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WOMEN, DEVELOPMENT AND THE EMERGENCE OF HOUSEHOLD ENERGY CRISIS IN THE DRY ZONE OF SRI LANKA: Implications for Sustainable Development

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Abstract

This paper highlights women's access to fuelwood and their management strategies of fuelwood resources in the traditional agrarian societies in the Dry Zone of Sri Lanka and points out, with reference to a selected irrigation and settlement project, that development planners' failure to give due attention to local women's fuelwood needs has resulted in fuelwood scarcity which has brought adverse effects on women and the project's sustainability.

Introduction

Development is usually defined in terms of gross national product (GNP) which is based on the monetary value of commodities produced during a given period. Therefore, many development projects aim at exploiting natural and human resources for the production of commodities, and in such development projects, goods and services which may be vitally important for survival, even though they do not have any exchange value, are not taken into account. Such goods and services are left unnoticed and unrecognized in economic development. Consequently, women's subsistence activities which have little or no market value are often not taken into account in development planning.

Supply of fuelwood for domestic cooking is considered as a women's task in the traditional agrarian society in Sri Lanka, same as in many other countries in the Third World. It is often neglected in development planning since it is an activity which has little or no market value. Furthermore, in development projects, forests are often valued in terms of their potential contribution to timber production as a commodity, and their non-commodity uses for the survival of local people, e.g. for

collection of food, fuelwood, fodder and medicinal plants etc., are neglected. Therefore, in both forestry and settlement development projects, the value of forests as a source of fuelwood is not often taken into account. Consequently development adversely affects the local women's access to fuelwood.

Therefore, in the process of development planning, women's access to fuelwood should be taken into account. It is at this point that knowledge of how women traditionally maintained easy access to fuelwood resources, and how conventional development interventions reduce their access to fuelwood, is vital. This study is an attempt to contribute to that knowledge with special reference to a selected irrigation and settlement project in the Dry Zone of Sri Lanka: Kirindi Oya Irrigation and Settlement Project (KOISP). The specific objectives of the study are (1) to examine how women met their fuelwood needs and managed the local fuelwood resources sustainably prior to the commencement of the project, (2) to assess the adverse impact of the project activities on fuelwood resources, (3) to identify the strategies that women have adopted to cope with the fuelwood scarcity and (4) to identify the consequences of fuelwood scarcity for women.

Study Area

The Dry Zone of Sri Lanka covers two thirds of the island and is characterized by harsh environmental conditions, i.e. a prolonged dry season and erratic rainfall. Annual rainfall therein is about 1270-1524 mm, whereas a 75% probability or rainfall expectancy is 762-889 mm per annum (Somasiri, 1978). While 70% of rainfall occurs in the period October-January (*Maha*: Major rainy season), the balance occurs in the period March-May (*Yala*: minor rainy season). The rest of the year is relatively rainless. The landscape of this area is gently undulating and is a composite of minor catchment areas. Based on the potential crop production, the soils are classified into three categories, (1) upland: well drained redish brown earth (RBE) soils which cover about 40 percent of the area, (2) intermediate: a mixture of RBE and low humic gley (LHG) soils which cover about 10 percent of the area, and (3) lowland: poorly drained LHG soils which cover 50 percent of the area. Because of

insufficient and erratic rainfall, paddy cultivation is virtually impossible without irrigation. Therefore, the early settlers who migrated from North-East India to the Dry Zone of Sri Lanka, developed means for local storage of rain water. They built embankments to retain water in the minor catchment areas and thereby created irrigation tanks. All human settlements and agricultural activities in this area were based on small-scale irrigation tanks.

From about 1200 AD, due to various reasons, prosperity of the Dry Zone economy began to decline, and there was a migration of population from the Dry Zone to the Wet Zone. Since then, Dry Zone has remained sparsely populated and isolated. It was at the beginning of this century that the state began to make efforts to restore the agrarian society in the Dry Zone. The KOISP is one of the latest efforts launched to develop the south-east part of the Dry Zone. The project, launched in 1979 with financial aid from the Asian Development Bank, the International Fund for Agricultural Development (IFAD) and the Kreditanstalt Fur Wiederaufbau (KEW) was designed to tap Kirindi Oya river by constructing a dam at Lunugamvehera, and thereby to expand the paddy cultivation by providing irrigation facilities.

The project area is divided into two: (1) newly irrigated area (NIA) and (2) old irrigated area (OIA). The NIA comprises the lands, which have been developed for paddy cultivation and settlements under the project, the OIA comprises of the land which has been under paddy cultivation for hundreds of years. The only impact of the project on the OIA is that its major irrigation systems: Ellagala and Badhagiriya systems, now receive water from the reservoir newly constructed under the project. Therefore, the OIA was excluded from the present study. It is the NIA which has undergone serious environmental changes due to the project activities. In the past, the landscape of the NIA was characterized by secondary forest, hundreds of small-scale irrigation tanks and their associated village settlements. Under the project, all these natural and man-made elements of the traditional landscape were completely destroyed and a new planned landscape was built up on it. An area of 4200 ha was developed for irrigated paddy fields, and 4200 families were settled in an area allocated for settlements. The families

for the NIA were selected from two categories: (1) settlers: families brought from outside of the project area, mainly from the neighbouring districts such as Hambantota, Ratnapura and Matara, (2) re-settlers: families who had lived in the same area but were displaced from their native lands due to project activities.

