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Farming Systems and Utilization of Environmental Resources in Rural Communities in the Dry Zone of Sri Lanka Case Study in *"Ritigala"*, Anuradhapura District

R. D. C. Rupasinghe, G. A. S. Ginigaddara[1] and Y. M. Wickramasinghe

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ABSTRACT

Majority of the world poor is living in rural areas and agriculture is the main source of their income and employment. Rural people utilize environmental resources as consumption goods, input goods, output goods and storage and durable goods. According to Cavendish and Campbell (2007), environmental resources are the resources that are freely provided by the natural processes. Farming systems found in the dry zone of Sri Lanka, which utilize natural resources, have been evolved over years. Due to the paucity of studies published on the relationship between the extraction of environmental resources and the farming systems in Sri Lanka, this study attempts to generate empirical information to fill up the prevailing information gap. A field survey was conducted with a multiple stage sampling (120 interviewers) in three surrounding villages situated in the periphery of "Ritigala" Strict Natural Reserve (SNR), Anuradhapura district. Descriptive analytical methods were used to analyze the data. Three farming systems were identified through the study and the community utilizes a vast number of environmental resources, which belongs to consumption goods, input goods, output goods and storage and durable goods. From the study, it can be concluded that the value and the quantity of environmental resources used has an association with the complexity of the farming system and the geographical location of the village. Value of consumption goods, input goods and durable and storage goods utilized is higher when the farming system is complex. Contribution of environmental goods to annual household income shows a positive relationship with the complexity of farming system. Value of environmental resource used in paddy -vegetable-livestock framing systems recorded the highest value.

Keywords: *Environmental Resources, Farming system, Rural community, Dry zone*

INTRODUCTION

According to the World Bank (undated), 70 percent of the world's poor live in rural areas and agriculture is the main source of their income and employment. Farming system is a way of decision making in utilizing farmer's resource according to the requirements of the farm household. It consists of several interrelated enterprises like cropping system, dairying, piggery, poultry, fishery, bee keeping and etc (Panda, 2013; Chatergee *et al.,* 1993).

The average household income of the rural people is comparatively low due to lack of access to non-farm income, low productivity and risk associated with agricultural production and marketing. In addition, various social, economic, institutional and environmental factors have contributed to this situation. As a result, they are compelled to depend on environmental resources found in their living environment for their survival. Forests, grazing lands and village tanks are the common property resources that are often used by rural communities in extracting environmental resource (Gupta *et al.,* 2004).

[1.] Department of Agricultural Systems, Faculty of Agriculture, Rajarata University of Sri Lanka, Puliyankulama, Anuradhapura. *sanjeewanieg@gmail.com*

State forests and village forest patches are more intensively used for grazing and fuel wood collection (Blokuhus *et al.,* 2002) and for the extract on of an array of non-timber forest products (NTFPs). Village provide water for consumption and irrigation and are rich with a number of other resources such as fish, sedges, edible plants and flowers etc (Perera *et al.,* 2005; Somasiri 2001; Nawarathne, 1999).

Exploitation of natural resources is an essential for human existence. Without a continuous use of natural resources, neither our economy nor our society could function. Dueto population growth and increasing worldwide demand for natural resources, pressure on renewable resources has been increased over time, recently serious environmental losses due to over-harvesting of renewable resources (Cronin, 2009). Previous researchers have explained as to how, overuse of course create environmental degradation and it is effect on the poor population (Liberty *et al.,* 2013; Scherer, 2000).

Therefore, assuring sustainable utilization of environmental resources has become a national concern. Simultaneously, it is evident that the amount of research efforts devoted to promote efficient and effective utilization of environmental resources in Sri Lanka seems inadequate. Valid, reliable and appropriate empirical evidence must be available to design a mechanism to utilize (extract and utilize) environmental recourses in a sustainable manner. Despite the usefulness of such empirical evidences, those are scantily unavailable. Therefore, this study attempts to identify the relationship between farming systems adopted and the utilization of environmental resources by the rural community in "*Ritigala*" area, Anuradhapura district in Sri Lanka.

MATERIAL AND METHODS

Study Area and Sampling

Anuradhapura district was purposely selected because it is one of the major districts situated in the dry zone where agriculture is the main livelihood activity of the majority (80%) of the households. *"Ritigala" was* considered as there is a strict natural forest reserve of 1,528 ha surrounded by sixteenvillages and most of the villagers in*"Ritigala"* area are farmers who utilize environmental resources for their survival.

Multiple stage sampling technique was used in sampling. During the first stage three villages were selected based on the farming systems prevailed and random samples of 40 farmers were selected from each village during the second step (Figure 01).

