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WOMEN AND THE ENVIRONMENT

EDITED BY
DIANA BAXTER



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UNIVERSITY OF KHARTOUM

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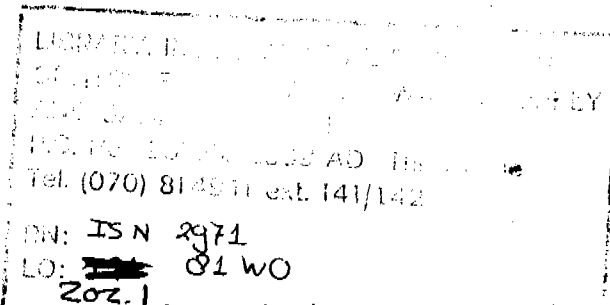
WOMEN AND THE ENVIRONMENT IN THE SUDAN

Papers presented at the Workshop
on 'Women and the Environment'
Khartoum, Sudan

April 4 - 7, 1981

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FOREWARD

Over the past decade women's role in all aspects of social and economic life has become a subject of increasing interest in countries throughout the world. International agencies, as well, are now directing more funds and programmes to women and are requiring that special attention be paid to the effects of projects on women.

In developing countries in particular, women are fundamental to the success or failure of development efforts, but until lately have been the 'invisible' half whose interests have seldom been included. This workshop aims to examine how women affect, and are affected by, the natural environment. This is a topic of considerable importance as the environment is not only vital for agricultural development, which is the backbone of our national economy, but is also a crucial factor which touches women's lives daily.

I would like to outline the background of the Institute of Environmental Studies, which is sponsoring this workshop.

The origins of the Institute go back to the Stockholm Conference on the Human Environment in 1972. The interest generated in the Sudan by this conference prompted the University of Khartoum to set up a committee to look into the possibility of establishing an institute that would be the focal point for research and training in the problem areas of the human environment that seemed significant. The plans became a reality when the Ford Foundation gave a grant for the first two years of operation and, in August 1979, the first group of nine post-graduate students were enrolled.

The Institute, which is the first of its kind in Africa, has two main functions--training and research. The first year of the two-year programme is devoted to course work in which the students from different disciplines are introduced to the fundamentals of environmental science. Some of the courses are also designed to train the students in specific research techniques and methods which will be used in their field work. Some of the areas of study that the students are working in are: freshwater ecosystems management, arid zone management, urban and regional environmental management and Red Sea coastal

management. The precise topic for research within these areas is selected by the students in accordance with their interests and training to serve, as far as possible, the government agencies from which they come.

The Institute recognises, however, that the natural environment cannot be looked at in isolation from its human counterpart. Many of the stresses placed on ecosystems can be attributed directly to such man-made factors as population growth, changes in land use, alterations in consumption patterns and new technology.

When we examine closely the activities of households and how they relate to the environment, what we discover is that, in both rural and urban areas, it is the women who make the primary contacts with those elements of the environment that are the basis of family life--water, fuel and food, hence their importance in any changes intended to improve the environment.

It is not expected that this workshop will come up with definitive solutions for women's problems, but rather it will take stock of the major areas requiring change in the Sudan, and formulate some concrete ways of effecting these improvements. It is the beginning of a process that will hopefully lead to a betterment of women's position within the environment, and hence their social and economic positions as well. Such a change can only be welcomed as it will ensure the future well-being of the nation as a whole.

Professor Mamoun El Khalifa,
Chairman,
Institute of Environmental Studies,
University of Khartoum

PREFACE

The idea for this workshop arose out of an earlier attempt to design a comprehensive research proposal for studying ways of bettering the conditions under which women operate in the natural environment both to improve their lot and preserve the fragile ecosystem of the Sudan. What the Planning Committee realized early on is that it could not proceed until it had a sense of what research is being carried out currently in this area so that gaps could be identified. This, then, was the primary aim of the workshop: to bring together people who were working on projects or programmes related to women and the environment and to determine where emphasis could be profitably placed.

Another important consideration was that the majority of Sudanese people, including women themselves, are still unaware of the crucial role women can play in preventing deterioration of the natural and human environments. Through this workshop, and the work of the Institute that will follow, we hope to inform the public of the situation and, in time, involve them in efforts to ameliorate it.

During the workshop, small groups identified salient issues and on the final day, the participants (120 in all) worked on each topic area to finalize the research areas for further investigation. A prime criterion was that the topic of study be practical and action-oriented, geared to raising the standard of living of women within the context they must now function. While it is recognized in a number of the papers, that a long-term solution to women's problems will require a fundamental change in many structures and customs in society, we wish to begin with manageable short-run approaches. The final research topics developed during the workshop are given in Appendix A.

The Institute will be seeking funding for a number of small research projects on these topics. It is hoped that three to four of them would be funded each year and be completed within a two-year time frame. The results of this research will be made available to planners and policymakers.

The papers given during the workshop addressed the following environmental issues: water supply and health; energy, wood supply

and deforestation, and agriculture and nutrition. Not surprisingly, these are all areas where women are actively involved. Recognizing that women cannot be considered in isolation from the social, economic and political influences in their lives, the Planning Committee decided to devote the opening session to those issues in order to set the context for the rest of the discussions.

I would like to point out that in the preparation of the manuscript every effort has been made to provide accurate references; this was hampered somewhat, by omission in the original papers and the fact that the final version was completed in Canada, preventing access to authors and publications unavailable here. I hope that any remaining omissions will not unduly inconvenience the reader. Also, in an effort to keep the publication to a manageable size and to reduce repetition of points covered among a number of papers, I took the liberty of reducing them to a more uniform length, though I tried to remain faithful to the principal ideas and themes of each of the authors. I apologize for any failings in my interpretation. It should also be noted that the transliteration of Arabic works has been carried out freely, following the rendering given by authors or one which will be easy for the non-Arabic speaking reader to follow.

To mount and implement a workshop of this size and scope in such a short period of time requires the help and support of many people. I would like to acknowledge the considerable contribution of the members of the Planning Committee who were instrumental in designing the workshop and participating through their papers and commentaries: Amna Ahmed Rahma, Amna Beshir, Asha Mustafa, Balghis Yousif Bedri, Fahima Zahir Al Sadaty, Fawzia Hammour and Judy El-Bushra. My gratitude also goes to the staff and students of the Institute for Environmental Studies who cheerfully assisted when help was needed, and to Professor Mamoun El Khalifa, Chairman of the Institute for Environmental Studies, who facilitated the organization. The staff of Friendship Hall, site of the proceedings, are to be commended for their untiring efforts to make the workshop a success and for providing such a pleasant and well-co-ordinated environment to stimulate thought and discussion. A special word of thanks also goes to Dr. Joseph Whitney who, as consultant to the Institute, provided the impetus and momentum for this project while at the same time giving guidance and support whenever needed. His constructive comments have been most helpful in editing the proceedings.

While the papers herein will, I hope, contribute to our store of knowledge about both women and the environment in the Sudan, their greatest values will be realized if they become a springboard from which we can leap toward solutions of these pressing problems.

Diana Baxter

OPENING ADDRESS

Sayda Nefissa Ahmed Al-Amin
Secretary General,
Women's Committee of the
Sudanese Socialist Union

First allow me to commend this valuable initiative by Khartoum University which reflects the scope of the University's concern for the vital social problems that need a deep and sober scientific approach. The problem of woman and environment, which we are about to discuss, is a most important and persisting problem which needs the application of academic research. Moreover, it is a major axis of the universal development in Sudan. Within this context, the issue of woman and her environment goes beyond her traditional submission to the exigencies of the environment to an exploration of ways to harmonise the needs of both people and the natural setting they live in.

Considering that more than 80 per cent of the population live in rural areas, we can emphasise that the environment is an integral aspect of the structure for lives of the rural human beings, family and women, as well as of their economic and social development.

Women have long had to deal with the environment to attain their daily needs, thereby learning production, and to adapt to changes to survive. Sudanese society, as any other developing society, is still dominated culturally, economically and socially, by a variety of civilised patterns. In spite of their co-existence and interaction, there is considerable diversification among various groups and roles people play. This lays upon womens' shoulders a heavy burden in adjusting to such different environments as agriculture, animal husbandry, and modern industry.

Women in Western Sudan, for instance, remain a major instrument in agricultural, pastoral and animal husbandry activities; she hews wood, carries water, builds houses, while also giving birth to children and rearing them. Women in Southern Sudan work in animal husbandry besides participating in the production of local raw material goods. Women in Northern and Central Sudan have worked side by side with men since the dawn of the Nile Valley civilisation, and the role of women in Eastern Sudan is also closely related to the nature and requirements of the environment.

Women in the urban environment engage in various modern

complicated fields that demand scientific qualifications and occupational specialisation. A large sector of women are now employed in different fields of work: occupational, industrial, commercial, banking, etc., in a manner unprecedented in the history of Sudan.

Historically, woman's ability to deal with her environment was limited by social backwardness, illiteracy and the domination of many values and traditions that hindered her movement to make full utilisation of her resources and potential capabilities. But the May Revolution constituted a decisive turn in the process of social change witnessed by Sudanese Woman in her social, economic, political and legal status. After the May Revolution women gained many rights and successes for which they had been struggling since the beginning of the Sudanese Women's movement during the imperialist era, after independence and during the military dictatorship. The women established, during this era, a universal organisation in its structure and membership, to effect the social change among women, to integrate them into society and utilise their capacities and potentialities to build the nation.

We, in the Women's Secretariat and Sudan Women's Union, know perfectly well that the social problems of women are very complicated due to inherited backwardness, illiteracy and ignorance, particularly among rural women.

Though the problems of women and environment are tackled by different executive organs such as Ministries of Health, Education, Agriculture, etc., our Union formulated an integrated plan to deal with the problems of women and their environment, such as:

Enlightenment and guidance in the fields of health and social services; promotion of prevention of environmental diseases, including enlightenment about diseases caused by unsafe water; development of housing in rural areas and marginal extensions around the cities; encouragement of utilisation of environmental raw materials and establishment of a central market for marketing their produce; training and qualification of women leaders.