Methodology

In order to collect data for this study, a rapid rural appraisal (RRA) and a questionnaire survey were undertaken in two hamlets where families displaced from a village: Seenukkuwa, were settled. Seenukkuwa was located in the valley of Kirindi Oya, and the village economy was based on irrigated paddy cultivation and "chena" or shifting cultivation. Same as in other villages in the Dry Zone, there was a small-scale irrigation tank which provided water for paddy cultivation. A part of this village was submerged under the new reservoir and the rest of the land was taken over by the project and converted into paddy fields. The displaced families were re-settled in two newly built up small villages (hamlets). These displaced families were surveyed with a view to collecting comparative data on present and past fuelwood situations. The first phase of the survey: RRA involved a review of documents including maps and aerial photographs, informal discussions with key informants, group and individual discussions with selected women, and direct observations. After the RRA, in order to collect quantitative information on some selected variables, a short questionnaire was structured and administered to 35 women selected from all socio-economic categories.

Fuelwood as a Source of Energy in the Rural Economy

Fuelwood has been the major source of energy in the study area as in other rural areas in Sri Lanka. It has been pointed out that fuelwood provides 60% of the total energy supply in Sri Lanka (Fernando *et.al.*1981). It is the prime source of energy for cooking in the rural areas. In urban areas too, it is heavily used by low-income households (Ulluwishewa,1989). The modern sources of energy such as kerosene, electricity and liquid petroleum gas (LP gas) are neither available nor

affordable for the majority of rural people. Although the national electricity network is now being gradually extended to rural areas, rural people still heavily depend on fuelwood for cooking. Wijesinghe (1983) identified three categories of fuelwood used in Sri Lanka: (1) rubber wood, (2) crop waste and (3) other fuelwood. The rubber wood consists of wood derived from rubber plantations which are felled for replanting and also from dead trees and branches. The category 'crop waste' consists mainly of the products of the coconut tree *(Cocus nucifera)* - fallen palm fronds, leaves, husks, and shells. Besides coconut wastes, the crop wastes include uprooted tea bushes, manioc and cinnamon sticks, arecanut *(Areca catechu)* wood, etc.

All biomass fuel which did not fall into the categories of rubber wood or crop wastes is collectively placed in the third category 'other fuelwood'. It has been pointed out that rubber wood, crop wastes and other fuelwood account for 18 percent, 28.8 percent and 53.2 percent of the total fuelwood supply respectively (Wijesinghe, 1983). While crop wastes and rubber wood represent the major source of fuelwood in the Wet Zone where coconut and rubber are widely grown, other fuelwood is the prime source of energy in the Dry zone where the area of the present study is located. While rubber wood is often a commodity in urban areas in the Wet Zone, crop wastes are still freely available from coconut plantations and home gardens. Other fuelwood which consists of dead wood derived from forest, chena cultivations, wastelands and home gardens is still available as free items, but gradually becoming commoditised with the growing fuelwood scarcity.

Fuelwood Situation during the Pre-Project Period

Women and Household Fuelwood Consumption

Domestic cooking was the major use of fuelwood. Since warm food was always preferred, women used to cook for all three meals. However, if there were leftovers remaining from previous meals, they were also eaten after re-warming. While lunch and dinner often included boiled rice, several curries of fish and vegetables, breakfast included boiled pulses, yams or rotti made of millet flour. There was no habit of eating

raw food except fresh fruits. Boiling of food reduced the danger of illness from parasitic and disease organisms that often contaminate raw food under tropical conditions. It also reduced chances of spoilage and improved digestibility. Daily fuelwood consumption mostly depended on the number of pots cooked. Number of pots cooked per day varied from 7-10 depending on the season and the household income. While it was low during the peak seasons when women were busy, it was higher during the post-harvest period and the festival seasons. Besides cooking, fuelwood was used to boil water. In most households, women used to keep a pot of boiled water to be given to children, elderly persons and sick persons.

Food preparation was vital not only for day to day subsistence but also in maintenance of interhousehold social interactions which have also been considered as a responsibility of women. According to traditional ideals in Sri Lanka, guests should be well treated. If a guest arrives during a meal-time, he/she should be invited to share the meal and on such an occasion, a special dish is prepared. Offering a cup of tea to a guest is a common tradition. Failure to offer a cup of tea for the guest is considered as an utter disrespect to the guest, and it is the housewife who is blamed for this disrespect. Therefore, whenever a guest arrives, the housewife must light the fire place to prepare tea. There were also some ceremonies in which kin and neighbours partake in food and drink. Some of such ceremonies were birth, marriage, donation of food in remembrance of dead relatives *(dana)* and the new year. In each case, women play a central role as food providers, and on every occasion they have to utilize fuelwood.

Preparation of traditional herbal medicine was another household activity which has often consumed a considerable amount of fuelwood. People in the rural areas still largely depend on indigenous treatment for minor illnesses, and home-made herbal medicinal drinks *(decoction)* are often prescribed by the indigenous medical practitioners *(wedamahaththaya)*. Preparation of *kashaya* is also a duty of women. To prepare decoction, a mixture of prescribed herbal material is put together in prescribed quantities into a big pot (filled with water) and boiled over a prolonged period until the water in the pot is reduced to the

prescribed proportion, e.g. one-third or one-fourth. Therefore, preparation of decoction requires much fuelwood. Production of curd was a women's task which also fuelwood. There were some cases in which fuelwood was burned to smoke out mosquitoes.

Sources of Fuelwood and Fuelwood Availability

The main fuelwood sources are chena cultivations, forest,[2] other commons,[3] home gardens and the river.[4] Out of 35 households surveyed, 25 (71 percent) mentioned chena lands, forests and other commons as their major fuelwood sources. Of the remainder, while 7 (20 percent) who lived near the river-bank mentioned river as their major source of fuelwood, the rest 3 (9 percent) who had fairly large home gardens with coconut trees mentioned home garden as their major source of fuelwood. However, later both groups also mentioned forest and chena lands as their secondary fuelwood sources. On the other hand, home garden were a secondary source of fuelwood for almost all households. Therefore, it seems that chena cultivation, forest and other commons represent the major fuelwood sources.

