Environmental Income and Income Inequality among Tribal Communities in Chattogram Hill Tracts (CHT), Bangladesh

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Abstract:

Background:Environmental income refers to the income earned from wild or uncultivated natural resources.In case of rural economy the contribution of environmental incometo the rural households is typically undervalued in standard socioeconomic surveys.Asan important component of the earth's ecosystems,natural resources are integral part of rural livelihoodsin Bangladesh.In recent years, there has been increasing interest to find out contribution that environmental resources make to local rural income and employment. The purpose of the study was to determine the relationship among dependence on tribal communities' environmental income and income inequality in ChattogramHill Tracts of Bangladesh.

Materials and Methods: The study is based on both primary and secondary data. The primary data were collected from ChattogramHill Tracts (CHT) based on a sample survey and employed cross section data of total 210 tribal respondents under 6 upazilas of Rangamati, Bandarban and Khagrachari districts from CHT by adopting multistage sampling procedures. A semi-structured and pre-tested questionnaire was used to collect data from the respondents through face to face interview. Descriptive statistics, Gini coefficient and Lorenz curve analysis were employed for analyzing the data.

Results:The study found that characteristics of sampled respondents from different tribes differ from each other in respect of their socioeconomic attributes. Household's annual income from different sources identified two main categories- income from environmental sources and non-environmental sources. Income from environmental sources accounts for 45.16 percent of the total household income while non-environmental income accounts for 54.84 percent. The highest share in total income came from agricultural income (28.72 percent) followed by wild income (16.44 percent) and wage labor (12.82 percent). The valueofGini coefficient with environmental income was 0.12 which indicates relative equality; while without environmental income, the coefficient was 0.59 indicating relative inequality. Again, Lorenz curve with the inclusion of environmental income is closer to the equidistributional line than that without the inclusion of environmental income.

Conclusion: The study comes to a conclusion that environmental incomeplays a noteworthy role in securing livelihoods of the rural tribal communities in Chattogram Hill Tracts of Bangladesh.Considering the findings, the study suggested some policy implication like conserving common property resources; encouraging public awareness about family planning, education, population growth; introducing effective pro-poor policies that may assist all poor people to shift in higher-return activities.Hence,policies that widen the sources of environmental income and reduces income inequality should be given proper attention.

Key Word: Environmental income; Income inequality; ChattogramHill Tracts (CHT); Tribal communities.

I. INTRODUCTION

Natural resources are an important component of the earth's ecosystems as they are an integral part of rural livelihoods, especially in the underdeveloped economies. In rural areas of developing countries, indigenous communities still lack modern amenities and opportunities for livelihoods, therefore, environmental income is a major contributor to meet subsistence needs and generate cash income. In recent years, there has been increasing interest to find out contribution that environmental resources make to local rural income and employment. There is a shared understanding among researchers, policy makers and development practitioners that quantifying the contribution of environmental income in rural economies are important to understand the welfare implications of environmental degradation and to design effective development and conservation strategies[1,2,3,4].However, the role of environmental income and its contribution to poverty alleviation and inequality reduction is still debated and there has been little empirical research on the level of dependence across different socioeconomic groups. Collecting environmental income information in quality terms is still considered difficult and costly to obtain[5,1].

At the household level, under rural livelihood context environmental income is "value, in cash or direct use, from ecosystem goods and services", including income from natural systems such as forests, woodlands, grasslands, lakes and marine waters etc.It also includes agricultural income—the output of agro ecosystems[5]. Again, there are other definitions of environmental income which are not broadly defined as this definition. Environmental income is defined as income earned from wild or uncultivated natural resources. So, based on this definition, wild income and agriculture are often inspected separately[4].However, this study uses environmental income, as defined by UNDP *et al.* (2005), where environmental income is "Only when income from agriculture is combined with the income from wild products do we begin to get a clear idea of how important ecosystem goods and services are as a source of rural livelihoods." That is, all sources of income based on nature given in the household budgets, are considered as components of environmental income. There are some reasons for this consideration; Such as- Researchers often make a distinction between agricultural income and wild income—that is, income from less manipulated natural systems like forests and fisheries. This distinction means that these two income streams are often counted and analyzed separately. Wild income deserves special attention, since it is often the element that is not accurately accounted for in most considerations of rural livelihoods. But both agricultural and wild income is important to an accurate assessment of the dependence of the poor on environmental resources for income.