The social problems related to women can only be solved with intensified and integrated efforts from many agencies and disciplines to come to some fundamental solutions. I am confident that this workshop will reach some sound conclusions that will contribute to formulating a clear vision about the existing relation between woman and her environment, and how to utilise different resources for local communities. I assure you that your recommendations and resolutions will find every concern from the competent bodies and will be executed and implemented.

INTRODUCTION

WOMEN AND ENVIRONMENT: A DOWNWARD SPIRAL*

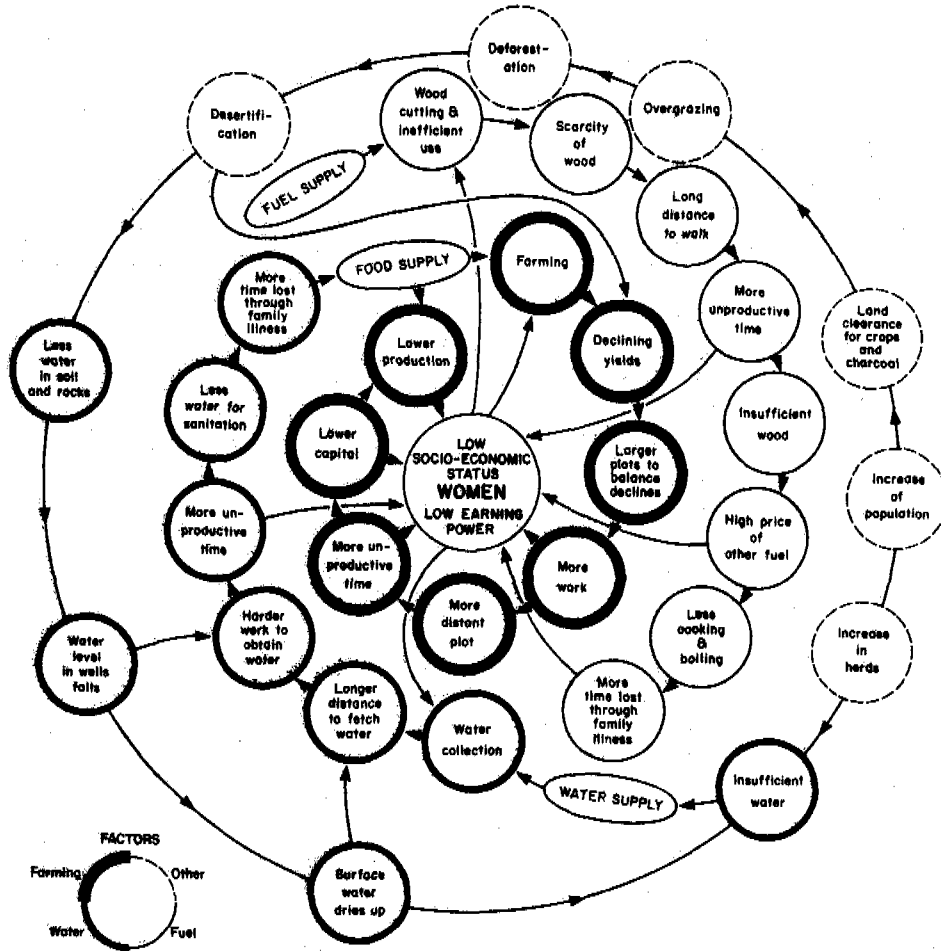
Diana Baxter

As the early morning light breaks over Sudan, millions of stoves and fires are lit and cups of tea made. By the time the sun has reddened the sky, half of the population is engaged in milking goats and cows and feeding their families. Still in the cool of the morning, they can be seen trekking several kilometres to their fields where they put in a full day cultivating and sowing. In between, flour must be ground, meals prepared, water fetched, wood collected and children tended. As the twilight gathers they are still busy cooking, cleaning or making handicrafts to supplement the family income. This half of the population which performs these duties is crucial to the country's economy, yet these are the ones most often overlooked by planners and policy makers--Sudanese women.

While frequently not recognised as such, women are a very important link in the chain between development and the environment. In the first place, women are instrumental in many activities that both utilise and/or affect the environment: agriculture, animal husbandry, handicraft production, food preservation and preparation, and water and fuel collection. Secondly, due to the nature of women's relationship to the environment, which tends to be at a basic and subsistence level, they are much more adversely affected than men by changes in the balance of nature. Furthermore, since much of their time is already spent in tasks directed to the maintenance of the family, such as feeding, housing and nurturing, which are generally regarded as 'unproductive', any increase in women's workload or reduction of their efficiency goes largely unnoticed. Thus, in most development projects, even those directed to improving the environment, women are the 'invisible' half who are always affected but seldom taken into account. How is this cycle in which women are trapped in a low social and economic position maintained?

The diagram illustrates the chain of relationships between the environment and women's activities that results in a downward spiral, reinforcing their disadvantaged social position. As the environment becomes imbalanced and natural resources are

* This article is being reprinted from Sudanow, March 1981 with kind permission.



Spiral of neglect: Men generate environmental problems, women deal with the consequences

reduced or eliminated, the work women must do is increased, family health is affected and more of women's time is consumed in household tasks, leaving less opportunity for the income generation which could improve their status.

The starting point in this downward spiral is found in the roles that are socially assigned to women in the family and, hence, in their wider environment. As in most other cultures, Sudanese women have traditionally been homemakers and nurturers, bearing and raising children and performing all tasks needed to maintain family well-being. This includes carrying water for daily needs, collecting fuel for cooking, and gathering vegetation for food and handicrafts. Much of the processing of food is regarded as 'women's work': winnowing, washing, pounding flour, making roab (yogurt) and semn (liquid butter) as well as drying fruits and vegetables. In addition, women are very active in food production, from raising domestic animals to being the sower, cultivator and harvester in subsistence agriculture.

Thus, women provide economic benefits directly to the family in many areas through their own labour. In Western Sudan they do heavy labour both on farms and in construction work. In Eastern Sudan, women build houses, make and sell handicrafts and assist with cotton picking and fruit growing. Semi-nomadic women frequently engage in agriculture as well as in rearing goats and chickens. Southern women also spend a large proportion of their time working on farms. Given this close alliance to the land, it is not surprising that women's lives have been dramatically affected by the changing ecology in all areas of the country.

Because the majority of the population relies on the land for its livelihood--either the 71 per cent who are cultivators or the 11 per cent who are nomads--the national economy is very vulnerable to changes in soil fertility, water supplies and pasture availability. Ironically, however, it is these same agricultural and pastoral activities which are creating one of Sudan's worst environmental hazards--desertification. Desertification refers to the destruction of ecological potential of the land resulting in the extension of desert-like conditions into areas which were hitherto productive. This process is primarily the result of man's misuse of semi-arid lands through over-grazing, over-cultivation and deforestation. When marginal lands are subjected to the pressures of increased human and livestock populations, particularly around man-made water supplies, it is inevitable that the fragile arid ecosystem will be destroyed.

The effect on human populations is also severe: the land is less productive, agricultural yields decline and there is less grazing for livestock. In some badly affected areas, such as Kordofan and Darfur in the West, there is an out-migration of younger men, leaving the women to support and care for the families. Even when the men are present, women are more

seriously affected by soil deterioration because they do most of the cultivation. In the Sahelian Zone, for instance, where the population is nomadic or semi-nomadic, the men are engaged in overseeing the herds or protecting them from rustling, leaving cultivation to the women. These semi-arid lands already have low agricultural potential and, in the past, crop rotation was practised to allow the fallow lands to regenerate fertility over several years. Now, with increasing populations in the area, intensive cultivation and excessive use have depleted fertility in the lands nearest the settlements, with the result that women must work harder to farm larger areas for the same production. Since no suitable land is left at the original site, they must travel longer distances to widely scattered fields in order to find sufficient area. Thus their workload has intensified with no commensurate increase in crops.

Closely related to the problem of desertification, as both cause and effect, is the increasing deforestation of Sudan. There are few places in the North where tree stocks have not been drastically reduced: for every 100 feddans of timber cut, only 70 are replaced naturally (Whitney, 1981). Ninety-eight per cent of this wood is used as fuel for domestic purposes, including that used in cottage industries, such as pottery making and baking. Women, who are the main participants in wood collection, distribution and consumption, are also the most directly affected by diminishing supplies. As forests near villages disappear, women are forced to walk farther and farther away to obtain enough fuel for their daily needs. In some areas, they may travel as much as 15 kilometres in a single day. For the most part, men help only in felling and cutting larger trees and occasionally marketing the wood. Men are responsible for charcoal production, although women may assist in chopping branches, and are its prime consumers.

One important factor in determining the amount of wood that must be collected is the effectiveness with which it is used. For the most part energy use, especially for cooking, is very wasteful in Sudan; open fires consume large quantities of wood, and the traditional charcoal burning stove with its unnecessarily large ventilation holes is less than 18 per cent efficient. Recent experiments have demonstrated that with modifications these stoves can increase to 25 per cent efficiency (Mudathir, 1981). The implications of such changes are considerable, as they would reduce by half the number of trips required by women for fuel, as well as retarding the elimination of woodlands.

In addition to the time spent in obtaining it, there are other effects caused by the scarcity of wood on women and their families. When supplies are short and hard to find there is a natural tendency to conserve fuel, which, in the absence of more efficient stoves, is done by limiting the number of cooked meals made per day, switching to foods requiring less preparation time or that can be eaten cold, and by not boiling drinking water. These dietary changes can have deleterious effects on family

health since many of the alternative foods are less nutritious and illnesses develop from untreated water. Also, women's economic status may be altered when they are hindered from pursuing cottage industries, such as beer making, which depend on wood.