Chena cultivation was an essential component of the farming system and it was practised in a cyclical manner on plots in the forest within reach of the homestead. Under this system, coarse grains, vegetable, pulses, yams, spice and fruits were grown.[5] After selecting a plot, its undergrowth with bushes and small trees were cleared and left for a few days to dry. Then, fire was set to burn the dried biomass. While most of the leaves and twigs were completely burnt, sticks and logs often remained half burnt. It was at this stage that women began to collect the half-burn wood. The collected half-burnt sticks and logs were piled up along the farm boundary and around the big trees remaining inside the farm. The piles of half-burnt wood demarcated the boundary of the farm and helped to keep out some pests, e.g. wildboar and rabbits etc. Whenever women returned home after work, they used to carry some wood from their fuelwood heaps in chena lands.

When the fuelwood stacked up in the chena lands ran out, women turned to adjacent forests in search of fuelwood. They used to organize themselves into teams when they went to the neighbouring forest for

fuelwood. In many cases, 3-5 women who live close to each other were in such teams. They could often find dead trees and fallen dead branches in the forest. In addition, they also collected fuelwood from the branches and twigs of the trees which were felled by men for timber. It was evident that women abstained from felling trees. They did not carry an axe with them when they went to collect fuelwood but used a kitchen knife. Dead-wood was adequately available in the forest and also it was light, easy to carry, and ready for immediate use. Therefore it was not necessary for women to undergo laborious tasks involved in felling trees. Use of green-wood as fuel would involved extra work such as chopping, splitting, cutting and drying. Therefore, fuelwood collection by women to meet the household energy requirement was not responsible for deforestation.

Women also used to collect fuelwood from the other commons that they passed whenever they returned home from chena cultivations or paddy fields. Women used to collect whatever dead wood they found on the way. When a chena land was abandoned, it again became a common property. Therefore, the dead wood remaining in such lands was also taken away by the women as fuel. Whenever the tank went dry, a lot of dead wood emerged in the tank-bed so that women could collect it to be used for fuel. Dead branches which had fallen into the river from the trees in the upper-stream were often found on the river bank. Floating logs in the river were common during the rainy season when a lot of dead logs were carried down by the river from the upper stream. Those logs were deposited on the river bed when the water level receded during the dry season.

There was no tradition of growing trees for fuelwood but trees were grown in home gardens for food, medicine, shade and to provide coolness. Coconut was a multi-purpose tree which was commonly grown in all home gardens. Though coconut cannot be cultivated under the dry climatic conditions prevailing in the Dry Zone, it was successfully grown in the home gardens in the Dry Zone due to some specific reasons. Home gardens were located just below the irrigation tanks and therefore ground water level of the home gardens was close to the surface. It was due to the close proximity of the ground water level that coconut

cultivation flourished in home gardens. Therefore, coconut cultivation in the Dry Zone was almost confined to small patches of home hardens which were located below the irrigation tanks. Coconut palms provided a lot of soft-wood and semi-wood fuel.

Among the other species grown in home gardens were jak *(Artocarpus heterophyllus)*, bread fruit *(Artocarpus nobilis)*, murunga *(Moringa gleifera)*, mango *(Mangifera indica)*, kohomba *(Azadirachta indica)*, kaju *(Anaeardium occidentale)* and wood apple *(Ficus racemosa)*. Trees were also grown along the fences. Among trees in fences, palu *(Manilkara hexandra)* and weera *(Drypetes sepiaria)* which have high timber value were very common. Among the trees in home gardens, only coconut trees played a significant role as a source of fuelwood. From other trees, only the dead and fallen branches were used as fuelwood. Hard wood trees in home gardens were never felled for fuelwood. They were felled only when the household was in urgent need of money, because such trees were regarded as savings.

When women were asked to rank their level of satisfaction with the fuelwood situation prior to the commencement of the project, 28 (80 percent) said it was highly satisfactory and the rest of them said it was satisfactory. There was not indication of dissatisfaction with the fuelwood supply. The reason for women's satisfaction with fuelwood supply was found to be the availability of diverse varieties of fuelwood from different sources in adequate quantities in the neighbourhood. The distance that they walked to collect fuelwood was relatively short: 0.25 - 0.5 km. Women could not say how much time they spent for fetching fuelwood because they often carried fuelwood on their way back from chena lands and paddy fields. Women hardly spent any time for cutting, splitting and drying of fuelwood since most of the fuelwood that they collected were dead-wood and half-burnt wood which did not require further preparations. There was also no requirement to either plant fuelwood frees or to fell trees for fuelwood. All this reflects that the availability of fuelwood was satisfactory.

As fuelwood was available in adequate quantities in the vicinity of their dwellings, it was not necessary for women to maintain fuelwood stocks at home and to bring large quantities of fuelwood. One of the women interviewed said that:

> 'in those days there was no problem of fuelwood. It was not necessary for us to maintain fuelwood stocks. We used to bring fuelwood only to meet our daily needs.'

They usually brought fuelwood in small quantities to meet their daily needs, and the average head-load of fuelwood was found to be as little as 8.3 kg. This is less than half of the maximum carrying weight recommended for women by the ILO:kg.20 (ILO, 1966). Due to the women's easy access to fuelwood, it was not necessary for most of the women to seek the support of men and children for collection and transportation of fuelwood. Among the women surveyed, 26 (74 percent) fetched fuelwood by themselves, 6 (17 percent) sought the support of female children to fetch fuelwood. Only 3 (9 percent) sought their husbands' support. Therefore, women were quite independent in the sense that they could manage to meet the fuelwood needs without men's support.