In addition, it is sometimes difficult to compute the two income sources separately since an output from one source can be used as an input for the other source. For example, forest grasses can be used to feed livestock, while forest leaf litter is a natural fertilizer for cropping. Income from wild products is a major part of the environmental income equation and income from agriculture is as important as wild income. The importance of goods and services from environmental sources as a household livelihood source is achieved only when both agriculture and wild income are incorporated into the equation [6].

Though, the contribution of natural resources such as forests and wild products to the rural economy is typically undervalued or overlooked in different socioeconomic surveys. However, this omission leads to the underestimation of incomes and the value of the environment to rural households[7,8], and misrepresent the understanding of the distribution of wealth within the rural economy[9,10,11]. Therefore, understanding rural livelihood strategies and Empirical investigation on environmental resource dependence may help to improve macro-level poverty estimates and improve policy planning and execution[12]. It has been noted that efforts to quantify the contribution of environment income have been undertaken because it may serve as an input of a conservation policy, and particularly establishment of protected areas, by determining the potential loss to rural dwellers of reduced access to environmental resources[12,13,14].Considering the significance of environmental income in under developed economy, and likely impacts on the welfare of local communities as a result of environmental degradation, this paper addresses two specific research questions: (i) what is the contribution of environmental income in rural income portfolios?and(ii) to what extent environmental income does affect rural income inequality?

II. MATERIAL AND METHODS

Study area and methodology
The study area

The study was conducted in 3 districts (Rangamati, Bandarban, Khagrachari) from ChattogramHill Tracts (CHT) as it fulfills the specific research objective. Chattogram division was considered as best to select based on the availability of the ethnic groups. The other reasons for selecting these areas were- close proximity to nature, tribes living in these areas have some unique characteristics like distinctive tradition, lifestyle, housing pattern, agricultural practices, food habits etc. Finally, no combined study like the present one is conducted previously in these areas.

Sampling techniques and data collection

Limited resources necessitated a multistage sampling procedure in the study area. In the first stage, Chattogram division was selected based on preliminary information received. Three districts from CHT were selected purposively and two upazilas from each district was selected based on the availability of the ethnic groups. Then 35 respondents from each upazila were covered for field survey. Finally, a total of 210 tribal households were selected randomly from the collected lists.

A questionnaire survey was administered to the 210 households during fieldwork from April to June 2018. Information was gathered on socio-demographic profile of tribal households, income and expenditure of the respondent's households, household characteristics and assets holdings, environmental income and its contribution etc. In addition to data on conventional household income, attention was given to different forms of environmental income accrued through both consumption and cash. Here, a resource must be freely provided by natural processes to qualify as an environmental utilization[12].Besides the field survey, focus group discussion

(FGD) and participatory rural appraisal (PRA) was conducted being assisted by local leaders to collect data in the study areas and also to cross check the collected data.

In addition to field level primary data, Secondary data were collected from different handouts, reports, published and unpublished documents of the Government of Bangladesh (GOB) and different organizations and agencies. Collection of primary data rested mainly on a detailed questionnaire and there were different sections which included questions on basic household variables, sources of income, livelihood patterns, agricultural production, livestock, environmental extraction, off-farm activities, and support services. The sections covering income sources included detailed questions on all relevant cost and revenues, allowing us to compute net income for not only the major categories of income but also subcategories.

Methods

A combination of descriptive and inferential techniques as demanded by the study was used to achieve the objectives and to get the meaningful results. In this present study, various descriptive statistical measures (i.e., sum, average, percentages, ratios, standard deviation etc.) were employed to describe socioeconomic characteristics of respondents and sources of environmental income and percentage shares of these sources in respect of total income.

