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WATER, SANITATION AND HYGIENE: CHALLENGES OF THE MILLENNIUM

Social linkages of watershed management

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SRI LANKA'S CENTRAL highland region, above 300 meters in altitude is the major watershed to its river system. There are 103 distinct natural river basins emanating from the central highland that cover over 90 percent of the Island. The Mahaweli River is the largest perennial river of the country. The Mahaweli river diversion and development program is the largest development project under taken in Sri Lanka after the independence with multiple socio-economic objectives. The Mahaweli catchement is the source of water for five large reservoirs - Polgolla, Victoria, Kothmale, Randenigala and Rantembe that have been constructed under the accelerated Mahaweli development programme for large scale irrigation, power generation and rural re-construction. The government intervention in Mahaweli development resulted in bringing 88,000 ha of irrigated land in the Mahaweli area. In 1994, a total of 533,000mt of paddy-the staple food of the country, which is 20% of domestic production and 79,000mt of subsidiary food crops, were produced by the Mahaweli. By 1996, 128,260 farmers have been settled under the Mahaweli settlement scheme, which is 96 percent of the target (National Planning Department, 1997). Similarly, hydropower generated under Mahaweli is the major source of electricity in the country. Since successful achievement of the objectives of this remarkable project primarily depend on the capacity of the river water, it is vital to conserve the Upper Mahaweli Catchment (UMC) area.

The introduction of crown land ordinance in the 19th century by the British colonial rulers is the starting point of degradation of UMC. Much of the peasant's land areas were taken by the colonial government for the establishment of coffee, cinchona and tea. In addition large tracks of virgin forest were cleared for the same and continued even after the independence for various development projects. Stirrat (1992) review that up to 50 percent of population in the UMC are land less or own no more than a household plot. This process caused severe pressure on land among traditional peasant farmers.

The composite effect of loss of fertile agricultural land owned by peasant farmers and population pressure has been manifold. Firstly its intensify the acquisition and extension of subsistence farming into the marginal, ecologically fragile and highly erodible lands; Secondly the process caused encroachment of forest lands in the catchment area; Thirdly it lead to the fragmentation of available land and increased intensity of production. Further to that due to the increasing scarcity of land and integration of market economy with UMC population, land use practices have tented to shift towards highly erosive commercial crops such as vegetables, tobacco and potato under intensive cultivation methods, which have lead to severe pressure on natural environment. It must be noted that crop production in UMC is overwhelmingly a small holder activity (small holder farmers include the farmers who cultivate less than on hectare of land). Currently, environmental degradation in the region is characterized by dry weather, land degradation, the silting of streams, rivers and reservoirs and increasing incidence of land slides (CEA, 1986).

The problem

Despite large amount of public investments in development of irrigation infrastructure and considerable amount of money to operate and maintain the infrastructure, Sri Lanka suffers from substantial water shortages resulting mainly from mismanagement of water resources. Most of the dry zone districts in Sri Lanka are already facing either seasonal or year-round severe water scarcities (Amarasinghe et al, 1999). UNDP (1998) reveals that 35 percent of rural people in Sri Lanka are deprived of safe water for drinking purposes. The National Water Supply and Drainage Board (NWSDB) of Sri Lanka estimates that 90 percent of piped water supply systems outside of Colombo are suffering from a combination of inadequate water supply and treatment capacity.

In the mean time, recent studies shows that 46% of capacity of the Polgolla reservoir and 36% of the Rantambe reservoir were silted with in 10 and 7 years of impoundment respectively. The available data also indicates that Victoria and Randenigala reservoirs are loosing their volume at the rate of 0.5 and 7.25 MCM per year respectively (Yatawara, 1997). Kothmale Reservoir is highly sensitive towards eutrophication and blooming effects mainly due to nutrient load carried from UMC (Piyasiri, 1997).

The government of Sri Lanka (GOSL) introduced various policies and programmes to minimize the degradation of land resources. Soil conservation act was introduced in 1951 and a separate division for soil conservation was established under the Department of Agriculture to curtail soil erosion. Stocking (1992) mentioned that during the past twelve years, three aid donors have spent over US $ 10 million on watershed management. Various subsidy programmes and incentive schemes for soil conservation were introduced at different times. Nevertheless, their achievements have been far short of the expectations as soil

erosion continues at a high rate (Stocking, 1986; Gunathilaka, 1990).