All households surveyed used traditional 3-stone stoves[6] for cooking, boiling water, herbal preparations and boiling milk for curd production. The 3-stone stoves allowed the use of any kind of wood regardless of its size and shape. It is the improved firewood stoves that require small pieces of wood in uniform size and shape. Therefore use of such stoves adds more work for women: splitting and chopping of wood into small pieces of uniform size and shape. In the rural areas of the dry zone where women could find adequate fuelwood in varying sizes and shapes, traditional 3-stone stoves were more appropriate, because it saves women's time that they otherwise would have to spend on fuelwood preparation. On the other hand, construction of 3-stone stoves was simple and did not involve any cost. At a time when there was no fuelwood scarcity, there was no reason for women to save fuelwood at the expense of extra time and labour.

Fuelwood Diversity, Fire Management and the Use-Efficiency

Women identified three categories of fuelwood: (1) hard-wood fuel, (2) soft-wood fuel and (3) semi-wood fuel. Some of the common hard-wood species were weera *(Drypetes sepiaria)*, palu *(Manilkara hexandra)*, milla *(Vitex pinnata)* and kone *(Schleichera oleosa)*, and they were mainly collected from chena lands and the forest. Among the soft-wood species, katupila *(Tephrosia purpurea)*, andara *(Dichrostachys cinerea)*, albesia and coconut residues, e.g. coconut husks and coconut branches, were common. The most common semi-wood fuels were the coconut residues such as dry leaves of coconut branches, *'kolapu'*, *'hanasu'* and *'matalu'*.[7] While the hard-wood was considered to be high-energy yielding fuelwood, soft-wood and semi-wood fuel were considered to be medium-energy and low energy respectively.

It was noted that women appreciated the fuelwood diversity because it enabled them to reduce the drudgery of cooking to some extent. Each type of fuelwood had its specific use. To light the fire place, they first burn some semi-wood fuel e.g. dry coconut leaves or other semi-wood coconut residues, and then with the help of the burning semi-wood fuel, fire is set to some soft-wood fuel in the fire place which eventually transmits the fire to hard-wood fuel. Once the fire is transmitted to the hard wood, it could sustain itself without being tendered by anyone. Thus, while the use of semi-wood and soft-wood fuel made it easy to light the fire place, hard-wood helped to keep the fire self-sustaining. This offered two advantages: (1) While the first pot was being cooked, women could attend to prepare the second pot so that the second could be kept on the fire place immediately after the first. By keeping the second pot ready, women could avoid the wastage of energy (fuelwood) which could occur in-between. (2) Since the burning of hard wood sustains the fire, women could stay away from the fire place and this help minimize excessive inhaling of smoke.

Women were aware of the various energy requirements for cooking of various food items. This knowledge helped them to pre-plan the use of fuelwood for each meal and thereby minimize the energy wastage. They categorized all the food items included in their traditional diet into

three groups, according to the energy requirement for cooking:(1) high-energy required food: rice, yams and pulses (2) medium-energy required food: vegetable, fish and meat, (3) low-energy required food: green leaves, leafy vegetable, dry fish and fermented fish. When cooking, all three types of fuelwood i.e. hard-wood, soft-wood and semi-wood, were combined according to the energy requirement of the item being cooked. For instance, if the food item to be cooked was a high energy required one, much hard wood was used. If not, they reduced the volume of hard wood and increased the soft wood, and thereby saved high-energy hard wood.

Women also changed the fuelwood combination according to the situation. They preferred soft-wood which burns faster when water was boiled to prepare tea, particularly if it was to be offered to a guest. Soft-wood was also preferred to prepare breakfast during the peak season when women were very busy in the morning. They also used to change the fuelwood combination according to the changing energy requirement of the food being cooked on the fire place. Women had knowledge and skill to judge the energy requirement of a food being cooked by watching, smelling or listening. When they realized that the food being cooked did not require much energy any more, they reduced the fire by removing the hard wood from the fire place. Fire was also reduced whenever a pot of high-energy required food was replaced by a medium-energy or low-energy required one. All these practices, contributed to avoid possible fuelwood wastage.

Kitchen Smoke: Hazard or Resource?

Kitchen-smoke is widely considered as a hazard and as a source of indoor pollution which causes health problems to women who spend considerable time in the kitchen. As it has been pointed out by the WHO (1984), emission from biomass fuels are dangerous sources of air pollution in the home, where women cook during the whole year or part of the year. However, it was evident that women themselves perceived the kitchen-smoke as a resource rather than a hazard. This is because the kitchen smoke was an essential input for the traditional 'household food system'.[8] The kitchen was not only the place of cooking but also the

place of storage. Women used to maintain food stocks in the kitchen to ensure the household food security. While grains, pulses, seeds, various kinds of wild fruits, meat and fish were stored in the 'smoke tray'*(atuwa)*.[9] some items e.g. pumpkin and maize, were hung on the roof of the kitchen. The excess was stored in gunny bags and kept inside the kitchen. During the rainy season, wet fuelwood was also stored in the smoke tray in order to make them dry. In order to protect the stored food items from pests and fungus, it was necessary to keep the kitchen warm and dry. It was the kitchen smoke generated by the burning wood in the stoves that contributed to maintain the dryness and warmth in the kitchen.

