunted for consumption as part of total consumption expenditure by rural households as it was done in 54th round of NSS data (1999). It was hypothesized that household level benefits from common property forest resources (CPRF) would be associated with the household and community attributes. Hence, variation in forest dependency among rural households can be explained by the socio-economic status of user household. This relationship can be represented as:

$$\sum_i^N Y_{ij} = f(CE_i, LST_i, LH_i, ED_i, HH_i, GEN_i, DM_i, CY_i)$$

Where,

Y = Total consumption expenditure of household (a proxy for income status)

- household in '000 rupee)
- CE = Household consumption value derived from commons
 (a proxy for income from community forest in '000 rupee)
- LST = Value of livestock owned by household in '000 rupee
- LH = Size of land holdings in hectare
- EDU = Average education of family members (number of school year)
- HH = Size of household i.e., number of family members in a household
- GEN = Gender i.e., male = 1, female = 0
- DM = Average distance between house and market (a dummy variable for a house 10 km. and above =1 and below 10 km.= 0)
- CY = Road connectivity between village and a constructed road (metal or non-metal) in kilometer
- 'j' = Forest products (timber, firewood, bamboo, leafy vegetables, herbs and medicinal plants, vegetables, roots and wild birds and animals etc.) and,
- 'i' = (1,2,3,.....N) observations.

Hence in log form, we can explain the above equation as in equation 1.

$$\ln \sum_{i=1}^{213} Y_{ij} = \beta_0 + \beta_1 \ln CE_i + \beta_2 \ln LST_i + \beta_3 \ln LH_i + \beta_4 \ln EDU_i + \beta_5 \ln HH_i + \beta_6 \ln GEN_i + \beta_7 \ln DM_i + \beta_8 \ln CY_i + \varepsilon_i \dots \dots \dots (1)$$

This equation is defined as double-log model and it is based on a similar model by Di Falco and Perrings (2003) used to understand the effect of cooperative production on inter-specific crop genetic diversity.

It would have been better if the household level income from community forests is taken as a dependent variable. However, the estimation of income in Arunachal economy is, on the one hand, very difficult since the production at the village level is meant mainly for home consumption. Hence, we have considered the total consumption expenditure of the household as the dependent variable. On the other hand, the level of monetization is very low. Even after intensive survey, the income data suffers from a lot of errors. This is because the respondents normally hesitate in reporting his/her income. The level of literacy is very low in the study area. It is not possible to get the reliable income data at the household level. Hence, we have no other alternative but to take a proxy variable of household level consumption value from the community forest as well as total consumption expenditure of household. For consumption purpose again various edibles, fuel, house building materials etc. gathered from the CPRs are not generally marketed and their valuation is a problem. We have

taken their imputed value in estimation of consumption. The data on quantities of different items gathered from forests are dependable but the problem is the non-existence of their village level prices. Some of these forest products are, no doubt, locally bartered but the exchange rate in barter does not reveal the absolute prices which are necessary to arrive at the value. Under these circumstances, we have to take into account of the prices of these products prevailing in the nearest local market.

The results of regression for determinants of household consumption value (Y) derived from CPRs on the above explanatory variables in the estimated equation are represented as:

$$\ln \hat{Y}_{ij} = 18.072^{*} + 0.645^{*} \ln CE_i + 0.100^{**} \ln LST_i - 0.007 \ln LH_i - 0.017 \ln EDU_i \\ + 0.062 \ln HH_i - 0.006 \ln GEN_i + 0.009 \ln DM_i - 0.032 \ln CY_i \dots \dots \dots (2)$$

3.095
10.576
1.730
-0.142
-0.321

1.140
-0.119
0.160
-0.645

$R^2 = 0.51$ $\bar{R}^2 = 0.49$ F = 26.785 N = 213

Note:

1. The figures in parentheses are t-values
2. The asterisk symbol (* and **) denote significant at 0.01 and 0.05 level.

It is evident from the analysis that in addition to constant term, some of the estimators of explanatory variables are significant with the expected sign such as ‘CE’ at 0.01 level and ‘LST’ at 0.05 level (2-tailed). The R-square and adjusted R-square (\bar{R}^2) for the estimation are as high as 51 per cent and 49 per cent respectively. The F-statistics for overall goodness of fit of the model is 26.79 which is highly significant at $\mu=0.000$. The parameters of the log transformation variables like $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7,$ and β_8 in the double log model are different elasticities of the explanatory variables which are measured in different units. The reason for transforming the equation in double-log model is to pull outlying data from a positively or negatively skewed distribution closer to the bulk of the data in a quest to have the variables be normally distributed.