Components of environmental income

Environmental Income is the value derived—in cash or direct use— from ecosystem goods and services. As we use the term in this study, environmental income is the sum of two important income streams[5].

Wild income

Wild income is considered as income from wild or uncultivated natural systems, such as forests, roadside forests, marine and inland open water fisheries, reefs, wetlands, and grasslands. This includes commodities such as fish, timber, and non-timber forest products such as fuelwood, fruits, medicinals and other foods, and materials for handicrafts or art. It also includes income from marine and inland fisheries.

Agricultural income

Agricultural income is considered as income earned from agro ecosystems—all agricultural lands, such as croplands, pastures, or orchards. In the context of the poor, agricultural income is mostly generated through small scale agriculture, including commodity crops-rice and non-rice crops, homestead gardens and large and small livestock. Income from aquaculture would also fit in this category.

In addition, there are recommendation that income from mineral and energy resources are also rationally considered as a component of environmental income. However, poor rural households normally do not gain direct sources of income from large-scale mineral and energy extraction[5]. Therefore, this source of income is not included generally in the environmental income category in context of rural household livelihoods. The main aim is to account all sources of income based on environmental resources that figure into the poor household budgets or can be tapped by them for sustainable wealth creation. So, the importance of goods and services from environmental sources as a household livelihood source is achieved only when both agriculture and wild income are incorporated into the equation[6].

Environmental income valuation

Valuation and household income accounting methods used in this study weredrawn on both consumption and cash income calculated for the different income sources[15,4,13]. The value of goods and services of environmental goods can be difficult to measure. Typically, net income was computed as the difference between total return and total cost by using the following formula[4];

NI = TR – TC

Where,

NI = Net income (profit) from the respective sources

TR = Total return (included return from both main product and by-products)

TC = Total cost (included labor and materials costs)

Total return was calculated by summing up the value of main product and the value of by-products. While estimating the value of main product and by-product, the existing market price of that area was considered. All the cost items involved in income earning were taken into consideration to compute the total cost of production.

Calculation of inequality with or without environmental income

The inequality status was analyzed by using Lorenz curve and Gini coefficient analysis considering with and without environmental income situation in study area. The Lorenz curve is a graphical representation of the distribution of income which representing inequality of the income distribution.

This study adapted astep-by-step procedure to build the Lorenz curve.Aftersorting the income distribution, the percentage of income owned by each household and the percentage of the population corresponding to each household is identified. In the next step the cumulative percentage of income and populationmust be identified. After that the equidistribution line is constructed with the assumption that everyone has the same level of income. In the last stage the cumulative percentage of income against the cumulative percentage of the population is plotted in the graph.

Comparison of Gini coefficient with and without environmental income

This current study estimated the Gini coefficients with and without environmental income and compares the results to find out the contribution of environmental income in reducing inequality.It is defined as a ratio with values between 0 and 1: the numerator is the area between the Lorenz curve of the distribution and the uniform distribution line; the denominator is the area under the uniform distribution line.

Firstly, environmental income is deducted from total household income.Secondly, Gini coefficients for total income with and without environmental income are computed. In these cases, Gini coefficient was calculated as a ratio of the areas on the Lorenz curve diagram. If the area between the line of perfect equality and Lorenz curve is A , and the area under the Lorenz curve is B, then the Gini coefficient is A/(A+B).
Since A+B = 0.5,
Gini coefficient, G = 2A = 1-2B.
Thirdly, a comparison of the Gini coefficients with and without environmental income provides an estimation of the impact of environmental on inequality.