It is a common fact that loss of food in storage is substantially high in tropics due to the existence of harmful pests. Various insects and rats represent the major pests that destroy stored food. Women managed to protect their food stocks in the smoke tray from pest attacks due to the smoke emanating from the stoves. The continuous flow of smoke repels all types of harmful insects and rats. Therefore, contrary to the widely accepted view, excessive smoke emanating from traditional stoves was a resource rather than a hazard. It was noticed that women did not extinguish all the burning wood in the fire place after cooking every meal. Instead, they used to leave some burning hard-wood in the fire place. This is because the burning wood helped them to light the fire place for the next time. To keep the rate of burning at a minimum level, the burning end was kept under the ash. The slow burning hard wood under the ash continuously generated heat and smoke and thereby contributed to maintain dryness and warmth in the kitchen.

Furthermore, the kitchen-smoke helped to maintain the thatched roof free of insects and pests. Most of the houses were made of poles, wattle and daub walls, and thatched roofs. Cooking was usually done indoors, and the heat and smoke emanating from the cooking fire repelled insects and pests in the thatched roof. The thatched roofs also allowed smoke to escape and reduced in-door pollution. Therefore, accumulation of smoke inside the kitchen was not so hazardous as it is widely believed. In the case of houses with tiled-roofs, separate kitchens were maintained with thatched roofs. Kitchen-smoke becomes a source

of in-door pollution and a serious health hazard when traditional style thatched roofs are replaced by modern style asbestos and galvanized roofs. Ash, the other by-product of fuelwood burning, was also used by women to fertilize their home gardens and to protect their crops from pests.

Development Interventions and the Emergence of Fuelwood Crisis

The KOISP activities have brought serious environmental changes which caused fuelwood scarcity in the project area. The objectives of the project were to increase the national rice production and thereby save foreign exchange which is spent on the importation of rice. Therefore, under the project, all natural resources in the project area were diverted to paddy cultivation. Each and every inch of irrigable land including all traditional sources of fuelwood, was converted into paddy fields. Trees in forests, chena lands , other commons and in home gardens which were used by local women as sources of fuelwood, were felled and the lands were developed for paddy fields. At the same time, local people were displaced from their native lands and re-settled in the blocks of lands allocated for new settlements (hamlets) within the project area.

There was no plan to save at least some parts of the forest to be developed as potential sources of fuelwood. At the very beginning of the project, 1800 ha of forest was cleared and developed for irrigated paddy fields, home gardens, roads, buildings and many other uses. At the stage of initial land clearing, no attempts were made to save trees on the lands allocated for home gardens and reservations. Therefore, treeless desert-like lands were given to the settlers. The so-called reservations which have been allocated along the irrigation canals and on road-sides were also almost treeless. While some reservations have been quickly encroached by squatters migrated from outside, some have been taken for cash crop cultivation by the settlers themselves. Consequently, few trees that escaped from the initial clearing have also been felled.

Settlers were expected to build their own houses in the allotments given for home gardens. But, there was no plan to meet the timber requirement for housing. To meet the growing demand for timber, some

of the re-settlers used the timber that they brought from their original villages. When they were asked to evacuate their villages, they cut down all the hard-wood trees which were in their home gardens and brought these with them to the new allotments to be used for the construction of new houses. However, the settlers who migrated from outside, had to seek alternative sources for timber. Such settlers cut down the trees which were left around the settlement areas.

Since there are no forests, chena lands and other commons in the project area, the home garden is the only place where women would find some wood that could be used to meet their fuelwood needs. But as mentioned earlier, most of the lands given for home gardens were treeless. Now, the project management expects women to grow trees in home gardens. But women are confronted with serious constraints to growing trees in the lands which have been given for home gardens. Size of the allotments given for home gardens is 0.5 ha, and within such a small home garden, there is no adequate space to grow trees. Women were also not used to growing trees for fuel. It was often a by-product of the multi-purpose trees which were grown mainly for food. Furthermore, since women have no chena lands to grow food crops, they prefer to use the remaining space in the home gardens for some seasonal food crops which give quick returns rather than perennial trees which give only long-term benefits.

On the other hand, women find it extremely difficult to grow trees due to lack of water. It was evident that some of the activities undertaken at the initial stage of the project, have given rise to an acute water scarcity. Under the project, all the small-scale village irrigation tanks which were in the command area were destroyed and the tank-beds were converted into paddy fields. Since irrigation water was to be provided from the large reservoir located elsewhere, existence of the local level-village irrigation tanks was considered to be unnecessary. However, in the absence of a widespread network of surface water-bodies which recharged the ground water table, now the ground water level has gone drastically down. Therefore, women find it difficult to grow coconut in the new home gardens.

Furthermore, new settlements were located not in the bottomlands[10] as it was traditionally done, but on the high ridges with poor access to ground water, because, all bottom lands were taken for paddy cultivation since they were irrigable. It was also found that digging wells was impossible in the new home gardens due to the underlying bed rock. The report of the mid-project evaluation points out that the presence of hard bed rock is a serious constraint to digging wells in most of the areas allocated for settlements, (ARTI,1988). Hence, now women find it extremely difficult to get water even for drinking. Under such circumstances, women cannot be expected to provide water for the trees in home gardens. It was also found that well water has acquired the salinity at a high level after the construction of the dam, and therefore wells are now not a suitable source of water for tree planting. According to McCall (1982) this could be due to the reduced flow of Kirindi Oya and to a lesser extent to the reduced recharge for diluting the salinity.