From the point of interpretation, it is very often to say of which explanatory variable is most important in determining the consumption value from community forest (Y) since the values of estimators like $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7,$ and β_8 depend on the choice of units to measure the explanatory variables.

Therefore, standard interpretation of estimators in the model is that one per cent change in 'CE' results in the respective estimator say (β_1) change in the expected value of Y while all the predictors are held constant. Thus, the elasticity of 'CE' reveals the rate of forest dependency as necessity since the estimator, $\beta_1 < 1$ i.e., 0.65. In this model we find all β 's as necessity. The necessity of forest dependency arises because of

- (i) Climatic conditions and
- (ii) Non-availability of alternative fuel.

For example, when there was no change in the average value of Y (Rupees 2, 06, 595 per annum), the average value of consumption value from community forests was found to be Rs. 64, 908 per annum. Hence, the forest dependency in the study area was found to be 31.47 per cent. The low forest dependency may be because of the availability of alternative fuel as the sample villages selected are near to the urban areas. In other words, when average value of 'Y' increased by one percent, the average value of Y would increase by 0.11 per cent at 0.01 level (2-tailed) and vice versa. Thus, the study shows that the dependency on community forests has direct bearing on the total household consumption expenditure and it is highly significant at 0.01 level.

In case of the explanatory variables like 'LH and EDU', it has a negative relation with the dependent variable and is statistically insignificant. The theory would say that there is inverse relationship between the dependent variable Y with landholdings and the number of schooling years in the study area. For example, an increase in the consumption expenditure derived from forests would lead to a decrease in landholdings. And the variable 'EDU' is negatively related. This is due to the fact that higher level of schooling may have better exit options (Ostrom, 2000) due to high opportunity cost and hence, forest extraction activities may be less attractive for those households. Besides, availability of government sector jobs may well divert people from dependency on forests. A similar finding of Gunatilake (1998) observed that education of the family members was negatively related to forest income in the tropical biosphere reserves in Sri Lanka. During the survey also, it is found that the dependency in community forests are a common practice among the tribal society as their life and culture are centered on forests.

Livestock (LST) is sometimes regarded as an asset of the rural community. The average value of livestock per household in the study area is Rupees 12,192 and it is positively related and significant to the consumption value from commons at 0.05 level. This may be due to the fact that the value of livestock is likely to be uniformly distributed among

the rural households in the study area. In other words, all the sample villages are on the hilly and mountainous terrain of Himalayas hence this distribution is uniform.

The dummy variable 'DM' (distance between house and market) was positively related to consumption from community forests and it was statistically significant at 0.01 levels. This indicates that the availability of market nearer the village may divert rural communities from forest dependent activities and other gainful activities due to alternative earning opportunities. At the same time, the rural communities living far away from market may have to depend more on community forests in order to sustain their livelihoods. Gunatilake (1998) also showed similar results in the Sinharaya forest of Sri Lanka.

With regard to the CY (road connectivity), it was observed that it is negatively but significantly related with the consumption of community forests. That means the villages having more connectivity have to depend less on community forests and vice versa. Probably with more accessibility, alternative livelihood options become available for the villagers and as a result dependence on community forest reduces.

In common literature, our variable GEN (gender) was often used to test the effect of gender difference on the level of consumption in CPRs management (Grossman, 1996). Some experimental studies on the gender and cooperative behaviour indicate that women contribute more than men in managing commons due to greater interdependent utility and altruism. However, in the present study one of the aims was to see whether access to and consumption from CPRs was significantly different between male-headed and female-headed households. It was found that the consumption from CPRs was positively related but not significantly affected by gender issue. This may be due to the fact that there was a very few female-headed households in the study area.

In order to understand the diverse intricacies of the relationship between the extent of rural community's dependency on consumption of different forest products and socio-economic variables, one more regression models is generated to analyse the heterogeneity in the study area i.e., regression on consumption of firewood, consumption of timber and consumption of bamboo and other minor forest products i.e., $CE = Tim + Fir + MFR$) where, CE represents consumption expenditure from commons, Tim for timber consumption value, Fir stands for firewood consumption value and MFR for all minor forest produces value from community forests including bamboo, leafy vegetable eatable roots,, wild birds and animal hunted and insects.

