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Factors Influencing Peripheral Villager Dependency on Forest Resources Use in the Knuckles Forest Range

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ABSTRACT

Dependency on forest resources by Peripheral communities may create problems in managing a protected forest, particularly, when the current resource utilization cause damages to the forest ecosystem. Identifying the socio economic factors influencing the dependency is one of the initial steps needed in developing a comprehensive management plan for a protected forest. This paper attempts to identify the socio economic factors influencing the forest dependency of the peripheral communities in the Knuckles Forest Range. Data were collected from eighty households living in the periphery of the forest using a structured questionnaire. Stratified random sampling procedure was adopted to select the 80 households. Two forest dependency models for total and subsistant forest dependency were developed incorporating eleven socio economic variables.

Results show that involvement in non-agricultural activities and higher productivity of paddy reduces forest dependency of the villagers. Those who are involved in cardamum production, chena cultivation and those who rear buffaloes are more dependant on forest resources. When both subsistent and commercial forest based activities are put together, higher income groups show greater dependency on forest resources. Education shows a negative impact on forest dependency when subsistence activities are only taken into account. In overall, the development process will reduce the subsistence forest dependency over time. Better education facilities, creating more non-agricultural employment opportunities for the peripheral communities and implementing programmes to upgrade agricultural productivity can be recommended as measures to reduce dependency on forest resources in Knuckles area. These measures, however, may not reduce the commercial forest dependency.

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Introduction

Severe deforestation and degradation of natural forests have afflicted Sri Lanka for decades. At the beginning of the century, around 70 percent of the land area was covered with natural forests. Close canopy natural forest cover has been reduced to about 20.3% of the land area today (Legg and Jewell, 1993). Distribution of different forest types shows that a large percentage of the remaining natural forests is of dryzone forest types. Some of the ecologically more important forest types such as wetzone and montane forests are confined to only small patches. Despite various efforts to arrest it, the deforestation in the country continues at an alarming (Legg and Jewell 1993).

Conservation of the wet-zone and montane forests in Sri Lanka is of utmost importance under the present circumstances. The Sinharaja, the Knuckles, and the Peak Wilderness are the most important protected forests in the country. In general, management of protected forests may become a difficult task when peripheral villagers depend heavily on forest resources (McNeely, 1988). This paper focuses on an issue related to interaction of the peripheral villagers with the Knuckles Forest Range. The forest range lies in Kandy and Matale district as a distinct morphological part of the central highlands. These forests provide great environmental services as an important catchment area and a climatic moderator for the region. It is also an important preserver of genetic resources as it houses a large number of endemic floral and faunal species (Balasubramanium, 1988, NARESA, 1991).

The government declared the Knuckles Forest Range as a national wilderness area in 1986. The forest Department is in the process of developing the management plan for Knuckles area in collaboration with the International Union for Conservation of Nature and Natural Resources (IUCN). There are about 1052 people in three villages within the protected area. Another 5585 families in 39 villages are located within a one mile range from the forest.

As usual, these villagers have been maintaining close links with the forest for a long time. Cardamum production, chena cultivation and collection of non-timber forest products (NTFP) are the major resource utilization patterns in this area. Grazing and tapping of Kitul trees also partly utilize resources from the forest (Gunatilake et. al, 1993, Gunatilake, 1994). Among the existing forest interactions, chena cultivation and cardamum production have been identified as hazardous land use practices to the forest ecosystem. Utilization of non-timber forest products may or may not threaten forest ecosystem depending on the rates of extraction and natural

regeneration.

The Problem and Objectives

A vast amount of information, such as the ecological status of the forest, socio-economic aspects of the peripheral communities and their interactions with the forest is required to develop a comprehensive forest management plan. Much of this information with respect to Knuckles, particularly socio economic information, is yet to be generated. Among the already conducted socio-economic research work, Abeygunawardena and Vincent (1993) provide an overall review of the costs and benefits of conserving the Knuckles area. Gunatilake et.al (1993) have studied the role of non-timber forest products in the rural economy. In this study they have identified 48 plant species that are utilized by surrounding villagers.

In another study, Gunatilake (1994) has studied the impact of the proposed conservation programme on the rural economy. He has shown in this study that peripheral communities are heavily dependant up-on forest resources as complete restriction of forest resources, on average, reduces the family income by about 58.3%. Further, he discusses the difficulty involved in receiving co-operation of peripheral communities in the face of heavy losses, without which a conservation programme can hardly achieve its objectives as previously experienced in many other cases (McConnel 1988).