Women in the Constructed Fuelwood Scarcity

Present Fuelwood Sources

Present fuelwood sources are different from those in the pre-project period. While some fuelwood sources have ceased to exist, dependence on some fuelwood sources has increased. On the other hand, some new sources of fuelwood have emerged. Chena cultivation and other commons which were very important as major sources of fuelwood are now almost non-existent. Therefore those who depended on those fuelwood sources, now almost exclusively depend on the remaining forest outside the project area. Of 35 households surveyed, 28 (80 percent) said that the forest outside of the project area is their only major source of fuelwood. Home gardens which had also held some significance as a major source of fuelwood in the past are now considered only as a secondary source of fuelwood. On the other hand, commercial fuelwood has emerged as a new source. It was found that 7 households (20 percent) exclusively depend on purchased fuelwood. Those who depend on the forest for fuelwood, considered home gardens and the reservoir as secondary fuelwood sources. They collect hard-wood emerging in the bottom of the newly constucted reservoir when its water level goes down in the dry

season. The river which was mentioned as a source of fuelwood in the past is now no more important, because there is no dead-wood floating in the downstream river after the construction of the dam in the upper-stream. Though fuelwood is still considered as a free item, it is gradually becoming a commodity. Some bullock-carters and tractor-owners are involved in the fuelwood business. They transport fuelwood from the forest outside the project. It was evident that, at the beginning, they transported only the dead wood collected from the forest. However, with the growing fuelwood scarcity, they are gradually beginning to cut trees. This eventually will contribute to the destruction of the remaining forest. These fuelwood suppliers transport on average 2-3 loads of fuelwood per week. Commoditization of fuelwood supply is a reflection of the growing fuelwood scarcity. When the women who were surveyed were asked to rank the level of their satisfaction with the current fuelwood availability, 30 (86 percent) said it was bad and the rest 5 (14 percent) said it was not satisfactory. In explaining why they were not satisfied with the current fuelwood supply, they compared the present fuelwood situation with that in the the pre-project period. They compared the present with the past in terms of the quantity as well as the quality of fuelwood, the distance they have to walk to fetch fuelwood, and the time they spend for collection, transportation and preparation of fuelwood. Women are of the opinion that now they spend more labour and time to meet their fuelwood need than they did before and therefore fuelwood supply is now a more cumbersome job than ever before.

Fuelwood Scarcity and Women's Time

Loss of fuelwood resources in the neighbourhood has forced women to travel to more distant locations in search of fuelwood. According to the survey, the distance that women walk for fuelwood has increased from 0.25 km. to 3.3 km. The increase in distance to the fuelwood sources is not the only problem. Collection of fuelwood in the forest itself has also become much more time consuming because dead wood is now very scarce in the forest due to the increased pressure on available dead wood. To collect a head-load of fuelwood now, one has to walk considerable distances within the forest. The average total time that they now spend to bring a head-load of fuelwood from the forest has increased from 0.5 hrs. to 4.5 hrs., approximately half a day.

It was found that the strategies women have adopted to cope with the growing fuelwood scarcity vary with the household income. As pointed out already, with the growing fuelwood scarcity, some fairly well-off households have shifted from the use of free fuelwood collected by themselves to the use of purchased fuelwood. Some women whose husbands possess bicycles, get their husbands to transport fuelwood by bicycles. Of 35 households surveyed, 10 households (29 percent) now used bicycles for fuelwood transportation. It was evident that with the increased use of bicycles for fuelwood transportation, male participation in collection and transportation of fuelwood has increased. This is because it is the men who own and ride bicycles.

When women need to use the bicycle for the transportation of fuelwood, they have to seek the support of their husbands. Women also required some security from their husbands since now they have to travel far beyond the area that they perceive to be safe. In most of the cases, couples ride together. It is a common sight that husband rides the bicycle keeping wife seated on the front bar and the bundle of fuelwood tied to the luggage carrier behind. There were few exceptional cases where men went alone for fuelwood. But not a single woman was reported to have ridden a bicycle to carry fuelwood. However, it should be noted that increased male participation in fuelwood collection does not mean that the responsibility for fuelwood supply has shifted from women to men. Fuelwood supply still remains a woman's responsibility. Men only help women to fulfil this responsibility if they possess bicycles. Women of the families who cannot afford to purchase bicycles, are unable to get any support from men for fuelwood collection. On the other hand, the low-income households who represent the majority have neither bicycles nor sufficient financial resources to purchase fuelwood. Therefore, women of these families have no alternative but to spend more time and labour on fuelwood collection. It was evident that they have increased the load per trip in order to reduce the number of trips they otherwise have to make to fetch fuelwood. While the number of trips per week has declined from 5 to 2, the load per trip has increased from 8.3 kg. to 27.6 kg. It should be noted that the weight of fuelwood load that is carried by women now is higher than the maximum carrying weight recommended for women by the ILO:kg.20 (ILO, 1966). All these figures indicate that women attempt to maintain a constant fuelwood supply by spending extra physical effort. Furthermore, women now seek

the support of female children in order to bring more fuelwood. Participation of girls in fuelwood collection and transportation had increased from 6 households (17 percent) to 22 households (63 percent).

Less Fuelwood Diversity, More Problems for Women

Depletion of fuelwood resources has reduced not only the total fuelwood availability but also the fuelwood diversity. In the past when there was plenty of fuelwood in various types: hard-wood fuel, soft-wood fuel and semi-wood fuel, women could choose whatever fuelwood they preferred according to their requirements. However, both hard-wood fuel and semi-wood fuel are now hardly available. As the pressure on the limited forest resources increases, it is the hard wood trees that disappear first. Semi-wood fuel: mainly coconut residues, are now scarce because, as pointed out earlier, now there are only few coconut trees in the home gardens. As hard-wood fuel and semi-wood fuel become more scarce, women have no choice but to collect more soft-wood fuel.