Environmentally, this decimation of forests exacerbates the problem of desertification, for, with fewer trees in an area, soil erosion occurs and in time the natural vegetation cannot regenerate. The land becomes dry and barren and even marginal uses that once sustained nomadic and semi-nomadic tribes become impossible. The most serious alteration occurs in the water balance. With the absence of plant roots and organic material to hold rain in the soil, there is increased loss of water through both evaporation and run-off, leading to less sub-surface water and eventually to declines in water reserves in aquifers (water bearing strata). The result is that the water supply decreases substantially and people must work harder to find sufficient water for even their basic needs.

Again, since women collect the water they are most affected by its disappearance from an area. It is not uncommon for women to spend up to one-third of their day drawing and carrying water and, in areas most affected by desertification, groups of women may travel up to three days to fetch water for their families. In a study in Bahr el Ghazal Province (Russell, 1979) women reported making 32 trips a week to collect water. Most of the water was used for drinking, food preparation and household tasks, while four trips were for clothes washing water. Even when wells are nearby, pulling the water several metres to the surface is difficult work. Two or more women are needed to bring the water up, and they often suffer from irritated and calloused hands.

Some parts of Sudan have bore holes installed with pumps, but these too have their difficulties: long line-ups may consume as much time as the trip to other water sources; pumps often break down and may not function for months if spare parts and benzene cannot be found; or other, less safe, water sources may continue to be used during the rainy season because they are closer. In villages where water is brought to the houses by donkey, some families may not be able to afford the cost. Although the provision of bore holes seems a relatively simple solution to the water supply problem, nearly 75 per cent of the country is not underlain with the water-bearing strata necessary for bore holes to function. Even when bore holes are present and working, they can create a 'cone of depression' effect, pulling water away from nearby areas, causing wells to dry up and women using them to struggle harder to raise the water.

Another important effect of water shortages comes in the area of environmental health, when a host of diseases results from the use of unsafe water for washing and sanitation. Water-borne diseases, such as malaria and schistosomiasis, are becoming more prevalent in Sudan, spread by development in the form of irri-

gation canals, ponds and dams which provide the breeding ground for both mosquitoes and snails. As people migrate in and out of these irrigation schemes, they spread diseases to other areas. Where malaria is present, the population experiences more infant mortality and susceptibility to other forms of infection, and pregnant women often miscarry as a result of disease. Also, where water is scarce, eye and skin diseases are caused by insufficient bathing.

The transportation and storage of water can introduce health hazards. Attempts to conserve water by putting twigs or sticks on the surface while it is being carried may contaminate it. In the West, where the baobab tree is used as a storage reservoir for water, it may be polluted by bird and bat droppings. Tar on the water skins used to convey water on donkeys can cause illness, as can keeping it in uncovered jars. On top of these risks, the desire to preserve this hard-won water results in poor sanitation--not boiling drinking water, not washing hands or dishes or babies' bottles, nor cleaning water containers properly. Diseases resulting from such omissions are a major cause of infant morbidity and mortality since bacteria in drinking water or from unclean utensils cause diarrhoea, producing malnutrition, dehydration and death.

Illnesses arising from lack of hygiene affect women in two ways. One is that they are responsible for caring for the unwell members of the family, which may include spending many hours travelling to a health centre or pharmacy, and the other is that they become ill themselves. Other environmental changes also jeopardise their health. For example, walking long distances over rough terrain carrying heavy loads can result in falls, strains and other injuries. With few labour-saving tools, much of women's work is heavy and exhausting, and their long days with child care added to an already demanding workload mean they get little time for rest or leisure. Certain traditions may affect nutritional status and hence, their health. In some tribes it is customary for the men and boys to eat first and be given the choicest foods. This can adversely affect growing girls and pregnant or lactating women who have extra requirements for particular nutrients. It may also mean that women who have manual tasks to perform are not getting adequate calorie and protein intake. With poor health and no spare time, there is little opportunity for women to improve their status.

So the spiral has taken its full course from the environmental hazards right down to the impact on women's social and economic position. While the major environmental problems are generated largely by men's activities--livestock herding, charcoal production and mechanised farming--it is the women who cope with the consequences on a day-to-day basis. Ironically, efforts to ameliorate the effects of such problems in the form of afforestation projects, Gum Arabic plantations, cash-crop projects and range management schemes, aim at improving incomes which go directly into the pockets of men and only indirectly and, to a limited extent, to women and subsistence peasant

families. Little account is taken of how a development project might affect distribution of income within and among families. For instance, projects that increase employment among men may raise family incomes so that wives no longer work and adopt the preferred urban custom of seclusion, thus limiting their access to an independent income. Similarly, when a milling machine is introduced into a community, landless women, who rely on income they receive from manually pounding grain, may be made redundant.

Women's access to goods and services derived from projects is often limited by customary or legal restrictions on their rights to land, credit and schooling. Illiteracy is high among rural women, which makes it difficult for them to learn new skills. Also, the more time they must devote to unrewarding and un-lucrative tasks, such as collecting water and wood, the less time they have available for income generation. Even when they do work outside the home, it is usually in subsistence farming. Women's role in agriculture aptly illustrates how they are locked out of the benefits of development.

A large number of rural women in Sudan are economically active--622,000 compared to 71,000 urban women--and 90 per cent of them work in agriculture (ILO, 1978). Although the majority of their time is spent in producing food, most of it is consumed by the family and, hence, brings in little income. Even when women do work on agricultural schemes, the type of work done is seasonal and poorly paid, and such labourers are often exploited. When farming improvements are introduced, they may be out of a job altogether. For example, when the Gezira Scheme was established in 1925, women participated in clearing land, mounding, sowing, weeding and harvesting, but recent studies have shown that with these tasks largely assumed by machines, there has been a shift of women away from wage labour. When investments are made in agriculture, the tendency is to concentrate money and efforts on improvements that expedite the work that men do rather than on less costly technologies that would facilitate women's labour, such as improved hand tools, animal drawn equipment, solar cookers, methane stoves, storage cribs for crops, and mills for grinding flour. Very few women receive vocational and technical training in agricultural technology.

How then, can this downward spiral which so many women are experiencing be reversed? Such problems as have been described here are not unique to Sudan, nor indeed to women; in many societies, disadvantaged groups are the first to suffer when economic or environmental deterioration occurs, and the last to gain when there are improvements. But for women, in particular, their inequality at each level of society, generated by the traditional division of labour, customs promoting seclusion, the double burden of work and domestic responsibilities and their exclusion from education and training, is reinforced by degradation of the environment. The first step to break this pattern is to give women access to social resources in the form of

literacy and vocational training and services, such as adequate transportation, child care and health facilities, which will permit them to move into the money economy. Development programmes, especially those related to the environment, must become more sensitive to women's needs. Women themselves must gain more political power before they can influence government policies and the redistribution of wealth.

It is true that in a developing country like Sudan, everyone must struggle against a harsh existence, but only when the benefits of development are available to all its citizens will the nation prosper.

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PART I.

WOMEN AND THE SOCIAL ENVIRONMENT

SOCIO-ECONOMIC DEVELOPMENT
AND WOMEN'S CHANGING STATUS

Judy El-Bushra, Abebech Bekele and Fawzia Hammour
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WOMEN AND DEVELOPMENT

After several decades of neglect, women are now figuring prominently in the concerns of development planners, administrators, and aid agencies. This concern arises partly from the realization that women have been an underused resource which few countries can afford to ignore, and partly from an understanding that the benefits of "development," such as they are, have been spread unequally. Indeed, there is evidence that development often results in actually lowering the material standards of women, and consequently of the future generations in their care. It is thus time to take stock of just what the impact of socio-economic development has been to date on the lives of women in the Sudan.

In a society like the Sudan's, in which the overwhelming majority of the population live directly from the land and its fruits, access to environmental resources such as land, water, fuel, crops and animals and building materials, is a crucial variable in the economic status of individuals, families and communities and therefore lies at the heart of the problem of women's socio-economic status. Thus, in this workshop we are concerned with women's control over environmental resources, and with the information, skills and political power which are needed if women are to make good use of these resources.

The Development Studies and Research Centres "Women in Development" project attempts to contribute to a positive improvement in the status of Sudanese women through a programme of linked research, documentation, dissemination and training activities. It aims to promote greater economic independence and access to decision-making processes for women, especially those less privileged in terms of wealth, status and education. The project is as yet at an exploratory stage and has so far limited itself to identifying what is known in the field and what important gaps in understanding need to be filled.

In this paper, we will show that development has been a mixed blessing for women, bringing opportunities and progress for some but severe problems for others. Our second argument is that

women as a group (and indeed the whole population) will not benefit from the fruits of development unless fundamental changes come about in the overall pattern of control and distribution of resources, whether these resources be economic and technological, information and education, or power to influence the decision-making structure.

The DSRC project has so far revealed more questions than answers. For this reason, rather than trying to present concrete findings, we propose in this paper to summarize what we know of the "state of the art" of research around the topic of "women and development," discussing some major theoretical considerations and indicating the sort of research which has been done so far. The paper will be divided into three sections: economic participation, the social impact of development, and participation in decision-making and planning.

PARTICIPATION IN THE ECONOMY

Globally, much research has already been done into the effect of development programmes on women's role in agriculture and their participation in the cash economy. The general picture is a depressing one. In regard to the impact of development on subsistence agriculture, for example, development programmes have been identified by no less a body than the World Bank (Lele, 1975) as being an important contributor to rural poverty and malnutrition. The argument goes like this: development projects aim to bring subsistence farmers into the orbit of the cash economy, and increase their productivity, both to decrease national reliance on food imports and to raise local incomes. Cash crop production however, requires significantly increased contributions from rural families in the form of land use, cash expenditure and labour. This means that families have less time and energy to spend on producing food for their own consumption. Moreover, the financial rewards of cash crop production are increasingly failing to meet the family's basic living requirements. So rural people have to resort to other additional means of acquiring money: for example, by borrowing money (often at extortionate rates), by wage labour migration, or by labour-intensive income-generating activities at home. These strategies, though usually regarded by planners as evidence of "modernization" are frequently entered into by force of circumstances rather than by choice. The burden placed on women is especially high, as it alters the patterns of sexual division of labour. In the past, the argument goes, there was a rough balance in the division of labour in the family. Especially in Africa, women were responsible for maintaining daily family food needs (by vegetable gardening and food processing, for example) while men contributed the heavy labour needed to produce staple crops. Now that rural families are obliged to put their major efforts into the production of cash crops, women and children are pressed into helping with heavy agricultural work to the neglect of domestic crops, thus contributing to the spiral of

physical strain, malnutrition and poverty. Moreover, development planning, even now, tends to assume that men are the "breadwinners" in rural Africa just as they are by tradition in the West, and so supporting inputs such as improved seed, credit and marketing facilities and agricultural extension services, are directed mainly at men, even though in some places women carry out an estimated 80 per cent of the agricultural work (Rogers, 1980; Young). Thus the previous balance has been tipped in favour of men, and women are increasingly carrying the burden imposed by male labour migration and the need to manage and support the family in the resulting absence of men.