III. RESULTS
Basic sample characteristics

The average household size was 4.67 which is slightly higher than the national average 4.06 [16]and the average age of household head was found to be about 41 years. In terms of household age composition, most of the respondents (94.3%) belonged to 15–64 years – or working age – bracket which is economically active group. Only 5.7% respondents belonged to 65+ years bracket while none was under 15 ages. Of the 210 sample households, 123 were male-headed and the remaining 87 female-headed. Historically, in Bangladesh, the male members are dominating than female members in the household as they are the main income earning persons[17] but in this study area the scenario is far different and that was the indication of women empowerment which is a combination of both positive and negative factors among tribal communities in the study area. In this present study, the sampled respondents belong to different tribes. *Chakma,* (43.8%), *Marma* (23.8%), *Tripura* (10%)*, Tanchangya*(5.7%)*,Mru*(4.8%)*,Chak*(8.1%) *and Lusai*(3.8%) were the ethnic groups represented in the sample. about 34.8% of household heads were illiterate. None of the household heads had completed higher studies or graduation to qualify for engagement in paid public services or other formal employment schemes.

Land, livestock, houses and savings constitute the main household asset endowment. The target community themselves identified number of livestock, land size, savings and housing as wealth indicators during focus group discussions. Land is the most important asset for households because farm families depend on the land. In Bangladesh the tribal communities believe that land, forest and hills are collective property. The existing government system of land registration is at variance with the ancestral land management system. To the *Chakmas*, land used for habitation is considered as one's personal property, but a collective ownership prevails over lands outside their habitats. According to the tradition of the *Chakma* clan, anyone can use a piece of land to build house for which no deed or legal document is needed. The perception about land ownership and use also largely vary from tribe to tribe. In spite of advancement in socio-economic conditions the tribal generally remained firm in their perception about land rights including use[18]. Among all the respondents there were no landless people while the majority (45.24%) were medium land holders while only 20% were small land holder. Again 34.76% resides in large land holder's category.

Services rendered by different government and non-government organization reached 60.95% of sampled households. Among the 210 respondents, 53.81% had access to credit from different sources such as *Raja/Mantri/*tribal chief, bank, NGOs, and relatives etc. while 46.19% had no access to credit. Ecological, institutional, and policy factors are shared by people in the study area but it's not considered in this study.

The household food security situation, distance to market, and proximity to the resource were seen as contextual factors identified for analysis. On average, the settlements were at a distance of 4.5 km and 3.2 km from forest and nearest town respectively. 37.6% of the sampled households satisfied their consumption needs through own farm production. The remaining 62.4% faced seasonal food shortages for an average of 3.5 months of the year.

Household environmental dependency and other sources

Income from environmental sources mainly from agricultural and wild income; accounts for 45.16% of the total household income while income from non-environmental sources contributes relatively larger portion which accounts for 54.84% of the total household income. This study reported some interesting insights into income earning pattern of the tribal community. In general, environment income and wage-based strategies are predominant in tribal communities followed by small business and service sector since more than 80% of the surveyed households follow these sources (Table no 1).

Table no 1: Average annual net income and percentage share of different environmental and non-environmental sources.

Income Sector	Sources of Income		Amount(Tk.)	% of EI/NEI	Share of total income (%)
Environmental Income	Agricultural Income	Rice	48673.17	1	8.42
		Maize	9500	3.64	1.64
		Wheat	8500	3.25	1.47
		Oilseed	15909.09	6.08	2.75
		Pulse crops	11600	4.43	2.00
		Vegetables	23180.23	8.88	4.01
		Homestead gardening	10482.05	4.02	1.81
		Pasture lands	11700	4.48	2.02
		Aquaculture	26636.36	10.20	4.60
	Wild income/ Common Property Resource	Aquatic source (River, natural lake etc.)	12615.38	4.83	2.18
		Forestry — Tree/ wood selling	17075	6.54	2.96
		Fruits	28601.26	10.95	4.95
		Forest products	29048.38	11.12	5.03
		Others	7656.25	2.93	1.32
A. Total Environmental Income			261029.89	100	45.16
Non-EnvironmentalIncome	Service		63976.92	20.18	11
	Small business		66840	21.09	11.56
	Wage labor		74102.27	23.38	12.82
	Shop keeping		60086.95	18.95	10.39
	Remittance		13500	4.27	2.34
	Handloom		16474.28	5.20	2.85
	Others		21936.17	6.93	3.79
B. Total Non-Environmental Income			316916.59	100	54.84
Total Income (A+B)			577946.48	100	