Due to the scarcity of hardwood fuel, now women find it very difficult to sustain the cooking fire. The soft-wood fuel that is used now in place of hard wood, burns itself quickly and finishes faster. Therefore, women have to stay near the fire place for a longer time in order to replenish the fuelwood. One woman said

> Now we have no good fuelwood which could sustain the fire. Therefore, we cannot get away from the fire place, because we must blow the fire continuously if the fire is to be sustained.

It has increased the chance of inhaling smoke and consequently women became more vulnerable to health hazards caused by inhaling excessive smoke. It has been pointed out that exposure to fire and smoke can bring acute bronchitis, pneumonia and even death where respiratory defences are impaired (Dankelman and Davidson, 1989). On the other hand, since women have to tender the cooking fire, they cannot attend to any other work while cooking. In the past, while one pot was being cooked, they prepared the other to be kept on the fire place next. But now, in order to prepare the pot to be cooked next, they have to wait till the first one is cooked. In consequence, the total time that women

have to spend for cooking has increased. Since hard-wood fuel is scarce, in order to save the hard-wood fuel, most of the women extinguish the burning hard-wood in the fire place immediately after cooking. However, when they want to light the fire place again, they find it very difficult due to the absence of burning hard-wood in the fire place. It becomes more difficult when they cannot find enough semi-wood fuel, e.g.coconut leaves: inflammable matter which they used in the past to light the fire place. In the absence of such inflammable matter, now some women use small amount of kerosene to douse the lighting end of the wood in the fire place to make it inflammable.

Coping Strategies: Time Saving or Fuelwood Saving?

As pointed out in the foregoing section, fuelwood collection, transportation and cooking now consume more time than before. On the other hand, time that women could spend for all these activities has become limited since most of the low-income women now work as wage labourers. In the past, they worked on their own farms: home gardens, chena cultivations and paddy fields. When working on their own farms, there are no strict working hours. They could adjust the working hours according to their domestic work and other social commitments. They could also look after children while working. However, in the absence of adequate cultivable space in home gardens[11] and due to the non-availability of land for chena cultivations,[12] most of the women in the low-income households now work as casual wage labourers. Of 35 households surveyed, women of 29 households (83 percent) work as casual labourers. Now it is the women's major source of income. When they work as casual labourers, they must adhere to strict working hours. They must leave home early in the morning and work till evening. Any failure to report to work on time costs part of their due wage. Therefore, they cannot now spend as much time for fuelwood gathering and cooking as they did before. One woman said

> 'We must report to work before 7 in the morning. If we fail to be there in time, Mudalali (employer) does not give us any work. Then, we have to return home with empty purse. Therefore, very often I fail to prepare the breakfast'

Since women now work as casual labourers, their time involves an opportunity cost. Though fuelwood has become a costly item, its price is still lower than the opportunity cost of women's labour, specially during the peak periods when women get casual jobs. Therefore, women do not want to spend their time for fuelwood collection at the expense of what they could earn by working as casual labourers. One woman said that

> 'By doing more than 8 hours of work, I earn only Rs.60.That is hardly enough to purchase our daily needs. So how can I spend a single cent of it to purchase fuelwood'

Therefore, they make every effort to save time as well as fuelwood, but they are more concerned about saving time rather than saving fuelwood. However, some strategies that women have adopted to save time on cooking, save fuelwood too. For instance, it was noticed that women now avoid cooking pulses and yams for breakfast because boiling of yams and pulses is very much time consuming. In the past, boiled pulses and yams, e.g. green gram, cow-pea, manioc and sweet potatoes were often cooked for breakfast. Now many of the householders who grow pulses and yams, prefer to sell what they grow and purchase bread for breakfast which is ready to eat. Low consumption of pulses and yams has been pointed out by the dietary intake and nutrition status survey (ARTI, 1986). According to the survey report, only about 50 percent of the survey population consumed pulses and among those who did, the quantities taken were very small.

It was also found that, in order to save time, some women cook more food than is required for a single meal so that the leftovers after the first meal could be consumed at the second meal. In the past, they used to warm the cold leftovers before eating, but now eating leftovers without re-warming is not uncommon. It saves time as well as fuelwood. Shifting from the use of indigenous herbal medicine to western medicine has taken place over past decades. According to the women surveyed, there are two major reasons for the shift: (1) the long time involved in the preparation of *kashaya* and (2) heavy fuelwood requirement. The habit of keeping a pot of boiled water for drinking appears to have ceased to

exist. This is partly due to the availability of pipe borne water during a part of the year. Since the pipe borne water is purified with chlorine, they believe it is not necessary to further purify by boiling. The other reasons are the present fuelwood scarcity and the women's need to save fuelwood and time.

As pointed out earlier, women prepare tea for guests, perhaps several times a day whenever they have guests. In the past, it was not very difficult to light the fire place whenever it was necessary to offer a cup of tea for a guest since the women used to keep some burning hardwood in the fire place. However, now women find it extremely difficult and time consuming since they do not keep burning hard wood in the fire place. In order to save time and fuelwood that they have to spend to boil water, women of some well-off families keep hot water in hot water plasks so that they could prepare tea without lighting the fire place. In some cases, instead of preparing tea, guests are offered soft drinks that are purchased from local boutiques. It was noticed that the traditional custom of sharing food with guests is not practised now as much as it was in the past. Though husbands welcome guests to share meals, wives are often reluctant to do so because it will cost extra time and fuelwood which they find it difficult to afford. In such cases, it is not uncommon that men take their guests out and treat them in local kiosks.