One of the major factors attributed to the failure of above policies and programmes is inadequate recognition given to the human causes of land degradation. Therefore, understanding the root causes of land degradation is essential for the effective implementation of policies and programmes targeted to curtail land degradation and to promote soil conservation measures. Poverty is one of the key social issues among UMC farmers. As mentioned in WCED (1987) poverty is the major cause of environmental problems and alleviation of poverty is a necessary and central condition of any effective program to deal with environmental concerns. World Bank (1992) further pinpointed this as "*poor families who have to meet short term needs mine the natural capital by excessive cutting of trees for fire wood and failure to replace nutrients*".

Objectives

The objective of this paper is to examine the effect of landlessness, low level of income and resultant poverty among small holders on land degradation and soil conservation and implications of this for UMC and water resources management.

Method

Selection of the Study Sites

Five villages were selected from four micro catchments in the UMC for detail field research where World Bank funded Environmental Action 1 Project (EA1P) is on progress. The details of the sample sites are given in table1.

Methods of Data Collection

The study is based on the data collected from a literature survey, key informant interviews and a structured questionnaire survey. A total of 150 households selected randomly consisted of 30 households from each of the study villages were interviewed.

Since the major objective of the study was to find out social and economic factors affecting soil erosion, no attempt was made to measures soil erosion in technical terms. However, a number of social scientific measures were employed to assess the severity of soil erosion in the field survey. First, the casual observations of soil erosion were made on uplands cultivated by the sample households. Trained field investigators were instituted to observe upland plots of land cultivated by each of the sample household and report the depth of the topsoil. Second field investigators were also instituted to observe the incidence of erosion on uplands according to the level of erosion. Third, data on income and soil conservation investments were collected. Later these observations were cross tabulated with household incomes to see their relationship.

Results and discussions

Agricultural Income

According to the survey data, average annual income among sample household was Rs.66, 603 (1US $ = Rs.73). However, 26% of the sample households had total annual incomes less than Rs.18, 000 with an average of Rs.10, 264 per family. The composition of household income of sample villagers shows that average income earned from agriculture is much lower compare to other income sources

Table 1.Details of the sample villages

Village	Micro Catchmnet	Major Land Use Type
Ududeniya	Bowatenna	Multi-layered home garden/minor export crops
Bopitiya	Bopitiya	Vegetables
Number five division	Doragala	Marginal tea lands/Vegetables
Ihala Pannala	Pannala- Oya	Vegetables
Serupitiya	Pannala- Oya	Shifting cultivation/upland farming

except Bopitiya and Doragala which are mostly vegetable cultivation villages. State sector employment, private sector employment and self-employment are major income sources for the rest of the villages. Paddy farming, a major source of incomes outside the UMC accounted only for 2% of the total average incomes among the sample households.

Secondary nature of agriculture makes the agricultural land operators depend on off farm incomes for subsistence. Low agricultural incomes among the majority of sample households may be linked to uneconomical size of land holding they operate. CEA (1993) observes that Soil erosion is much more prominent among small holders, whose earnings are often inadequate for re-investment on soil conservation. Further, high dependency on non-farm incomes affects the time available for land management by them.

Capital Availability

Table 2 presents the main constraints for soil conservation for farmers who have already adopted soil conservation measures and reasons for not adopting soil conservation by rest of the farmers. The findings clearly show that main constraint in soil conservation measures identified by 74 percent of farmers who have already adopted certain soil conservation measures was lack of funds. It is the reason for not adopting soil conservation by 34 percent of farmers.