Data and Data Analysis

This study depends heavily on primary data collected through a field survey. As data collected were qualitative in nature, both open-ended and close-ended questions were included in the questionnaire and responses of open-ended questions were analyzed qualitatively, as suggested by Hancock *et al.,* in 2007. Close-ended questions were structured giving a set of answers and requested the respondent to choose the correct answer because such questions are efficient where the possible alternative replies are known (Anon, 2012). Accuracy, validity and reliability of information depend on behavior and attitude of the interviewers and thus, during the survey, special care was taken to minimized data errors.

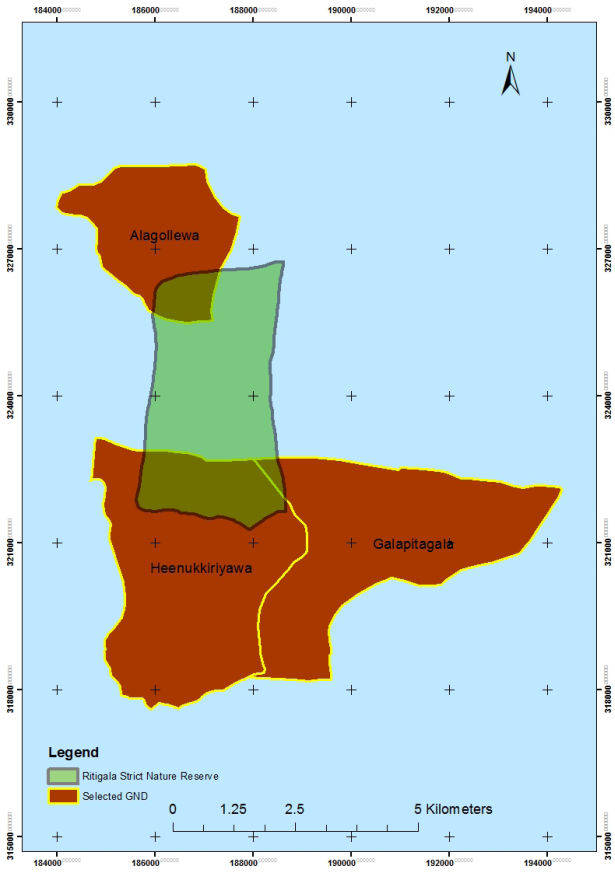


Figure 01: Map of the research area

RESULT AND DISCUSSION

Farming systems of the study area

"Hinukkiriyawa", "Alagollewa", and *"Galapitagala"* were the three villages included in the study. Paddy cultivation in low lands during '*Maha*[1]*'*season and vegetable cultivation in upland during *'Yala*[2]*'* season is the farming system found in *'Hinukkiriyawa.* This village is located in the close proximity of "*Ganewalpola*[3]*"*township as well as by the side of *'Habarana'-'Maradankadawala'* highway. A considerable number of residents of this village is engaged in full-time off farm work. As a result, they have paid lower attention to agriculture, especially to vegetable cultivation during "*Yala*" season.

'Alagollawa' is a village located far away from both '*Ganewalpola'* town center and the highway. The geographical location of the village has restricted villagers' access to off-farm work. This situation has compelled them to pay more attention to agriculture. Paddy is grown in low lands during *'Maha'* season and vegetables are grown in uplands and *'Chena*[4]*'* during *'Yala'* season. Livestock rearing was also found in this village. As a result, the farming system found in *'Alagollawa'* is more intensive than that found in *'Hinukkiriyawa'.*

"Galapitagala' is an interior village situated closer to *'Ritigala'* Strict Natural Reserve (SNR) where intensive agriculture is adopted. Villagers cultivate paddy in low lands in both seasons and vegetables in uplands. They also rare farm animals (Table 01).

1. *Maha* in the major cultivation season of the study area. It commences with the North –East monsoonal rains
2. *Yala* is the minor cultivation season which commences with the South –west monsoonal rains.
3. A small town center located in the studying area
4. An area of virgin or secondary forest cleared and cultivated for only a few years and then abandoned

Table 01: Components of farming system of the study area

Village	Crop				Live stock
	Maha		Yala		
	Low land	Up land	Low land	Up land	
Hinukkiriyawa	Paddy	Vegetable	Fallow	Vegetable	No
Alagollawa	Paddy	Vegetable	Fallow	Vegetable	Yes
Galapitagala	Paddy	Vegetable	Paddy	Vegetable	Yes

Source: Field survey, (2014)

According to Panabokke *et al.,* (2001), the "*Gangoda"*(home garden) "*Chena*" (shifting cultivation) and "*Welyaya"*(lowland paddy tract) are the components of a typical dry zone farming system that sustained the livelihood of peasantry. According to Vithanage *et al.,* (2013), there is an interaction between cattle/buffalo (livestock) farming and crop farming in the dry zone of Sri Lanka. Animals are sent for free grazing in forests, fallowed paddy fields, road/ stream/tank sides or on uncultivated uplands (Vithanage *et al.,* 2013).Results revealed that, type of the farming system adopted is based on the geographical location, access to town centers, access to transport facilities and availability of off-farm employments