In much the same way, in regard to other forms of economic activity women are similarly caught between their role as family food-providers on the one hand, and the pressures of a free market economy on the other. The literature abounds with descriptions of mothers who are obliged by the demands of a "modern" economy, in which everything has to be paid for, to leave their children behind uncared for while they scratch a living selling peanuts, washing clothes, portering sacks of concrete, or working in domestic service (Wellesley Editorial Committee, 1977). The increase in prostitution observed in many a boom-town owes much to women's position as fall-guy in the process of socio-economic development (Tourism and Prostitution).

How far is this depressing global picture mirrored in the present-day Sudan? A first point to be made is that few generalizations are possible: the position varies from one part of the country to another and from one economic stratum to another. In the Gezira Scheme wives of the tenants are rarely found working in the fields. This holds true for several areas of the Northern Sudan, but in the Southern Region and in parts of the North the picture is very different, as illustrated by the background papers prepared by the then Ministry of Social Welfare for the ILO Comprehensive Employment Strategy Mission to the Sudan in 1975 (UNECA Women's Programme). These still form one of the major research contributions in this field, and draw on a wealth of anthropological research, official statistics and a special survey comparing women's economic role in Darfur and the Red Sea area. The papers indicate, for example, that in the traditional sector in Darfur, women participate to the extent of around 35 per cent - 43 per cent in major agricultural operations such as cleaning fields, turning the soil, sowing and planting, weeding and harvesting. In contrast they do about 12 per cent of work connected with grain storage and only 0.9 per cent of crop transport and sales. Less than 10 per cent of the money made from the sale of crops is kept by women, but women's income is supplemented by the sale of handicrafts and agricultural products. In addition women in this sector cook, fetch water and wood, and care for children, helped significantly by their daughters. In nomadic sectors, on the other hand, women contribute heavily in non-agricultural activities such as house-building and animal husbandry.

The reports show that in modernized agricultural sectors, notably in the west of the country, women often do more work than men in agricultural operations as a whole, especially in weeding, watering, harvesting and storage and in the care and harvesting of tree-crops. Men, on the other hand have the main share in marketing operations. Women from agricultural areas near towns also supplement their income from labouring of various sorts. In other words, "development" does not seem to have reduced the burden of women's work on the basis of this comparison.

HEALTH

The first question to which investigation should turn is how far development in general has resulted in a rise in health standards. As far as health services go, in rural areas, government services of all sorts have still hardly penetrated. There are still innumerable villages where there is no electricity, no school, no dispensary, no transport, no radio or television and no clean water. Nomadic communities are even less well served for obvious practical reasons. In more densely populated areas where provision of services is more feasible the picture is different. In Gezira Province, for example, where 2 per cent of the net cotton revenue from the great Gezira Scheme is allocated to social services, there were in 1977 a total of 19 hospitals, 1,847 hospital beds, 32 health centres, 150 dispensaries and 450 dressing stations, giving a much higher ratio of services to population than the country as a whole. Thus in the case of the Gezira, the irrigated agricultural development of the area has provided the inhabitants with significantly better facilities than other rural parts of the country. (Saeed)

The question however remains unanswered, for better services alone do not necessarily result in a healthier population. The infant mortality rate, at 135-145 per 1,000 living births, is still unacceptably high, and the major killing and debilitating diseases are still the preventable ones - gastrointestinal and respiratory illnesses, malaria and bilharzia, and malnutrition - (El-Dawwi) which thrive in poor environmental conditions. Moreover, though lack of services may partly explain the poor health of rural communities, this is not the case for poor urban families who suffer all the strains of modern urban life without appearing to reap any of its benefits. Nutritional standards among poor urban families seem to be lower than that for both middle-class urban and rural families (El Shazali, 1973). Squatter settlements on town peripheries, with poor housing and no piped water, are cut off by distance from the safety-net of subsistence farming, and by cultural and economic factors from official services provided nearby. The physical and mental health of these communities is perhaps one of the most immediate causes of concern in the health field.

In addition to the general health picture, women are affected in certain particular ways. The burden of women's work in the Sudan is shown clearly by age statistics (El Dawwi) which show that after the age of 35 the proportion of women in the population goes down progressively. In other words, women are living shorter lives than men, the opposite of what one expects on the basis of world experience. Furthermore, a variety of social and environmental factors detrimental to women's health, such as female circumcision and frequent childbearing, show no sign of disappearing in spite of increased educational facilities and better communications. Fertility too is closely bound up with women's health, and needs to be seen as an issue of national policy. The usual assumption on the part of both policymakers and the general public is that the Sudan is underpopulated and that, given the large percentage of cultivatable but presently uncultivated land, a sizeable increase in population can easily be absorbed. This view ignores two serious objections. Firstly, the high level of parity found among many women affects the health of both mothers and children adversely. Secondly, the population growth rate (estimated at 2.8 per cent nationally) undoubtedly puts heavy pressure on the country's already precarious food resources. Population increases have been partly responsible for the overcultivation of grain crops and overgrazing in areas of uncertain rainfall, and hence for the spread of the arid zone. (Ibrahim, 1978) Population increase, moreover, adds to the over-growing gap between social welfare services actually provided and those needed.

Looked at from the point of view of individual families, however, the picture is rather different. Large families are rationally - viewed as an investment, bringing in both financial and social bonuses later in life. Jay O'Brien, for example, found that a successful farmer in a Rahad village would need his wife or wives to provide him with several sons in quick succession early in his adult life, in order to provide the necessary labour later on when the family reaches peak size. (O'Brien, 1980)

EDUCATION

Many of the points raised in relation to health apply equally to education. The expansion of schooling for all, including women, is one of the features of post-independence history in nearly all developing countries. Education brings women increased social mobility and access to professional opportunities hardly credible a decade ago. However, educational facilities for girls still lag far behind those for boys, as a quick glance through Ministry of Education statistics shows. The disparity begins in primary grades and increases at every stage of the educational ladder. Thus, not only do fewer girls than boys ever attend school, but those girls who do go to school leave earlier and stand a much lower chance of achieving academic success at higher secondary or tertiary level and with it, of entering the professions.

One might expect that adult education for women would be more closely geared to real-life working situations, and indeed beginnings have been made in this direction. Every province has a certain number of women's centres which offer child-care and medical facilities while mothers meet each other and learn about nutrition and hygiene, literacy or handicrafts. Some also attempt to organize their graduates into working groups producing goods for sale. Many such centres have achieved success in terms of numbers of graduates, skills taught, and so on, but have faced problems which have limited their effectiveness. Students often do not find transport, staff are unavailable, equipment in short supply. Worse, centres are often badly planned so that they get built, for example, in prestigious residential areas rather than in the poor neighbourhoods where the students are supposed to come from (El Wassela, 1980; Eyben, 1978). This indicates the chronic lack of skills in research and project preparation, among aid agencies and government organs alike.

DECISION-MAKING

Women are formally represented in political structures in three ways. Firstly, a minimum of 25 per cent of the membership of every local council must be women, according to the 1971 Local Government Act. Secondly, the Sudan Women's Union was set up as a sort of "Ministry for Women," pressing for women's needs at every political level within the structure of the SSU network. Thirdly, provincial councils include a certain number of seats for Women's Union representatives elected by WU members from the lower levels. Thus the political will for women's participation in the statutory organs is there. Whether or not these statutory organs are themselves truly participative is an open question beyond our present scope; beyond that, there are some other questions which need to be raised. The question of women's participation in local government has hardly begun to be documented. Most of the remarks in this section are based on discussions with people experienced in this field rather than on formal research findings.

The 25 per cent women's representation on councils is widely held to have failed to establish women within the decision-making structure. In most councils the 25 per cent level has never been reached, and many women who have become council members have failed to earn the respect of their communities. Three main reasons are usually advanced for this. Firstly, the common assumption that only disreputable women would put themselves into the public arena discourages many women from taking part, and adversely affects the social standing of women who do take part. Secondly, the bad name of the local government system in general as being a channel for corruption discourages large parts of the population, men and women. Thirdly, women themselves are not fully aware of the opportunities presented by the system, or of how they as women might make use of them. Moreover, women tend not to even think of themselves as having any influence over decision-making. Thus issues such as the

siting of water-pumps or health facilities, of vital concern to women, tend to be decided arbitrarily, or else in reference to men's needs, not women's, and all women can do is complain among themselves after the event. However, it is not really clear what the extent of women's participation in local councils is, over the country as a whole. It is quite possible that in parts of the country where women are most active in economic fields outside the home, they also have a much bigger say in formal government structures.

More attention also needs to be given to the role of women in the underlying social structures on which "development" is being overlaid. Some anthropological accounts (such as Cunnison's of the Baggara (Cunnison, 1963) have documented the political strength of women in former times and described the channels through which it operates. Modern political mechanisms do not build on these traditional patterns; indeed, the present administrative structure is an overt attempt to dismantle them and replace them with one which is, supposedly, more egalitarian, more effective, more involving the mass of the population, and more in tune with the needs of a modern nation. Whether this policy is either correct or effective is in doubt. Certainly, we do not know enough about how far indigenous systems of decision-making involved women, much less about how current social, economic and political changes have affected their involvement. In theory, the current local government system offers an open invitation to all adults to express their views, regardless of status. But it may be that it simply represents a foreign, imported ideology which women are not associated with, thereby effectively removing them from the arena.