The relationship between capital availability and adoption of conservation practices was studied to test the argument of "poor has less capacity to care and maintain agricultural lands". The results are given in table 3. Samarakoon and Abeygunawardane (1995) estimated that initial establishment costs for stone terracing, contour drains and SALT method are Rs.2024, 1883 and 3643 per acre respectively under potato cultivation in sloping land. Level of investment made by farmers on the establishment of soil conservation structures in the study area has increased with higher level of household income and investment made by low income groups is much lower than actual requirement. The level of investment made for annual soil conservation maintenance has no significant

Table 2. Main constraints encountered in soil conservation

Constraint/Reasons	Farmers who are practicing certain soil conservation measures (N = 123)		Farmers who do not adopt any soil conservation (N = 91)	
	No	%	No	%
1. No need for conservation of the land	-	-	23	25.5
2. Shortage of material	22	18	-	-
3. Lack of funds	91	74	31	34
4. Shortage of labors	56	46	21	23
5. Lack of awareness	50	41	37	41
6. Land tenure problems	19	15	14	15
7. Protect structures from wild animals	38	31	-	-
8. Other	4	4	5	6

Table 3. Level of soil conservation investment vs income level

Annual Income Groups (Rs '000)	No. of Farmers	Initial Soil Conservation Establishment Investment (Rs/Ac)	Annual Maintenance Investment (excluding imputed cost) Rs/Ac	Annual Maintenance Investment (including imputed cost Rs/Ac	Family Labour contribution for Annual Maintenance Cost (%)
<18	36	774	375	1840	80
18 – 60	42	1778	376	1153	67
>60	50	3543	1401	1869	25

relationship with the level of incomes. However, the value of family labour contributed by low-income groups limits additional money investment on soil conservation establishment and maintenance. On the other hand family labour contribution is the major contribution they made on soil conservation. Yet, higher level of labour contribution for soil conservation by low-income groups undoubtedly indicates their interest on care and maintenance of land and natural resources.

The association between poverty and land degradation was further examined by developing an erosion index against which the incomes among various income groups in the sample population were compared. Farmers were requested to indicate the level of soil erosion on the plots of land they cultivated. The index was arrived at by multiplying highly eroded extent by a factor of 4, moderately eroded extent by 2, less eroded extent by 1 and not eroded extent by 0. Finally, the scores for each erosion category was