It was evident that there is a shift from traditional 3-stone open stoves to mud stoves[14] and improved clay stoves.[15] Out of the household surveyed, 17 (49 percent) have shifted to mud stoves and 6 (17 percent) shifted to improved clay stoves from the traditional 3-stone open stoves. This change can be considered as a strategy to save fuelwood rather than to save time, because according to women it does not significantly improve time consumption but it clearly saves fuelwood. Furthermore, in the past when women used to maintain extra food stocks in the kitchen, they wanted to keep the space of the kitchen dry and warm because as it has already been mentioned, dry and warm space was an essential requirement for the preservation of food stocks. Therefore, women did not mind using the 3 stone fire places which generate excessive heat and smoke. However, it was evident that women no longer have such food stocks.[16] Therefore now they do not find any special reason to use traditional 3-stone stoves.

It was also evident that 22 households (63 percent) have shifted from the use of clay pots to aluminium vessels. According to women, the prime motivation for the shift was time saving. Cooking in aluminium vessels is relatively quicker, energy-efficient and also saves fuelwood. However, they still believe that food tastes better when cooked in clay pots. Food can also be kept warm in clay pots for a longer period of time than the food cooked and kept in aluminium vessels. High price of aluminium vessels was mentioned as another disadvantage. In the past when curd was produced, each pot was individually boiled.[17] However, due to the scarcity of fuelwood, the traditional method of curd production has now changed. In order to save time and fuelwood, the total volume of milk is boiled in a big aluminium vessel and then the boiling milk is poured into small clay pots in which curd is produced.

Most of these strategies adopted by women to cope with the growing fuelwood scarcity would bring adverse impacts on economic, social, health and nutritional status of women themselves. In the present study, no attempts were made to find empirical evidence for the possible adverse effects of the coping strategies. But most of the strategies do seem to bring adverse effects. For instance, staying a longer time near the fire place, carrying heavier loads of fuelwood, low consumption of pulses and yams, drinking un-boiled water and eating leftovers without re-warming would adversely affect not only the health of women themselves but also of all others in the family. Ill health of any family member will add extra work to women. The longer time that women spend now for cooking and fuelwood collection would have reduced the time that they otherwise could spend for income-generation. Women's failure to fulfil their responsibility in treating guests in due manner would adversely affect not only the inter-household social relationships but also the intra-household relationship between men and women.

Conclusion

The KOISP has diverted all the resources in the project area for paddy production, and neglected other subsistence needs, especially the domestic needs which women are supposed to provide, e.g. food, fuel and

drinking water. The project adversely affected the traditional fuelwood sources and it failed to provide alternatives. The resulting fuelwood crisis caused much difficulties to women because it is the women who hold the responsibility for domestic cooking which exclusively depends on fuelwood energy. Many of these difficulties are felt by the women of poor families and it is the poor women who suffer most from the growing fuelwood crisis. Most of the strategies adopted by them to cope with the growing fuelwood scarcity have brought adverse effects on women themselves.

Notes

1. Hydroelectricity and petroleum account for 13.3% and 26.7% of the total energy supply respectively.

2. Mainly the secondary forest which has risen on abandoned chena cultivations. Virgin forest is virtually absent.

3. Other commons include all common property resources within the village except the forest, eg. abandoned chena lands (Kanathu), road-sides, canal-sides, river-bank, tank-bed, etc.

4. dead wood floating in the river was collected to be used as fuelwood.

5. Farmers gave top priority to chena cultivation, because it is the crop diversity of chena cultivations that stabilized the household food security. The land brought under chena cultivation was abandoned after 5-6 years so that the soil fertility could be regenerated during the fallow period. It has been a tradition that people first attend to chena cultivation at the beginning of the rainy season. They begin to work on paddy fields only after the irrigation tank is filled.

6. Three stone stove: Three stones are placed in a triangular arrangement to support the cooking vessel while leaving room below the vessel for placing the fuel.

7. Kolapu: Cover of the coconut flower. It is easily inflammable when dry.
   Matalu: A thin cloth-like layer grown at the root of the coconut branches.
   Hanasu: The bunch of coconut stems that remain when coconuts are plucked.

8. Household Food System includes all interrelated activities such as food production, processing, storing, preservation and cooking.

9. A wooden deck upon the fire place.

10. The gently undulating landscape of the Dry Zone consists of ridges and bottomlands (valleys). In the past, while the bottomlands were used for paddy cultivation and for home gardens, chena cultivation was done in the forest on gentle slopes.

11. Size of land plots given as home gardens is 0.5 ha. Women find it grossly inadequate for any farm activity which they could employ themselves productively. Soil infertility and poor access to water also constrain the productivity of home gardens.

12. In the project area, there are no CPR where women could practice chena cultivation.

13. According to the survey report (ARTI, 1986), the relatively better price of pulses in the market is the major reason for selling off the pulses that they produce. However, according to the women interviewed for the present study, it was evident that time-saving over boiling of pulses is also a major reason for the low consumption of pulses. If price incentive is the major reason for the low consumption, they should have eaten much manioc and sweet potatoes which they grow in home gardens since their market price was very low. But, on the contrary, consumption of manioc and sweet potatoes, people prefer to sell them rather than eat them. Therefore, it is safe to assume that the prolonged time required for cooking is the main reason for low consumptin of pulses and yams.

14. A stove built out of bricks and mud which is open on one side for inserting fuel.

15. A stove made out of clay which is open on one side for inserting fuel. These stoves are commercially produced and are small, portable, compact and fuel saving.

16. Now men are the only producers. What they produce is sold in the market.

17. Curd has been traditionally produced and sold in small clay pots, and people still prefer the curd produced in clay pots.

18. It was learned that women's reluctance or failure to treat guests in due manner has led to quarrels between husbands and wives.

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