A comprehensive, long term management plan of a protected forest should include programmes to reduce peripheral villager forest dependency over time when the current use causes damage to forest ecosystem. Forest dependency vary across the households around a forest. Some families may depend more on forest resources depending on their socio economic characteristics. Identification of factors influencing forest dependency will essentially be an initial step in formulating such policies and programmes. Such an analysis would also provide the basis to identify the target groups for whom the economic incentives and other programmes are meant. Following these, the objective of this study is to identify socio economic factors influencing forest dependency of peripheral villagers of the Knuckles forest range.

Hypothesis

Theory and empirical evidence on socio-economic factors influencing dependency on forest resources has drawn little attention in social science literature in the past. Therefore, there is limited prior knowledge that has been accumulated on this subject. In modelling social and economic factors influencing forest dependency, therefore, one has to depend on the basic theoretical framework of economics and other social sciences. In the following section, variables

used to model forest dependency and the related hypothesis are briefly discussed.

Education : In general, education opens up better employment opportunities which deviate people from the subsistence agricultural and gathering activities. The higher social status of the educated, government or private sector employees may preclude them from getting involved in forest dependant activities. They may not want to spend their free time in forest-based gathering and other activities because their opportunity cost of time is high. Therefore, it was hypothesized that the education level of the family is negatively related to the forest dependency.

Household Income: As the household income level increases, people diversify their economic activities and generally deviate from subsistent economic activities such as shifting cultivation and gathering NTFP. This behavior is explained by the rationale of time allocation between work and leisure. High income groups may want to get away from labor incentive forest-based activities to allocate more time for leisure. Therefore, it is hypothesized that forest dependency is negatively related to the household income level.

Debt Level: In rural villages, those who are economically marginalized are generally indebted and are forced to utilize forest resources heavily. Resource endowments of such marginalized groups may also be poor. It is therefore hypothesized that the debt level of peripheral villagers is positively related to the forest dependency.

Resource Endowments Within the Village: Those who have better resource endowments within the village may depend less on forest resources. This relationship could be particularly true if the peripheral communities are mainly engaged in subsistence economic activities. This also can be partly attributed to the time allocation between forest-based and village-based activities. Land, the most important resource in a rural village, can be used to measure the resource endowment within the village. The total operated land extent within the village was assumed to be negatively related to forest dependency.

Labor Availability: Forest dependent activities in general, are labor intensive. Cardamum production may be an exception to this as it requires less labor compared to other forest based activities. Therefore, families with more members can mobilize more labor for forest-dependant activities. Hence, it is assumed that the number of persons in the work force of the family is positively related to the forest dependency.

Distance to the Forest: Those who are living close to the forest have the advantage of less time requirement to reach a particular forest resource.

Their links with forests are expected to be high. Therefore, it was hypothesized that the distance to the forest is negatively related to forest dependency.

Non-agricultural Activities: The seasonal nature of agricultural activities release labor during the off-season for the forest-dependant activities whereas the non-agricultural activities occupy people throughout the year. On the other hand agriculture, specially subsistence agriculture, may not provide sufficient income or material for the family forcing them towards forest dependant activities. Therefore, it is hypothesized that those who are involved in non-agricultural activities are less dependant on forest resources.

Forest-based Activities : In general, those who are involved in cardamum production and chena cultivation and those who own buffaloes should evince greater dependency compared to others. Therefore, it is assumed that those who are involved in such activities are more dependant on forest resources.

Male Female Ratio: In traditional labor division, males are supposed to do heavy work and females are allocated household work and some identified light work in agriculture. Forest dependant activities could be heavy and associated with high risks. Therefore, it was assumed that males are more involved in forest dependent activities and those families having more males in the work force depend more on forest resources. However, there can be many exceptions to this assumption. Fuelwood collection, collection of mushrooms and green leaves, hunting of some small animals, for example, are done by females. Therefore, the positive relationship of forest dependency with the number of males may always not be true. It depends on the composition of the activities found in the locality.

Productivity of Village-based Agricultural Systems: In the evolution of agricultural systems people shifted from forest based activities to more sedentary village based activities (Ruthenberg, 1980). When village based activities are inadequate to maintain the livelihood system, in general, people do not give up their links with the forest i.e, they are dependant on the forest resources. If the village based agricultural systems are adequately productive, people depend less on forest resources. Therefore it was hypothesized that forest dependency is negatively related to the productivity of the main agricultural systems in the village.

Data Sources and Methods

Data required for this study were collected using a structured questionnaire. Four villages namely Narangamuwa, Meemure, Kiwlewa-diya and Kalugala, were selected for

the study based on the information collected in a rapid appraisal conducted prior to the study. The total sample of 80 households were equally divided among the villages and a random sample of 20 households was interviewed using the structured questionnaire. Field data collection was carried out during the months of October and November, 1992. Some of the selected families from the same sample were revisited to clarify some issues in July 1993. Out of the total 80 questionnaires filled two were discarded due to inconsistencies found in the answers and the final analysis was conducted only in respect of 78 households.