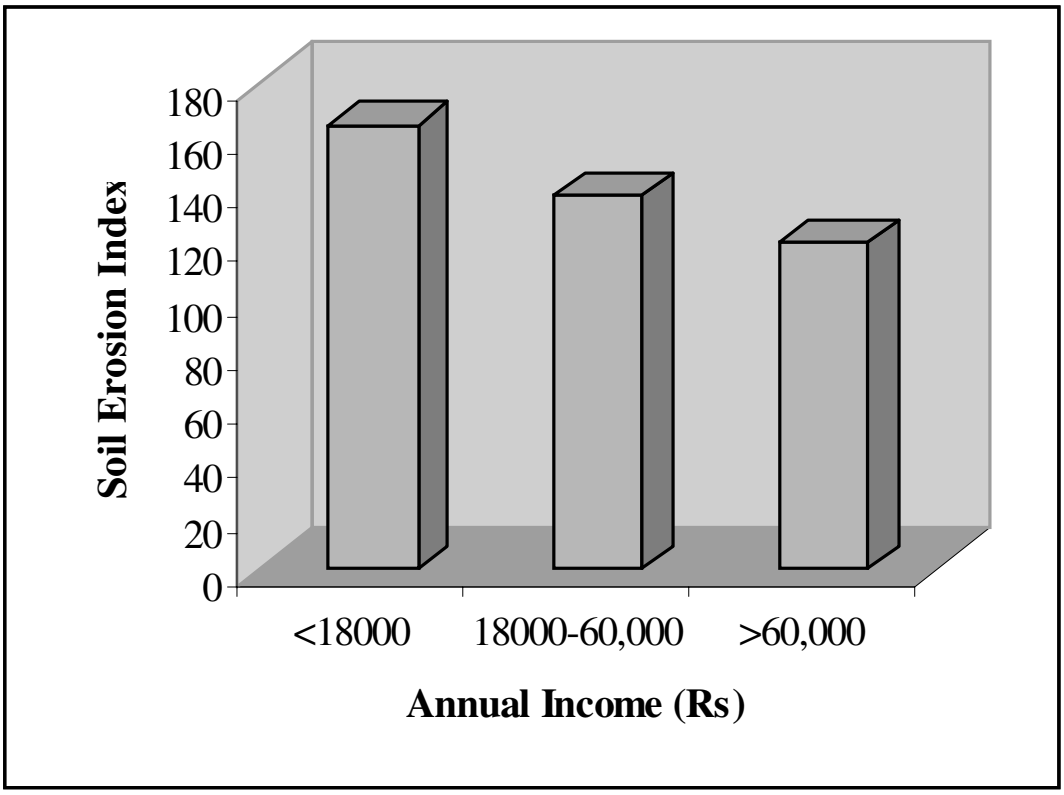

Figure 1: Relationships between level of erosion and household income

added up to make the index. Therefore, high erosion gives a high erosion index value. Figure 1 illustrates the relationship between level of land degradation with different level of income. The figure clearly shows that the land operated by low-income groups are more susceptible to soil erosion.

Upland Cash Crop Farming

Upland cash crop farming (vegetables, potato and tobacco) is another primary factor, which links the income level with land management. Survey data revealed that 70% of all the sample households received Rs.48, 000 annually from agriculture. About 32% of agricultural income were from vegetable cultivation. Paddy, which is cultivated in terraced fields and less erosive, provides less contribution to the household income. In this sense, upland farming is by far the major source of agricultural incomes among the sample households. It was found that 32% of total highlands is geographically above 30% slope in which 62% of the area is under highly erosive cash crops (vegetables + tobacco) cultivation. Stocking (1992) formulated an index for various crops cultivated in the up country of Sri Lanka, called Erosion Hazard Rate (EHR). According to his estimates EHR for perennial crops ranges from 0.01 to 4 and EHR for vegetables without conservation, vegetables with contour drains, vegetables with SALT and vegetables with bench terrace are 40, 20, 3.2 and 0.02 respectively.

If we consider the composition of income of 'Samurdhi' recipients (Samurdhi is the government poverty alleviation program in which poor peoples in various levels receive monthly government subsidy in cash) of the population who earn less than Rs.1500 per month, 35 percent of their total income is from cash crop cultivation. The cultivation of cash crops (vegetables and tobacco) without adequate conservation, indeed have led to higher level of land degradation. This is a reflection of lack of income earning opportunities and non-availability of suitable land for agriculture or uneconomical size of land holdings.

Conclusions

Rural poverty and resultant financial constraints at farm level are serious obstacle in adopting soil conservation and watershed management. Effects of poverty of farmers have direct and indirect relationship with land degradation. When farmers get marginal income from agriculture, the amount of funds a farmer can afford to spend on conservation of his land is limited. Economic decision of private individual under these circumstances will be a delaying of conservation and exploitation of resources unless individuals receive a net economic gain. The indirect effect of poverty on land resource is that when they do not have sufficient income, they are forced to encroach into state lands or reservations and cultivate cash crops or do shifting cultivation. Main constraint faced by farmers both in adopting soil conservation measures and maintenance of already adopted soil conservation structures is lack of funds. Low-income farmers still invest some amount for soil conservation implicating their interest in the Land management. The main contribution of poor farmers for soil conservation is labour rather than cash investment. However, cash investment is essential for initial establishment of soil conservation structures, which is the main constraint faced by the low-income farmers.

High landlessness in the area is the direct outcome of population pressure on land and associated factors. A great majority of the farm households operated small uneconomic holdings (Stirrat, 1992). Land use in turn has resulted in fragmentation and share cropping of existing land as well as encroachment on ecologically fragile steep lands, forests and stream reservations. A low agricultural income among the majority of farmers in the area is linked to uneconomical size of land holdings they operate. Hence, farmers are forced to depend on off farm income, which affect the time available for land management, by them.

As Stirrat (1992) pointed out, considering the political sensitiveness of land use and land use planning in the UMC, it would be unwise for any watershed management project to directly involved in project implementation. Rather, it should build upon its role as a provider of services for other institutions and attempt to influence their activities in more socially oriented ways. The projects essentially must take either interest in poverty alleviation and other matters with in the broad ambit of social development. Any form of land use plan should be under taken under the effective integration & participation of the communities though it may be costly & time consuming. As farmers are lives at subsistence level concept such as watershed management are not easy to attract the farmers. Further it is recommended to implement the integrated long-term benefit projects with the activities that bring direct benefits to the community as an approach of entry.

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