It is represented as:

$$\ln \sum_{i=1}^{213} Y_{i1} = \beta_0 + (\beta_{10} \ln Tim_i + \beta_{11} \ln Fir_i + \beta_{12} \ln MFR_i) + \beta_2 \ln LST_i + \beta_3 \ln LH_i + \beta_4 \ln EDU_i + \beta_5 \ln HH_i + \beta_6 \ln GEN_i + \beta_7 \ln DM_i + \beta_8 \ln CY_i + \varepsilon_i \dots \dots \dots (3)$$

To quantify the magnitude of the effect of forest products including timber, firewood, bamboo, leafy vegetables, eatable roots, wild birds and animal hunted and insects and on other explanatory variables, the results are represented in estimated equation form as:

$$\begin{aligned} \hat{\ln Y}_{i1} = & 18.611 * + (0.604 * \ln Tim_i + 0.152 *** \ln Fir_i + 0.027 \ln MFR_i) \\ & (3.156) \quad (10.054) \quad (2.597) \quad (0.476) \\ & + 0.75 \ln LST_i - 0.002 \ln LH_i - 0.019 \ln EDU_i + 0.000 \ln Gen_i \\ & (1.254) \quad (-0.044) \quad (-0.355) \quad (0.987) \\ & - 0.004 \ln DM_i - 0.025 \ln CY_i \dots \dots \dots (4) \\ & (- 0.073) \quad (- 0.496) \\ & R^2 = 0.51 \quad \bar{R}^2 = 0.49 \quad F = 21.045 \quad N = 213 \end{aligned}$$

Note:

1. The figures in parentheses are t-values
2. The asterisk symbols (* and ***) denote significant at 0.01 and 0.10 level.

The estimated equation shows that important explanatory variables have the expected signs and some of the variables are statistically significant at different levels. However, Timber and firewood consumption from community forest are significant at 0.01 and 0.10 level Therefore, Timber and firewood contribute significantly to total household consumption expenditure from forests irrespective of poor and non-poor households. In other words, when average value of ‘Y’ increased by say 10 per cent, i.e., around rupees 31.74, the average value of timber is increased by Rs.6.48 and firewood consumption by 3.39 per cent at 0.01 and 0.10 levels respectively and vice versa. Though the average consumption of minor forest products also positive relation but insignificant to total consumption expenditure of the household.

In this equation we find that the constant term is statistically significant at 0.01 level. The consumption expenditure derived from commons as per the questionnaire gave emphasis on all items of forest products viz., timber, firewood, minor forest produces like leafy vegetable, eatable roots, wild birds and animals and other medicinal plants. And we find that timber is the highest contributor to the consumption expenditure derived from commons followed by firewood in the surveyed villages of Papum Pare district of Arunachal Pradesh. Due to speedy urbanization in Papum Pare district and nearby areas, it seems the demand for these products is increased.

Hence, as stated above in an attempt is made to see the degree of forest dependency between poor ($\sum_{i=1}^{146} Y_{ijp}$) and non-poor ($\sum_{i=1}^{67} Y_{ijn}$) households. In fact the average household consumption expenditure of poor and non-poor in the surveyed villages are Rs. 2, 06, 595 and Rs. 5, 58, 861 respectively. The average income derived from community forest for poor and non-poor households stood at Rs. 64, 908 and Rs. 2, 18, 470. Hence, the extraction level between poor and non-poor households is to the ratio of 1:7 i.e., one unit of share of forest dependency of poor is equal to seven unit share of non-poor households in the study area. In order to have a clear understanding we represent equation (5) representing the poor households and equation (6) the non-poor households as follows:

$$\hat{InY}_{ijp} = 12.119 * + 0.720 * InCE_i + 0.068 InLST_i - 0.118 InLH_i + 0.059 InEDU_i$$

(3.141) (12.250) (1.166) (-2.070) (1.018)

$$+ 0.013 InHH_i + 0.041 InGEN_i + 0.122 *** InDM_i - 0.067 InCY_i \dots \dots \dots (5)$$

(0.228) (0.758) (2.201) (-1.232)

$R^2 = 0.61$ $\bar{R}^2 = 0.58$ $F = 26.344$ $N = 146$

And,

$$\hat{InY}_{ijn} = 44.058 * + 0.115 * InCE_i + 0.172 InLST_i + 0.31 InLH_i - 0.147 InEDU_i$$