CONCLUSION

It is difficult to draw conclusions from a paper which is itself basically a collection of conclusions. We hope that, if nothing else, we have shown in what areas our ignorance lies and what issues are least illuminated by research.

The main line of argument in this paper rests on the assumption that women's most pressing need is for more independent control of economic resources, of the secondary resources such as health and education which enable them to take best advantage of available opportunities, and of the systems by which these resources are allotted. We have tried to show that by and large, in spite of some minor improvements brought about in recent times, and among small sections of the population, the majority of Sudanese women have not acquired this independent control.

We have also assumed that changes are needed not so much in the position of women vis-a-vis men (though some would argue that society itself is a male-dominated institution) but in the patterns of resource distribution over the country as a whole, and indeed between the Sudan and the world as a whole. We would argue that piecemeal changes will not bring about lasting

improvements as long as the world economic system remains inequitable and exploitative, and as long as such drastic imbalances persist in the Sudan as between urban and rural communities, between different parts of the country and ethnic groups, between land-owners and peasants, between groups of different political persuasions, and between the growing divisions based on economically-defined classes which appear to be one of the most insidious results of socio-economic development.

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WOMEN AND THEIR ENVIRONMENT:
A GENERAL VIEW

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In this general paper, I contend that the "Environment" is conceived in its socio-cultural and eco-political as well as its physical dimensions. Thus, any venture that claims to relate women to their environment must be made within a socio-economic and political framework, and should be dealt with by a comprehensive plan or policy. Environmental conservation and improvement should also be so conceived. Furthermore, women share certain problems with other components of society at the same socio-economic level and cannot be seen as separate entities. Therefore, any solutions to radically improve women's environmental handicaps cannot be achieved separately from a total societal transformation. Finally, by way of practically suggesting a strategy for action, definite proposals will be put forward at the end of this general paper.

Perhaps, now, it is commonplace to talk about women and their problems. As a result of such events as International Women's Year in 1979, and a recent proliferation of women's literature, women's studies, women's discussion and study groups, women are being 'discovered.' Yet in the Sudan, the women's liberation movement which in the later 1940s and from its early years, realized that women's difficulties could not be solved in isolation from economic and political changes in society.

In satisfying fundamental human needs through environmental management, there is rarely an easy answer, or simple solutions. Choices must be made: among the needs to be satisfied, among methods chosen to satisfy these needs, and the environmental and other side-effects which those methods imply. Perhaps of crucial importance here is the position of women in their interaction with environmental resources, notably, that women are active in their role in the production and reproduction of mankind - especially their role in food production, storage, preparation and consumption, income generation, and use of energy. Through their position in the family women have a central role in the environmental management and planning, improving and disposing of environmental resources.

Women generally, and Sudanese women in particular, have the dual disadvantage of being economically deprived, exploited and

dependent by virtue of their sex and their relative lack of education, skill, training and expertise. Here I am not referring to the educated women elites, who have not yet emancipated themselves from exploitation by men and the society at large, but have individually and with various degrees become aware of their problems and have more or less individually worked out to end this exploitation. I am in fact referring to millions of women in the rural countryside and the poor urban women.

Both men and women have been subordinated and subjected to a socio-economic system which favours only a small portion of the total Sudanese society. In that respect, men's exploitation of women is part of the general exploitation he also suffers. Therefore, women's role and their interaction with the environment is both structural and functional under such socio-economic conditions. Sudanese women are subject to social inequality and inequitable distribution of the resources. Rights to work, equal rights for equal pay, independent decisions to dispose of their earnings are still unattained privileges for the majority of women in this country.

However, as long as women's time and labour power is consumed in the use of outmoded and inappropriate techniques in producing and preparing and storing food, constructing houses, collecting fuel, giving birth and providing care for children and traditionally dealing with disease and illness, they have little time to innovate, let alone undertake the formidable task of realizing that all her disabilities and difficulties are connected with what we call economic planning, the state institutions and the state responsibilities. Moreover, the most decisive weapon for steering a clear course in this mess is to have access to the state institutions and solicit recognition of her right to active and effective participation.

To release women from their misery is to provide them with appropriate and simple technology for food production, to extend health training and health measures, to initiate income-generating activities, to provide sanitary housing and shelter; thereby saving time and energy and thus restoring human dignity. It may yet be argued that there are numerous international agencies, state departments, the university, the National Council for Research and other research bodies and organizations which are developing new techniques, tools, equipment to ameliorate women's environmental disabilities. The quality and magnitude of this effort needs to be substantiated before one makes sweeping generalizations, and it is one of this workshop's objectives to evaluate and to put this effort into the record before we would be in a position to start on any kind of strategy towards achieving more ambitious objectives.

There is one important point, however, to be stressed here - that these efforts are of a piece-meal nature and generally lack an overall comprehensive plan and co-ordination. Even the specialists in this field seem to be unaware or reluctant to

recognize or, worse still, unable to realize that their work bears directly on other fields of specialization within the global field of the human environment. If the common ground is found, much unnecessary duplication of work can be avoided. Women's groups and women specialists in this wide field should also co-ordinate their efforts with other economically dependent and deprived sections of Sudanese society since they are all victims of the type of socio-economic development and the inter-related state apparatus that protects these economic interests of a small portion of the Sudanese society. Here one could cite the numerous commercial mechanized agricultural schemes in southern Darfur, Nuba Hills, White Nile, Gadarif, etc., where thousands of men and women have been dislocated from their farms in unequal competition with new farming techniques, capital, and marketing facilities. They have either ended up in engaging themselves as seasonal labour migrants to these schemes or directly moving to the big towns, (Zahir, 1972). This further resulted in an influx of labour migrants, shanty towns and haphazard urbanization. Abandoning their lands at home and leaving the soil exposed results in a major environmental hazard. When they arrive in the urban centres with relatively poor skills, they are unable to compete favourably in the labour market, and will be most likely living in depressed housing and under poor health conditions with all their concomitant consequences. This further strains the use and distribution of environmental resources.

Being one of those Sudanese women who are deeply concerned with women and their environment, I am most curious to know how much government effort and money have been spent in devising a modern stove that is both technically efficient and economical for the average, poor and dependent Sudanese woman. Also, how much work is both possible and available from water supply and water disease specialists to eliminate many hazardous water contact diseases? What innovations have been made by the building industry by way of introducing national and local expertise to improve the obsolete traditional methods of erecting houses to thousands in order to provide decent and human comfort? How much modernization has been effected in agricultural technology, organization or marketing to help thousands of women in the most burdensome agricultural activities? Many other questions pose themselves and it is optimistically hoped that they will be answered by the various specialists. While it seems that many of these improvements could only be realistically made by the private sector because they have the capital and funding, this sector by definition is not likely to be interested in producing for millions of poor women consumers. The private sector's major concern is quick, secure and maximum profits which none of the millions of poor women in the rural countryside and depressed sections of the urban centres could afford.

Apart from the census data (1955-1956, household and budget surveys 1967-1968, census 1973, ILO report 1975) and few scattered references to women here and there in the literature there is practically nothing written on the female labour force

in the Sudan, about women's contribution to the national per capita income, nor about factors that inhibit women's full participation in the economy. However unreliable the census data may be, estimates relating to women's participation in the various economic sectors have not been made, and although women total about 85 per cent in the labour force of traditional food production, according to the first work of its kind by Mahasin Khidir, (1981) there is complete neglect of women in the various national economic plans since Sudanese independence was achieved in 1956. This non-availability of information relating to the degree and magnitude of women's participation in the economy for the Sudan is a major handicap in mapping areas for future research.

This lack of reference to women's economic potential is not unintentional. Dr. Mahasin has argued in her doctorate thesis that despite increased concern for reforming the socio-economic conditions of rural women, developmental plans still fall short of achieving the intended goals. Dr. Mahasin holds the view that the various national programmes submitted by the successive governments on economic and social development since 1956 do not fully recognize the importance of women's participation in the development process. All the development plans including the extended five-year plan of economic and social development (1970-1977) did not include projects with targets for the improvement of the women's lot in the rural sector. Likewise the six-year plan (1977-1983) had ignored the issue, and is not expected to change the situation of women qualitatively. Here I am in full agreement with Dr. Mahasin that all the constitutional, legislative and other measures initiated during the last twenty-five years have failed to bring about substantial change in the lives of women or achieve the objective of the social equality of the sexes. Indeed, it is highly questionable if the aspirations, needs and emancipation of women in the countryside as well as in the urban centres could be achieved by the Sudan Women's Union under the existing political set-up.

The Sudan Women's Union by being composed of elitest urban women is very widely separated from the masses of poor, uneducated women. It has even failed miserably to spearhead and effect a literary campaign for women on a national scale despite all its machinery and capabilities. It looks as though much of what will be proposed by the environmentalists in this workshop will be confronted by the double challenge of teaching women to read and write before they can begin to introduce technology, training and equipment for the masses of illiterate women.

According to the census data, at least 87 per cent of the Sudan's female labour is concentrated in rural agriculture; the country is heavily dependent on women's productivity for the provision of food. The 1973 census lists only 10 per cent of the total female population as gainfully employed or economically active. But the census material defines work in terms of

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a monetary value which, of course, excludes the majority of working women whose product of labour is reinvested in the welfare of their families. These basic facts should have drawn the attention of the Sudanese planners more towards agriculture and rural development programmes directed to women within the context of overall development programmes in food production and domestic labour.

Most of this working population of women shoulder the burden of double work including domestic, child-care and agricultural work. Yet, very few of the women in either the rural countryside or the urban centres can independently make decisions as to how they should spend their earnings. This in fact brings me back to the first section of this paper where I advocated that a break-through for Sudanese women is only attainable within a total and a radical socio-economic and political change.