Forest dependency was measured in terms of the income earned from forest-based activities. Cardamum and produces from chena cultivation were valued using farm gate prices. In valuing NTFP forestgate prices were used as the base. When forestgate prices are not available, price at the nearest marketing centre were used after deducting the transport cost. The most common means of transport is carrying loads in one's head while carts and cattle were used in certain occasions. The cost of the former method was estimated using the opportunity cost of labor. When no market exists for NTFP, the opportunity cost approach or the willingness to pay approach were used to value NTFP (See Gunatilake et.al 1993 for details).

In measuring education, the number of members in a family who have passed GCE ordinary level was used as the variable. Income level, resource endowment (extent of operated land in the village), debt level, and distance to the forest were directly borrowed from the questionnaire. The male to female ratio was used to study the impact of the gender difference on the forest dependency. The extent of Chena cultivated in the last season, extent of cardamum and the number of buffaloes owned by the family were incorporated into the model. The most important village based agricultural activity, i.e, paddy cultivation, was selected to study the impact of agricultural productivity on forest dependency. Productivity of paddy during the last Maha season was used to measure this variable. Involvement in non-agricultural activities was measured as a dummy variable. Those families earn more than 80% of the total income from non-agricultural activities were assigned one and the others were assigned zeros.

Since there is limited prior knowledge about the relationships, scatter plots were used for preliminary scrutinizing of the independent variables. Then the multicollinearity was checked using the covariance matrix. It was found that the total land area operated (within the village) and the total labor force are highly correlated with the total income. Also, total operated land area and the number of people in

the work force do not show a significant relationship to forest dependency. Therefore, these variables were dropped from the model. The final model that was fitted for ten independent variables was free from the multicollinearity problem. The Goldfeld Quandt test was performed to check the heteroscadasticity problem and it was found to be non significant at 0.05 level.

Two models were fitted using two different dependant variables for the same data. In the first model the total income from forest-based activities, including cardamum, was used as the dependant variable. In the second model total income from forest-based activities excluding cardamum was used. The reason to fit these two models is that the two models distinguished the subsistence forest dependency and the subsistence plus commercial forest dependency (total dependency). This distinction was made because cardamum cultivation is not a traditional subsistence forest-dependent activity compared to shifting cultivation, grazing and extraction of NTFP. Cardamum contributes mainly to the cash income while other forest-based activities provide mainly other subsistent needs (Gunatilake et.al, 1993, Gunatilake 1994).

Results and Discussion

The following table presents the basic features of the two models fitted. Model one uses the total income from the forest-based activities as the dependant variable, thus representing the existing total dependency on forest resources. The dependant variable in Model two is the subsistence income from forest-based activities representing the subsistent dependency on forest resources. According to the characteristics of the Models presented in Table 1 both models are reliable and free from common problems of regression analysis and results are suitable to be used for policy formulations.

Table 2 provides the results of the regression model 1. According to the results, forest dependency is negatively related to the distance from the forest. This is a quite expected result and could be used in identifying the target groups to implement conservation related rural development activities in peripheral communities. As hypothesized, the three variables related to forest dependant activities viz. the extent of chena and cardamum, and number of buffaloes show positive relationship to forest dependency. One can expect this result since Chena and cardamum cultivation are dominant activities found in the study area which lead to forest dependency. However, the results show that grazing buffaloes in the forest is also an important activity which causes the dependency of villagers on the forest.

Table 1: Basic features of two forest dependency models

	Model 1	Model 2
R^2	0.91	0.64
Adjusted R^2	0.89	0.59
F value	66.79(0.0001)	13.21(0.0001)*

* value given within brackets are the pro > F values.

Table 2: Results of Forest Dependency Model 1

Variable	DF	Coefficient	T value	Prob > [T]
Intercept	1	4594.07	1.22	0.226
Distance	1	-6143.13	-4.77	0.000**
Debt	1	-0.05	2.09	0.041*
No. of Buffaloes	1	1360.95	2.44	0.017*
M/F ratio	1	-666.95	-0.63	0.533
Non-agcic act.	1	-6549.17	-3.09	0.003**
Paddy productivity	1	-124.33	-2.31	0.024**
Education	1	-481.31	-0.70	0.485
Extent of chena	1	4725.46	4.15	0.000**
Extent of Cardamum	1	3231.43	6.88	0.000**
Total income	1	0.39	9.46	0.000**

As hypothesized, indebtness should have a positive relationship with the forest dependency. Contrary to the theoretical expectations, indebtness shows a statistically significant positive relation with forest dependency. This suggests that instead of poor and marginalized families, well to do families are more dependant upon forest resources. This could be due to the impact of producing cardamum which is a high income earning commercial activity. It seems that the impact of cardamum overshadows the other effects. This is more evident when one looks at the relationship between total income and forest dependency. Total income, as shown by the results, is positively related to forest dependency and the level of significance is also very high. Thus, results suggest that when one looks at the present level of dependency which is a combination of commercial dependency and subsistent dependency, high income groups are more dependant on forest resource than the low income groups.