(3.817) (2.749) (1.284) (0.251) (-1.147)

$$+ 0.006 InHH_i - 0.005 InGEN_i - 0.002 InDM_i + 0.158 InCY_i \dots \dots \dots (6)$$

(0.050) (-0.046) (-0.015) (1.317)

$R^2 = 0.31$ $\bar{R}^2 = 0.22$ $F = 3.295$ $N = 67$

Note:

1. The figures in parentheses are t-values
2. The asterisk symbols (*) denote significant at 0.01 level.

The study clearly shows that the poor households are found to be benefiting more from community forests than non-poor households i.e., dependency on community forests of poor is more than the non-poor households of the surveyed villages as a survival technique for their sustainable livelihood strategy. In addition to this, it can be derived that the poor households' dependency on community forests is an age old traditions and customs of the tribal people in the study area. The estimator of 'CE' of the poor households was found to be 0.72 and for the non-poor households it was 0.40 and both are statistically significant at 0.01 level (2-tail). Some interesting facts in these two equations are

- (i) Size of landholdings for poor is negatively related with the dependent variable while it has a positive relation for non-poor households.

- (ii) Numbers of schooling year for poor is positively related with the dependent variable while it has a negative relation for non-poor households. So, the higher level of schooling of non-poor households may have some better exit options.
- (iii) In case of Gender as variable, we find that it is positively related with the dependent variable for the poor while it has a negative relation for non-poor households. It happens because of the reason that female headed households are there among the non-poor households.
- (iv) Distance from market (DM) has a direct bearings for the poor but it does not matter for the non-poor and
- (v) Connectivity plays a role in maintaining the eco system and environment. In our study it is negatively related for the poor while it is positively related for the non-poor but they are not statistically insignificant.

This dependency if we look at different forest products, the poor stakeholders had the estimators of timber; firewood and MFR as 0.5, 0.4 and 0.8. However, for the non-poor households the estimators are 0.7 (timber), 0.6 (firewood) and 0.04 (MFR) respectively. In other words, the non-poor household has higher dependency on timber and firewood consumption than the poor households. Further, if we see at different minor forest products, it was found that the poor households consumed more of bamboo, leafy vegetables, eatable roots and leaves (the estimator is 0.8) but the non-poor households had lower consumption of the MFP (the estimator is 0.04). Therefore, socio-economic heterogeneity in rural community determines the different level of consumption from the community forests. At the same time, heterogeneity in the extraction of forest products between poor and non-poor households was also observed in the study area since these resources were very significant source of rural livelihood to the tribal people who reside in the ecologically fragile and economically poor State.

Conclusion and Policy Implications:

In need of social and institutional arrangements, the role of heterogeneity in commons management has tended to diverge in two schools of thought. The first pioneered by Olson (1965), and subsequently formalized in the theory of public goods, holds that inequality favours collective action. The second school of thought that is closely associated with field study literature insists that heterogeneity hampers collective action. For example, “Olson

effects” demonstrated that considerable degree of inequality may favour provision of collective goods and suggested that inequality is beneficial to successful commons management. Bardhan and Dayton-Johnson (2000) in their case studies found that economic and social heterogeneity is consistently and significantly associated with lower levels of infrastructure management and a U-shaped relationship between inequality and commons management. Broadly, the taxonomy of socio-economic heterogeneity on which different scholars referred to the commons management are different types of heterogeneity like economic heterogeneity, cultural heterogeneity, ethnic heterogeneity and location heterogeneity etc. Economic heterogeneity which fundamentally refers to asymmetric distribution of wealth or income among the members of the resource-using groups; inequalities in the sacrifices of the community members make in cooperating with commons management; inequalities in the benefits they derived from such resources; and inequalities in outside earning opportunities is likely closely correlated with other form of heterogeneity. Despite the differences in the interpretation of relevant types of heterogeneity there is a consensus that heterogeneity is a factor in community-based resource management but there is no clear answer as to how and to what extent heterogeneity explains the dependency on CPRs. In this chapter, an attempt is made to explain in the context of Arunachal Pradesh where majority of the people in rural areas depend on community forests.

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ⁱ Household schedule covers all information regarding physical assets owned, financial assets, human capital, social capital, natural capital of the household. And Village schedule consists of all village information regarding the village history, the role of village institutions and institutional framework of resource management of CPRs in the village.