However, I do not want to end on this pessimistic and gloomy note. In conclusion, I will put forward some definite practical suggestions and a strategy for action within the realities of the situation which we are in. There is, of course, a general conceptualization within which these practical suggestions will fit. We need to:

1. map out areas for action and I hope a clear indication would be given by the different specialists at this workshop;
2. assess this baseline information for research projects in areas where this is most needed;
3. organize literacy and training in these priority areas;
4. develop new techniques, equipment and tools at the grassroot local community level where local women specialists, such as extension workers, social workers, health visitors, nurses and teachers would be engaged in implementing the new devices the various environmentalists have made available. These new devices and services would perhaps best be delivered within a co-operative organization. This will ensure the whole local community involvement and participation.

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WOMEN, ECONOMIC BACKWARDNESS AND
EDUCATION IN THE SUDAN

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Women's position can be properly understood only in the context of its relationship to men within the social institutions which determine the interaction between the sexes. Improvement in women's status implies changes of traditional roles of both sexes within the family and outside (Stavenhagen, 1980).

The role of women within society differs from one culture to another. In agricultural societies the division of labour according to sex is not so clear, so there is an essential equality between both sexes, at least within the economic sphere. When subsistence agriculture is commercialised and becomes more market oriented, men become the controllers of economic activity. Generally, remunerated labour is valued, while non-remunerated labour--domestic labour--is devalued economically and thus socially and culturally, but, in "keeping the home fires burning", as the saying goes, caring, bearing and raising children, women play a key role in the labour force (Stavenhagen, 1980). Unless, however, data are collected to measure woman's non-remunerative activities, their contribution will continue to be undervalued in the sphere of development, and women will remain at the bottom of society.

In the Sudan more than 80 per cent of the population live in rural areas, and more than 80 per cent depend totally on traditional cultivation for their subsistence. Often both sexes share the burden of activity. However, when men migrate to find work in urban areas, women remain to carry the full burden. Unlike urban females, rural women, besides cultivation, participate actively in raising the family income by handicrafts.

The underestimation of women's contribution to the national economy is shown, for example, by the Statistics Department who report that in 1967-68 only 8.2 per cent of cultivators were women. Development policies, therefore, often reflect data inadequacies and reinforce the belief that women's main work is in the home. Whenever women have been targetted as concerns to development planners, it is because of their reproduction and child-rearing function, and not because of their unremunerated economic activities. A famous economist once remarked that if all gentlemen were to marry their paid housekeepers, economic

indicators would show a decrease in participation of women in the labour force and a reduction in the national income.

If we accept the usual definition of the female labour force we limit the scope of analysis to formal employment only. We have to measure the real effort exerted by rural women in both the fields and in the homes to get a true picture of women's economic contribution.

One of the major causes of women's backwardness in the Sudan is the lack of education and the high prevalence of illiteracy. Girls' education was very slow to develop before independence for a number of reasons, but after independence was obtained successive national governments paid increasing attention to women's education and made efforts to expand it. Thus, at present, women university students occupy about one-quarter of the total student body.

The Six-Year Education Plan will increase the participation rate by 1982-83 to 87 per cent for boys and 62 per cent for girls. A pilot scheme for integrated rural education centres will also be undertaken, which, in addition to providing primary education would also serve as community development centres with facilities for adult education (UNDP, 1977).

To complete the picture we have to see what has been done for the 80 per cent of people who are illiterate. The Six-Year Education Plan aims to reduce illiteracy in the 10-45 year age group from 80 per cent to 30 per cent. The achievements of the eradication of illiteracy campaign have not been impressive with a reduction of 9 per cent in the first year, 1977-78, 5 per cent in the second year, and only 3 per cent in the third year. This means that the required reduction had not nearly been achieved and that it would take some 63 years at this rate of reduction to meet the objectives of the plan. It is feared that the situation will not improve and the scourge of illiteracy will continue because the primary schools only admit 44.5 per cent of the children eligible to enter, and the population is increasing at 3 per cent.

To solve the predicament of women in the Sudan it is advisable to solve the illiteracy problem first and make an effort to encourage women to become aware of the environmental problems. It is difficult to communicate at any level with so many illiterate women unless the problem is reduced.

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WOMEN IN THE ECONOMIC ENVIRONMENT:
A COMPARISON OF TWO CO-OPERATIVES

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INTRODUCTION

First I would like to present to you two women's co-operatives, the National Co-operative Development and Training Centre, designed to promote small scale industrial and handicraft production. One is situated in North Kordofan, in a nomadic area, the other in a small village in the rural area of the Jumuheya, near Khartoum.

BACKGROUND

The National Co-operative Development and Training Centre, in co-ordination with the Ministry of Co-operation, Commerce and Supply, is promoting these two small projects under the supervision and technical assistance of UNDP/ILO. This activity is a fulfilment of the objective stated in the Six Year Plan, of the promotion and establishment of co-operative thought and consciousness among the common people, and more particularly the women of Sudan especially in deprived rural communities.

CO-OPERATIVE ORGANIZATION

I will examine both projects and see how it is possible to organise the women in a "Co-operative Society" and especially a "Productive Co-operative" which requires the daily presence of the women.

The difficulties that have to be faced include: lack of education; absenteeism; and male authority.

Education

The great lack of education among the women prevents them from taking a role in any administrative organisation in these rural areas. This problem could be solved with an intensive educational co-operative campaign and a programme of enlightenment with the help of the governmental agencies concerned. But there is still a difficult point to be solved in the future. I have noticed that most of the educated women working as trainers in the different ministries and agencies are not in a

position to travel and have direct contacts with the women of the most deprived rural areas. If work is restricted to the urban centres the women in the bush are left alone with their problems. In North Kordofan, for example, if you speak with women of the villages they do not have any idea of what a co-operative is, and usually they will refer to the men who have very often already organised themselves into a flour mill co-operative or consumer co-operative.

Absenteeism

It is difficult for the women to combine social and family life with another external activity. Housework takes a great part of the morning: carrying water, cooking, gathering plants for food and handicrafts, taking care of the children, and sometimes cultivating and harvesting the land.

In addition, if there is a wedding, birth or death, nearly all the women of the village visit and participate in the event for up to three days, resulting in periodic absenteeism among the women.

Male authority

It is also difficult to avoid the authority of men, and in many cases the men would refuse to let the women go to work outside the family house if this means that the women will have to neglect her work at home. Secondly, it is not so evident that the benefits of any kind of industry where women work will reach them and raise their standard of living. In some developing countries, where you can find, for example, a great number of small workshops for carpets and rugs, women are employed there all day for a low wage. The carpets are usually sold at a high price, but most of the profits go to the merchants and the women receive nothing and their standard of life remains very low. To avoid such things the women have to be educated.

Let us see how these difficulties affected the two projects under discussion.

SOLIMANIYA

Solimaniya is a small village lying on the western bank of the White Nile (near Jebel Aulia), an hour's drive from Khartoum. Although the area is mainly agricultural, all public services are found there. The municipality has welcomed the project with pleasure and has provided it with a locale and facilities for a workshop for the women.

Education

One of the criteria for the choice of this village was that the women are relatively well educated, having been to primary school at least, and most are still unmarried and unoccupied.

Another criterion was that the village is located near Khartoum and such a location would facilitate the supervision of the Co-operative Trainers. This work was done by the Co-operative Inspector in the Co-operative Office, Khartoum Municipality.

Absenteeism

In Solimaniya we registered about 85 women who wanted to be trained in the workshop, though two weeks later only 60 were actually coming to the meetings and participating.

Now, after a month and a half of training with two instructors, we have two groups of about 35 women doing handicrafts and sewing, and there is little absenteeism in the workshop.

At the demand of the women themselves, evening courses were provided. This arose from the fact that a lot of girls are out of school, unmarried and unoccupied, so they are free for any kind of activity. The second favourable factor is our obtaining from Abu Halima Centre two instructors, one for handicrafts, the other for general sewing. They stay four days a week in the village and live among the women, which encourages the trainees to work more and to take care of their workshop.

Male authority

We also found the members of the municipality (the majority of whom are men) ready to co-operate and to help us in this project. A good relationship between the population and the official representative in the village is important for the success of such projects.

NORTH KORDOFAN

This project was originally to be in the town of Sodiri in North Kordofan, but currently this location is under more intense scrutiny. The result of this study is not yet known completely and no official decision has been taken, but we can examine the same points as for Solimaniya.

Education

It is not surprising that the women here are more deprived educationally than in Solimaniya, even though there are, in Sodiri and in the other small towns around, secondary schools for girls. Usually the contacts with the schools are good and, in the future, they could assist in the development of a Women's Co-operative. In that case, they would also have to receive training.

In fact, the help and assistance provided by the Co-operative office in the area is quite low because of poor transportation. The implementation of a project in the area might give them a chance to obtain more resources and might be a starting point

for the future of the co-operative movement in the area.

Absenteeism

More than in any other part of Sudan the women of nomadic areas are traditionally the economic pillars of the family. The conditions of their life are made even more difficult by lack of water and desertification. Under these circumstances, it is difficult to ask them to work regularly in a workshop.

Although most of the female population belong to sedentarised tribes settled around or in the big centres like Sodiri, Tina, and Umbader, their domestic activities still take a large part of their time.

The nomads are outside the village in camps and are not settled in the same area more than five to six months at a time. For this reason it is difficult to determine the right female target population and how to integrate them in a co-operative system.

The difficulties of communication and transportation during the rainy season mean that some villages are completely isolated for two or three months, while others are reachable but with difficulty.

Male authority

Of course, in such areas, traditions are stronger than in any other area. The men seldom let the women go to work and neglect their home tasks.

TRAINING AND PRODUCTION

First, the production has to be determined according to the marketing: what is the demand in the market, what can be sold and to whom?

The traditional work of women in Sudan is weaving of baskets, carpets, etc. This can be introduced when the raw material is available in large quantities.