Productivity of paddy lands shows a negative relationship as expected. Those who are able to get higher yields from paddy depend less on forest resources. Similarly those who are involved in non-agricultural activities depend less on forest resources. Education shows a negative relationship with forest dependency though it is not statistically significant. Higher productivity of agriculture, more involvements in non-agricultural activities are signs of the development process. Thus the results suggest that the overall development of the peripheral communities will make people less depend upon forest resources.

The purpose of fitting the second model, as mentioned earlier, is to remove the impact of cardamum leaving subsistence forest-based activities. Extent of cardamum was also not included as a independent variable in the second model. Results of this model are presented in Table 3. In the second model, relation of distance, the extent of chena and number of buffaloes remain unchanged. Indebtness shows a positive relationship which, however, cannot be established statistically. Impacts of non-agricultural activities and the productivity of paddy on the forest dependency also have not shown changes in the second model.

One of the important differences observed in the second model is the impact of education on forest dependency. When both commercial and subsistence forest based activities are put together the negative impact of education on forest dependency is statistically not significant. In the second model, education shows a statistically significant negative effect on forest dependency. Thus, it is clear that when villagers have better education they get away from the forest-based subsistence activities. Also, although statistically not supported, total income does not show a positive relationship as far as subsistent forest dependency is concerned. Thus, the second model further confirms, thorough the impact of education, that overall development of the peripheral villages will eventually make villagers less dependant upon forest resource, especially for their subsistent needs.

In developing management strategies for a protected forest, one of the objectives should be to find ways and means of reducing forest dependency over time. One could argue that reduction of forest dependency may be not necessary if the current resource utilization is sustainable. In knuckles for that matter, there is evidence to suggest that the current forest resource utilization is not sustainable. Even if the present resource utilization patterns are sustainable, population growth in these villages would, most likely, increase the pressure on forest resources. Therefore, reduction of the dependency on forest resources should be given due consideration by

Table 3: Results of Forest Dependency Model 2

Variable	DF	Coefficient	T value	Prob > [T]
Intercept	1	4736.81	2.25	0.028
Distance	1	-1313.12	-1.93	0.058*
Debt	1	0.04	0.36	0.722
No. of buffaloes	1	2034.88	6.73	0.000**
M/F ratio	1	66.03	0.11	0.912
Non-agcic act.	1	-2067.50	-1.76	0.082*
Paddy productivity	1	-143.48	-2.45	0.012**
Education	1	-733.03	-1.91	0.061*
Chena extent	1	3504.13	5.65	0.000**
Total income	1	-0.003	0.21	0.834

the management plans of protected forests.

The results suggest that overall development of the peripheral villages will reduce forest dependency over time. Nevertheless, as has happened in the Knuckles area, the pattern of development may cause secondary level of dependency if the development process opens up higher income opportunities through forest-based activities. In Knuckles area higher income groups have achieved their present status mainly through cardamum production. That is why the income level of households is positively related when one study forest dependency pooling commercial and subsistence dependency together. Development of commercially oriented forest dependency in a protected area, could create serious problems in implementing conservation programmes when the related activity is not a sustainable resource utilization system such as cardamum production.

Conclusion and Policy Implications

Findings of this study suggest that there could be two different types of forest dependency, namely, subsistence and commercial. Commercial forest dependency could develop if the high income earning activities are forest-based. Such a type of forest dependency could create problems in managing a protected forest, specially, when the activity is hazardous to the forest ecosystem. As observed in this study the same variable can have different effects on forest dependency as far as subsistence and commercial forest dependency are concerned. Therefore, in identifying the factors influencing forest dependency, it may be necessary to analyze commercial and subsistent forest dependency separately.

According to the results of the study, people living close to the forest depend more on forest resources. Therefore, the distance

from the households to the forest can be used to identify the target groups within the peripheral villagers. Grazing buffaloes, although not prominent like cardamum production and Chena cultivations, is also an important activity that cause forest dependency. Overall results suggest that the development of the peripheral villages would reduce the forest dependency over time.

As shown by the results more specifically, higher level of education, involvement in non-agricultural activities and higher productivity of village based agricultural systems cause people to reduce their dependency on forest resources. Therefore, the management plan of the Knuckles area can incorporate better education facilities for the villagers, agricultural development programmes to upgrade productivity and possibilities for more non-agricultural activities as measures to reduce forest dependency over time. However, it must be noted here that the commercially oriented lucrative forest-based activities may not necessarily be reduced by these activities and thus be handled separately with different measures.

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