Environmental resources utilized

Environmental resources are the resources that are freely provided by the natural processes (Cavendish and Campbell, 2007). Rural farming communities are vulnerable to changes in markets as well as in natural environment due to low level of education, low level of skills, unfavorable attitudes, backwardness, lack of voice or voice lessness, social and economic discrimination, and under developed / inadequate social as well as economic infrastructure. As a result, their income is low and is subjected to frequent fluctuations. Owing to that, rural poverty has become a common phenomenon in rural communities. Under these circumstances, rural people are compelled to supplement their household income with environmental resources. Environmental resources which are used by people in study area can be categorized as consumption goods, input goods, output goods and durable and stock goods. Consumption goods which are utilized by villagers around are basically in different types namely wild fruits, leafy vegetables, fire wood, lotus flower, lime, curry leaves (*Murrayakoenigii*), medicinal herbs, mushrooms, bee honey, water chest nut ("*kekeatiya"),* wild meat, fresh water fish collected for household consumption, wood collected for handles of farm tools. Input goods are namely fire wood used in brick making, clay used in brick making, fodder used as animal feed, poles/ sticks used in constructing huts/ sheds, fences and sticks to support climbing crops, leaf litter used as an organic matter and cajans used as a roofing material. Villagers are using fire wood, lotus seeds, lime, curry leaves (*Murrayakoenigii*), medicinal herbs, bee honey, tamarind and cajans collected for sale are used as output goods while sand, metal, timber used for construction and wooden furniture are used as durable and stock goods. This information explains that, the category to which an environmental resource belonged depends on the quantity extracted and purpose of extraction. If a resource was extracted for household consumption it was considered as consumption good. When a resource was used as an input in producing another good/ service, it was known as an input good. Output goods are the ones that are used for commercial purposes. Goods used in producing durable items were called durable and storage goods. According to above description a single resource could function as different goods depending on the way it was utilized.

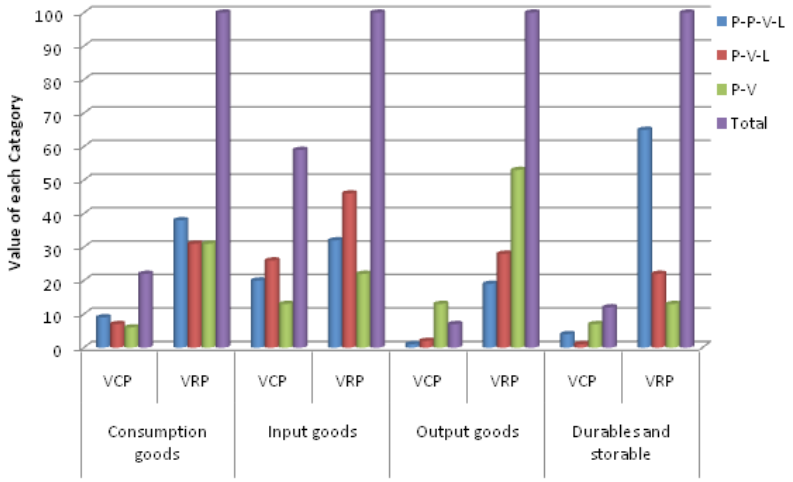
Results revealed that, fire wood used in brick making; clay mined for brick making; poles used in constructing huts, fences and sticks used to support climbing crops and forage used in feeding animals were the frequently used environmental resource.

Relationship between farming systems and environmental resource usage

It was founded that consumption, inputs, outputs and durable and storage goods consumed has accounted for 21,07,62 and 08 percent respectively. So in general output goods (items collected for commercial purposes) and consumption goods are the most demanded categories of environmental goods.

Pattern of different environmental goods consumed by the people who have adopted different farming systems reveals the link between farming systems and recourse use. Allocation of consumption, inputs, outputs and durables and storable goods was analyzed and results indicated that proportion of consumption and durable goods consumed and the complexity of the farming systems are directly related. That is the higher the components of the farming systems higher the proportion of consumption goods and durables and storable goods used. That is because more complex farming systems were found in interior locations close to the forest reserve and main livelihood achievement of the people in such area is farming. Due to seasonality in agricultural income, people in interior locations have supplemented their household income by consuming more consumption goods. Reason for relatively higher use of proportion of durables and storable goods might be due to their higher access to the forest. So they can extract timber and make durables and storable items.

Proportion of the value of input goods used in different farming systems to value of total input goods used in general increased as the complexity of the farming systems increased (Figure 02). So people have utilized relatively higher amount of environmental resource as production inputs in relatively complex farming systems. It is not a surprise because locations where complex farming systems were found were interior allowing relatively higher access to source of environmental resources.