Training

Once the products the co-operative is going to manufacture have been determined, a programme of training has to be decided carefully. To improve techniques, foreign experts may be needed from other African countries where handicraft techniques are better known and of a higher quality. The problem is that the production of many Women's Centres in Sudan is not marketable because of the poor quality of the products. Thus, during the training period, the instructors should be vigilant about maintaining a high quality of work.

Production

Actually, there is no organised body or association that assists women with supply of raw materials and marketing. Thus, a co-operative society, if well planned, should obtain raw materials, organise production and management, as well as find suitable markets for the products. Most of the women who are making handicraft production sell their own products in the "souk" or through the channel of existing consumer co-operatives, but this can only suffice as a temporary measure.

A better solution still needs to be worked out.

INCOME GENERATING PROJECTS FOR WOMEN:
A VILLAGE CASE STUDY

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INTRODUCTION

This research was done by the Ahfad University College for Women in line with its policy of involving university students in the role of rural women in development. This research is a part of the College's programme "Extension Agents in Rural Development for Women." The research is a case study in four villages in the north-east of the White Nile Province. The goal of this work is to create a model for income-generating programmes for rural women and future research will evaluate this work.

In this research we used different methods of collecting data - observation methods, interviews with rural women, children and teachers, officials in government and co-operative offices, and field trips. In total we stayed with families in these villages for about 15-20 days, shared in some of the housework, collected water from the wells and participated in some social events in the village. Most of our information was obtained during informal conversations.

THE VILLAGES

The four villages (Umalaga, El-Talha, Abukilab and Wad-Balal) lie about 15 km from El-Gitaina town. The soil of these villages is very sandy, since they are far from the river. Wad-Balal, which lies on the bank of the Nile, has beautiful green trees near the river. The people of this village depend on fishing. All four villages suffer from the problem of desertification: the sand is so high that it almost reaches the roofs of the houses. The houses, built from mud, consist of two rooms and rakuba, and are detached.

POPULATION

From the estimate made by the Town Council of El-Gitaina the population of the four villages is the following:

Table 1: Distribution of population in the four villages.

Name of village	No. of Children	No. of Women	No. of Men	Total
Umalaga	300	500	950	1,750
El-Talha	150	200	350	700
Abukilab	200	500	800	1,500
Wad-Balal	150	170	300	620

Source: El-Gitaina Local Council, White Nile Province.

INCOME

From conversations with the rural women about the family income of these villages, it is clear that the monthly income for the four villages is low. Most of the families have a monthly income ranging between 20-40 pounds, but a few have incomes ranging between 100-120 pounds. These are the few who have some cattle and goats. In general, they are very poor. Most of the men work as building constructors, labourers, fishermen and bakers. Some of the families migrate to work in the Gezira Scheme as cotton pickers.

WOMEN'S PARTICIPATION IN INCOME EARNING

Most women are housewives and do not generally participate in income generation, although some of the girls may work at cotton picking in the Gezira. Mothers and daughters share in the housework and are untrained except for some basic handicraft skills. Of the 132 women in the villages, only 38 (29 per cent) earned an income mainly from selling eggs and chickens.

There are few educational facilities in the area: only two co-educational elementary schools and literacy classes arranged by the Ministry of Education. Most of the women are not motivated to read and write, however. They say, "What are we going to do with alphabets? We don't get magazines or newspapers. We need skills to help us earn money and take care of our children."

THE TRAINING WORKSHOP

Based on our observations from our field trips, it was decided that a workshop would be held to give these women the skills they felt they needed. In addition, this was an opportunity to hone our own techniques in extension work and set the groundwork for establishing a rural training centre. The workshop was held in Umalaga village for three days in February, 1980.

At the beginning small group discussions revealed that the women had the following problems: shortages of water, markets, health services, transportation and advanced education. Such fundamental difficulties greatly affect their ability to benefit from training courses. They stressed the need for classes in sewing, embroidery, handicrafts, knitting and crochet. We also added classes in food preservation, water purification and home economics.

During the workshop, the women were taught how to use the sewing machine donated by Ahfad College. Some women raised the problem of access to the machine, since there was only one for the four villages and transportation is a problem. In the end, the machine was to be left in the primary school in Umalaga under the headmaster's wife who agreed to help anyone who wished to use it. After this, a discussion on nutrition ensued.

Two trainers were selected from among the villages and have been seconded from the Education Department for this project. They have the advantage of having worked in these villages for 6 to 9 years and have experience of organizing women's associations as well. Each of the trainers spends two weeks in her assigned village and has the assistance of an elected village leader who takes attendance and does administrative work.

In order to ensure the maintenance of the income-generating activities in the villages, co-operative committees were formed to do the following: introduce the idea of co-operation to the village women; train them in basic accounting, investment and financial management and co-ordinate the income-generating activities. In addition, the co-operative will purchase the training equipment, develop the sewing centre into a small sewing factory and concentrate on economic activities for the women. The intention is to avoid the problem which occurred in the past when LS 800 was laboriously collected to initiate a bakery but was frustrated when no flour could be obtained.

THE TRAINING CENTRE

Based on the information we gathered at the workshop, a training centre was established. During the period November, 1980 - February, 1981 the attendance of women has been high and regular during the month and afternoon sessions. In Umalaga it ranges between 36-40 women per day in El-Talha 27-30, in Abukilab 40-50 and in Wad-Balal 26-30.

At this stage, training concentrates on using the sewing machine to make women and children's clothes, some nutritional training involving local foods and hygiene and water purification. Already, since the beginning of the programme some of the small canteens in the villages have been selling raw material for the women's projects. The sale of their products is still worked out on an individual basis. Some women said that they would send their products with their husbands or brothers when they went to El-Gitaina or Abu-Gota markets with

donkeys. Some said that they would sell them at an exhibition from time to time and call families from the villages around and even from El-Gitaina town to come and buy their products.

PROBLEMS FACING THE PROGRAMME

A number of social and environmental factors inherent in the lives of these village women have a major impact on their ability to participate in and utilize these training programmes.

1. Unavailability of qualified trainers

The trainers who were appointed are not qualified as multi-disciplinary trainers. They had been teaching literacy classes in other villages which did not equip them to deal with problems of water supply, health education, co-operative accounting, organization management and other trade skills.

2. Absence of reliable and safe water resources

This is the main problem that affects the performance of women and their utilization of time. These villages suffer more and more from shortage of water, especially safe water. Women and girls spend most of their time getting and filtering it. This problem affects their attendance at the daily training session and their health.

3. Deficiency of health services

The four villages lack clinics or even a first-aid post. There is no medical assistant nearby nor anyone to instruct them in preventive health measures. The four villages also lack trained midwives so they use traditional methods for delivery which sometimes cause the death of the mother and her child. All these health problems limit the women's attendance at the training class.

4. Lack of transportation

With such poor transportation systems, many aspects of the woman's lives are hindered: communications are limited, equipment is difficult to obtain, training courses are hard to reach and access to markets is reduced. All of this affects the success of their income-generating efforts.

5. Factors in the natural environment

Desertification constitutes a considerable problem in these villages as it touches both housing and living conditions and transportation, even by donkey. In the sewing class, sand contributes to breakdowns of the machines and affects the quality of their products which are then less marketable. Furthermore, environmental degradation results in greater time being taken by the women to collect fuel and water which limits the spare time they have for other activities.

6. Shortage of time

As a result of the above living conditions, women already have a full programme of household chores as shown in Table 2 below. The training then becomes another commitment which is added to this daily schedule, making regular attendance difficult for married women with households to maintain.

Table 2: Typical daily schedule for girls and women in the villages.

Tasks	Average hours required
Fetching water and preparing morning tea	2
Cleaning house, making meals, washing dishes	3
Laundry	1
Collecting wood from desert	2
Feeding, watering and milking animals	3
Preparing supper and washing up	1
TOTAL	12 hours

RECOMMENDATIONS

1. Trainers should be given courses in such areas as sewing, nutrition, child care, economics, public health, first-aid and organizational management. This training must be multi-disciplinary to equip the village leaders to act as consultants and should involve the Ministries of Health, Education, the National Council for Social and Community Development and the Co-operative Training Centre in developing a special syllabus.
2. The trainers should be drawn from the villages and as much as possible be selected by the villagers themselves.
3. The programme should encompass a range of topics that will assist in general community development.
4. The course should include:
 - i) planning income-generating activities in a relaxed atmosphere based on the women's preferences and needs. The materials used should be natural to the village environment;
 - ii) co-operative leadership and formation of co-operatives. Hence, leaders of the organization must be democratically elected by the rural women; membership should

be open to all the women in the village; through this organization rural women must be trained to set their own group objectives; rural women should be encouraged to participate in groups in the development of training materials; rural women should be motivated to pay contributions to the association for specific purposes; this association should gradually develop into a women's co-operative which will be responsible for administration of the women's income-generating activities.

5. The Ministry of Co-operatives should be flexible in its requirements for registration of rural women's co-operatives.

6. The students who continue this project should evaluate the work of these rural woman and the programme in all its aspects particularly in economic terms.

PITFALLS IN SOCIAL DEVELOPMENT: A
CRITICAL REVIEW OF A TRAINING CENTRE FOR WOMEN*

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In this paper the Abu Halima Social Model Centre will be used as a case study to demonstrate the pitfalls to avoid in planning for women and community development. It is not enough for us to aim to improve the conditions of life for women and raise their participation in development, if they cannot reap the fruits of their efforts. Changing laws to give women equal opportunities, payment and promotion will not automatically lead to their participation in the labour force. Nor will creating community development or training centres for women automatically integrate them into development. In the following paper, I will show the importance of removing technical and social constraints that limit women's integration even within the domestic domain.

BACKGROUND

Abu Halima is a small village lying on the east bank of the River Nile a few miles north of Khartoum and was selected as the site for the Centre from a chain of fourteen villages. These villages are crossed by a highway which links the capital with northern parts of the country. Abu Halima has a population of 1,000 people, while all the villages contain about 25,000 people. The general pattern of life in the villages is based on small-scale farming, trade and skilled work. The Centre, initiated by the former Social Welfare Department, was intended to serve all the villages. The Arab League offered a grant of \$25,000 and the Sudan government supplemented the fund with another LS75,000. In 1974 work was started and in 1975 the project was officially inaugurated.