Income Inequality and Environmental Income

There is strong link between environmental income and its role in household welfare for the environment-dependent communities. Environmental income has an important role in reducing income inequality[19] and a potential role in poverty alleviation [9,13]. The Gini coefficient and Lorenz curve are often used to assess the contribution of environmental income to per capita household income[9,20] and clearly indicate an important role in the livelihoods of households in the study areas.

To explore the distributional effects of environmental income, a Gini coefficient, indicating the level of inequality was computed for total per capita income. Environmental income was then deducted from total income and a new Gini coefficient was computed. The resulting Gini coefficients were then compared to determine if environmental incomes contribute to income equalization among rural households.

Table no2: Ginicoefficient decomposition for household income (with and without environmental income).

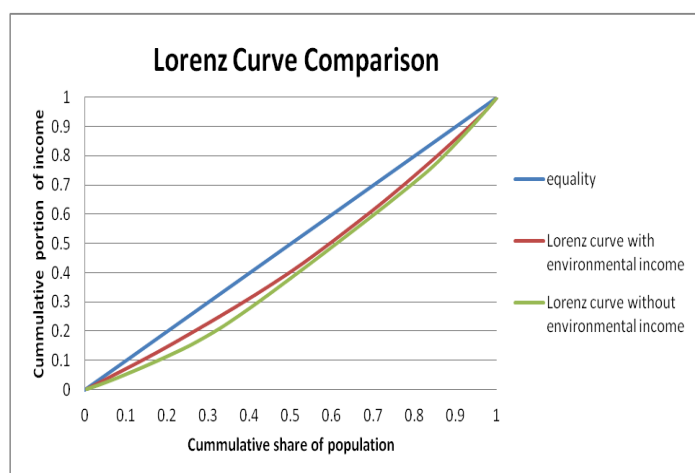| Inequality component	With environmental Income	Without environmental income	Mean difference
Ginicoefficient	0.12	0.59	-0.47
Source: Field Survey, 2018			

Figure no 1: Lorenz curve comparison with and without environmental income

However, for the whole sample, the inclusion of environmental income reduced the Gini coefficient from 0.59 to 0.12; it was a drop of 79.66% (0.47/0.59) (Table no 2). The Gini coefficient is often represented graphically through the Lorenz curve, which shows income (or wealth) distribution by plotting the population percentile by income on the horizontal axis and cumulative income on the vertical axis. The Gini coefficient is equal to the area below the line of perfect equality (0.5 by definition) minus the area below the Lorenz curve, divided by the area below the line of perfect equality. In other words, it is double the area between the Lorenz curve and the line of perfect equality.

Figureno1 visually illustrate the comparison of with and without environmental income on income inequality. The crosswise line is the equidistributionline, representing perfect inequality [21].

The Lorenz curves in Figure no 1 are developed using the household incomes from the included and excluded environmental incomes. The figure shows that, the Lorenz curve with the inclusion of environmental income is closer to the equidistributionline than that without the inclusion of environmental income. It was found that, contribution of non-environmental income to the total income increases inequity where the contribution of environmental income decreases inequity in the total income. The inequality without environmental income to total household income attest to the fact that inequality is associated with environmental earning pattern and sources.

IV. DISCUSSIONS

Results based on questionnaire surveys – and thus on the recall, accuracy, and intentions of respondents – are subject to various biases though the recall periods in the survey were quite normal (maximum 12 months). The problems of recall will under some circumstances show up as white noise while the familiarity of all the authors with the survey area may have reduced strategic answers (particularly with respect to illegal harvesting). However, such bias cannot be entirely eliminated and figures on environmental incomes and dependence should be treated as conservative estimates.