VRP- Values of each category of resource used as a % of total value of resource used;
VCP- Value of resource allocated as a percentage of total value of resources;
P-P-V-L = Paddy-paddy- vegetable-Live stock; P-V-L= Paddy–vegetable- Livestock;
P-V=Paddy-vegetable

Figure 02: Relationship between farming systems and utilization of environmental resource and value of different resources used as a percentage of total value of resources

As expected, proportional value of output goods utilized has increased as the complexity of the farming system decreases (Figure 02). This has happened because locations where less complex farming systems were found have access to off farm employments, improved transport facilities and town centers. People living in each location have collected relatively larger quantities of environmental resource for sale.

When value of each category of resources consumed as a percentage of total value of resources consumed was examined and it was evident that, proportion of consumption, inputs, outputs and durables and stock goods to total value accounted for 23,61,09 and 07 percent respectively. That is, people have consumed more of consumption and input goods. The input goods were the most demanded category of resources. This shows that material use as consumption goods and input goods are more popular (Figure 02).

Contribution of Environmental Resource to Household

The average value of consumption, inputs, output and durables and stock good consumed within one year were valued as Rs.15,704 (USD 104.93), Rs. 42,161 (USD 281.70), Rs.5,912 (USD 39.50) and Rs. 4,944 (USD33.03) respectively (Table 02). Value of consumption and input goods used was comparatively higher than others. Value of consumption goods, input goods and durable and stock goods have increased when the complexity of the farming systems is high (Table 02) where the highest contribution was recorded by the input goods per household.

Composition of household income

Income from environmental goods, non-farm income and agricultural income were the main elementof household income. Average annual household income was Rs.341,957 (USD 2284.80) (Rs. 28,496 per month/ USD 190.40). The magnitude of household income was higher with the complexity of farming systems. Contribution of environmental goods has also increased as the complexity of the farming systems increases and value of environmental goods accounted for 20% of the household income. Off-farm income has become less important when the farming systems were employed. Agricultural income was higher in families adopted to moderately complex farming systems (Table 03). The general trend observed in consumption of environmental goods increases as the complexity of the farming systems increases. Therefore it is mandatory to educate rural people to utilize environmental resources efficiently and effectively in order to assure the sustainability of the source of natural resources.

Table 02: Relationship between farming systems and use of environmental resources

Farming System	Annual value of resources (Rs/Household)			
	Consumption goods	Input goods	Output goods	Durable and stock goods
P-V	14,815.02 (31)	27,425.45 (22)	9.458.13 (53)	1.925.00 (13)
P-V-L	14,396.32 (31)	58,666.09 (46)	4,897.50 (28)	3,320.00 (22)
P-P-V-L	17,901.28 (38)	40,390.36 (32)	3,379.25 (19)	9,587.50 (65)
Value per household	15,704.21	42,160.63	5,911.63	4,944.17

P-P-V-L = Paddy-paddy- vegetable-Live stock; P-V-L= Paddy–vegetable- Livestock; P-V==Paddy-vegetable Value in parenthesis are percentages of different type of goods to the total unitization in the forest reserve

Source : Field survey (2014)

Table 03: Contribution of value of environmental resources to household income

Farming systems	Annual average value of resources extracted (Rs/Household)			
	P-V	P-V-L	P-P-V-L	Value per household
Environmental goods	53,623.00 (17)	81,329.91 (22)	71,258.23 (21)	68,737.10 (20)
Non-Farm income	208,855.00 (63)	106,900.00 (28)	135,453.00 (39)	150,402.67 (43)
Agricultural income	66,418.00 (20)	182,458.90 (50)	127,974.37 (39)	122,817.09 (37)
Total	325,496.00	365,688.81	334,685.76	341,956.86

P-P-V-L = Paddy-paddy- vegetable-Live stock; P-V-L= Paddy–vegetable- Livestock; P-V==Paddy-vegetable Values in parentheses are percentages

Source; Field survey, (2014)

CONCLUSIONS

The complexity of farming systems adopted is based on geographical location, access of town centers and off farm employment. Monetary value of the environmental resources extracted varies according to their complexity of the farming system adapted. Villages that adopted paddy-vegetable-livestock had utilized the highest amount of environmental resources. The values of the consumption goods, input goods and durable and stock goods utilized by community in *'Ritigala'* are positively related with the complexity of the farming systems adopted and the value of the output goods used is inversely related with complexity of the farming system. Contribution of environmental resources and agriculture to annual household income were higher in complex farming systems while the combination of off-farm employment has declined as the complexity of the systems was high.

Geographical location of the villages also has influenced the utilization of environmental goods as well as the complexity of the farming system adopted. It is important to identify the effective and efficient methods of sustainable use of environmental resources,which is compatible with adopted farming systems in order to assure a continuous future availability of those resource.

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