The results of this study with regard to environmental income and dependence support the findings of other studies[9,12,13]. In particular, the present study supports the notion that many rural poor populations are highly dependent upon environmental resources for their livelihoods.

In the study area, household income is generated from different sources and these income-generating sources were mainly classified into two categories: environmental and non-environmental sources. Environmental income contributed on average 45.16% of all household income in the study area. A more detailed breakdown of household environmental income by sources, the agricultural income including crop sources, pasture lands (small and large livestock) and aquaculture sources followed by wild income sources including aquatic sources, forest and other sources (Figure 1).

This result is similar to a survey of 400 tribal households in the CHT area, where the identified occupations of the sampled households were mainly- agriculture (64%), followed by agricultural labor (12.5%),

business (8.5%), service/professional (7.8%), fishing (4.8%) and others (2.5%)[22]. While forest income is the primary contributor to total environmental income, non-forest environmental income also plays an important role in rural livelihoods confirming the findings of seminal environmental income studies[12]. The regression analyses yielded a number of insights as to the determinants of environmental income. The result of the model shows that environmental income being more important to households with young household heads and to less-educated households.

Here, the increasing age of the respondent will decrease the environmental income and the reasons could be the older people may be physically less capable than the younger counter parts of the communities to access the forest and wild resources. We find support for environmental income being more important to households with young household heads[1]. In case of education, the reason could be households with more years of education tend to have higher total income and lower environmental income. This might reflect better opportunities for the households in the non-environmental income earning sector which is similar with other studies [23,3,13].

In general, this study confirms the important role of environmental income in securing livelihoods among the rural tribal communities. When environmental incomes were removed, the Gini coefficient raisedfrom0.12 to 0.59, a substantial change in the context of a uniformly poor rural area. This is identical a study in Zimbabwe that reported a 30% reduction in measured inequality among rural households due to inclusion of environmental income [24], 12% reduction when income from forests was included in annual household income found in Malawi[25]. This is also identical to the increase of 0.06 found in Uganda[19] and comparable to the increase of 0.10[4] for a collection of studies from different developing countries. In Ethiopia the income equalizing role of forests for rural households also follows the similar trend[13].The scenario can be different from case to case due to different facts, but the general trend indicates that environmental income hasconsiderable potential for reducing income inequality among rural tribal households, and this present study also supports this.

V. CONCLUSION

This analysis illustrates the importance of environmental income to rural household welfare in ChattogramHill Tracts (CHT). In terms of rural areas in developing countries, with similar characteristics to those included in this present study, ignoring environmental income in socioeconomic surveys would give a misleading picture of rural livelihoods and provide an inadequate basis for policy design. In light of the above discussion, an important point obtains with regard to poverty surveys, which often overlook environmental income and one effect of this is the overestimation of rural poverty in absolute terms; more problematically, policies based on such incomplete surveys may culminate in policies of crucial importance to natural resources and rural livelihoods that are based on complete ignorance of the link between the two.

With the given importance of environment income, the findings from this study threw significant challenges for policymakers- whether to implement policies that ensure continued access to environmental resources for rural households, or to support the development of other sectors. In short run policymakers should support conservation of forests and other environmental resources but there is a fear that this type of use and dependence on environmental income may lead to overexploitation. So,in the long term, policies that support diversification of income sources are critically needed. Expanding the range and profitability of livelihood options other than environmental extraction appear as a viable alternative. Policies should focus on enhancing the productivity of agricultural land plots owned by tribal households, which are the main inputs of agricultural activities, instead of enhancing the households' access to common property resources, because this could be more realistic in the context of rural areas of CHT. Therefore, effective pro-poor policies should assist all poor people with shifting to higher-return activities, such as wage employment, non-wage or non-farm businesses, services etc. To achieve this goal, the government may consider effective policies to combat poor households' vulnerability to shocks and expanding their income earning abilities.

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