*I would like to thank the Faculty of Economics and Social Studies Research Board Committee which has granted me a sum of money to help me carry out my research project under the title "The development of women's handicraft and cottage industries." The Abu Halima Social Model Centre study constitutes the first phase of this project. I gratefully acknowledge the assistance and hospitality I received from the Director, staff and students of the Centre.

The information given in this paper is the result of research carried out during the period from July, 1980 to January, 1981.

The Policy for Abu Halima Social Model Centre was drawn from the model of Egyptian community development centres. Its buildings include various classrooms, a big hall, a kitchen unit, a health centre, offices, kindergarten, attached fields and a large open space. At the outset, the objectives of the Centre were to be the following:

1. the formation of ideal farms to teach villagers modern ways of raising fruits, vegetables, fodder and beans and increasing productivity;
2. formation of poultry and animal farms with the purpose of introducing better methods and technologies;
3. formation of workshops to train males in different crafts;
4. formation of a unit to cater for the advancement of women through: literacy classes, cultural classes, home economics classes and sewing and embroidery classes;
5. provision of services to the villagers in the form of a kindergarten, health centre, sports grounds, library and a lecture hall and a moveable cinema.

A few years after its opening, the aims were broadened to include:

1. The collection and development of local handicrafts from various parts of the country for the purpose of drawing up a plan for a national handicrafts industry.
2. To raise the standard of training to match the requirements needed for a national training centre for staff who could be dispersed throughout various regions.

The Centre is administered by a Board of Trustees composed of the Director of the Centre, the assistant administrators, and representatives from eight government departments whose activities are related to those of the Centre. In addition to the Director and assistant administrators, nine women do classroom teaching; an assistant doctor and nurse run the health centre and two women operate the kindergarten. Most of the forty children attending the latter come from Abu Halima village itself.

Since 1975, a total of 682 women have registered in the Centre, coming from a variety of areas from El Halfaya in Khartoum North to El Gaili farther north. In order of popularity, the students enrol in the following classes: general sewing, handicrafts, cloth painting, literacy training, patron sewing, home economics, machine knitting and carpet making.

CURRICULUM

I would like to begin my assessment of the Centre with a

review of the limitations of this curricula, in terms of producing graduates capable of entering the wage market.

The handicraft class teaches embroidery, crochet, straw and plastic work. The students told me that they use these skills primarily to make tablecloths and decorate toabs and aimas for their families. A few of the students, may get orders from people they meet at social occasions, but most do not consider this the point of the class, since no instruction is given on income generation or co-operative ventures. In fact, the students I spoke with were astonished to learn of some of their colleagues who actually were involved in such profit-making activities.

The situation is similar in the patron sewing classes, where the women are trained on sewing machines. The difficulty is that the students seldom have such machines at home nor does the Centre encourage them to use the machines in the evenings or after classes. Here, too, most of the women saw the class as a way of serving their families primarily by saving the expense of hiring an outside seamstress.

The cloth painting classes are given in advanced techniques requiring special tools which are expensive and difficult to obtain. They are not taught alternative, simple methods that would be feasible for self-employment. The same holds true for the carpet and machine knitting classes.

Without the incentive of learning how to make use of their skills after their nine months of training, few of the women graduate and most remain unemployed.* In fact, most of them have low expectations and only expect to pick up a new skill that will improve their housekeeping. The extent to which the potential of the Centre and the graduates is now under-utilized is epitomized by the home economics classes. Presently, cooking of juices, jams, pickles and so on only is taught. Nothing is given on family nutrition, economical ways of fuel consumption, how to prepare meatless meals or budget management. No connection is drawn between locally available foodstuffs and the dishes they are taught, nor are they trained how to employ available land around their own homes for farming or poultry raising. Training women in farming and fencing would permit them to profitably use their courtyards to supply food for their families and for income generation.

The family planning unit gives no information about family planning but merely distributes pills every month. Women receive no information about their socio-economic role, health problems or environmental conditions that would help them to improve their situations. On top of this, the graduates from such a limited programme will be expensive trainees given that

*In a 1979 report, 78 per cent of the graduates were not engaged in income generation.

they are not well-equipped at the end to act as murshidas in other rural areas, nor indeed, do most of the women see this as their role. The Director himself feels that the Centre is successful because it has attracted students from large distances and has secured subsidized transportation for them. In order to maintain a large enrollment of these women, evening classes have been eliminated, thus discouraging males from enrolling. (In these conservative Islamic villages it is preferred if males and females attend separate classes.)

The administration asserted in my talks with them that the graduates' families would not permit them to work outside their villages; yet when I contacted students to work as trainees in El Sulimanya village south of Khartoum, about 70 showed their interest and brought letters of consent from their parents!

Future plans include forming production societies in different villages by giving loans for raw materials, holding exhibitions at the Centre or sending their products to national exhibitions to help them market their crafts. The problem is that the administration has no records of the graduates and has not kept contact with them. It would be more practical if they began encouraging the present students to form production units with the villagers and act as consultants in terms of running the unit, raising money and providing basic equipment and tools.

Problems

I would like to reiterate the main problem areas:

- No courses are given which would help students use their skills after graduation for income-generation.

- No contact is maintained with graduates nor is the Board of Trustees being used to co-ordinate with government bodies who help in placing students.

- Many of the facilities offered at the Centre either duplicate others in the area (e.g., there is a hospital only 20 minutes drive away from the Centre's health unit) or do not adequately replace existing facilities (e.g., fields attached to the Centre are not productive enough to attract villagers).

- The major service provided is training in crafts; but this is not geared to turning out village leaders. The cost of such training is excessively high in extension programmes.

- Certain members of the target population cannot be served adequately either because of customs in the villages (such as, the aversion to having men and women attend the same school in Muslim society) or because of the difficulty of reaching the Centre from distant villages.

- Most importantly, the Centre has failed to raise women's awareness regarding their ability to share in income earning with their husbands. Since many of the families have other adults present, it would be possible for these women to give some time to co-operatives in farming, which would merely be an extension of what they already do now anyway.

CONCLUSIONS AND RECOMMENDATIONS

It is my feeling that the extension worker (murshida) is a vital agent in the social development of rural women and as such, requires the best of training. Such training should take the following form: thirteen months of courses, emphasizing women's consciousness raising, time management, leadership, co-operative formation and adult education. In addition, practical courses would include home economics, public health and family planning, home management and handicrafts. Further topics could be chosen from sewing, tailoring, business management weaving, painting and literacy training.

Four women from each village should be enrolled, plus any of the older women who may be interested. In accordance with the normal daily schedule, evening classes should be held, run by the students to give them practical experience. The daycare centre should be open during all classes.

The graduates would return to the villages to set up training centres with support from the villages, governmental agencies and the Abu Halima Centre. Each centre should have two full-time employees receiving good financial rewards to encourage high calibre work. What is really needed is a major training centre for these murshida with a comprehensive curricula and good resource materials. People with experience with this type of education and community work should be involved in the planning, particularly those from the Social Welfare and Development Council.

I propose also that courses in community development, research methodology, project planning and evaluation should be emphasized to enhance grassroots work.

One point to bear in mind is that our models should be developed on the basis of our own needs and culture in the Sudan and not brought in wholesale from another country.

In conclusion, I would like to stress that unless we raise the standards of the murshida, we cannot hope to improve the status of women: she is the key to their development.

DISCUSSANTS' COMMENTS

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The six papers delivered in this session deal with women in their social environment. Two points in particular are relevant to the issues raised by the authors. The first point concerns the rights given to women by the government to hold 25 per cent of the seats in the municipal council in the Sudan. How many of the well-educated women in the Sudan have tried to fill one of those seats and become involved in the actual decision making to shape the social environment for the benefit of women?

Secondly, I have noticed no mention of the use of the mass media as a way of reaching women. Information programmes directed to rural women could be very effective training devices, especially in light of the widespread use of transistor radios in the villages.

PART II.

WOMEN, WATER AND THE ENVIRONMENT

AN OVERVIEW OF THE WATER SITUATION IN THE SUDAN

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"Water is the source of all life". This message from the Koran emphasises the human perception of a scarce resource in the arid environment.

In the Sudan, where rainfall is less than 600 mms, alternative water supplies must be sought if man is to survive. The Nile is the largest of these alternative supplies, and the majority of the Northern Sudanese live along its course. On the other hand, non-riverine communities of Northern Sudan have existed for centuries on other sources of water. The population of these communities has been fixed by their water supply, which by most standards of the world is inadequate.

In recent years technology has enabled man to make available new and increased water supplies. This additional water has then provided a bigger resource base to support larger populations and animals. The quest for more water has become a never-ending effort to prevent that extra population from being below the margin of thirst.

SOURCES OF WATER

In a country like the Sudan, with diverse climatic conditions and geologic structures, the natural conditions influence the availability of water supply and have greatly shaped the habitation of rural areas and governed the rise and distribution of settlements.

The Nile provides the most dependable surface supply, and this source contributed to the growth of early civilisations. Most of the settlements are located close to its banks, and the inhabitants practice peasant agriculture. Away from the Nile a number of water sources are found, ranging from shallow wells, Khors, Hafirs, Fulas, Turdas and Boreholes (water yards).

Shallow wells were the only man-made source in rural areas until 1918 when the first borehole was drilled in Umm Ruwaba in East Kordofan. Since then more boreholes have been slowly added in different parts of the country according to the suitability of the geological structure.

Fulas and Turdas are natural depressions and provide water during the rainy season. In many areas these are excavated and widened to collect additional water, and then called hafirs. Hafirs are not found everywhere as they can be excavated only in areas with clay soils.

The geographical location of water sources influenced the regional patterns of rural settlements, resulting in a linear development along water courses, in clustered patterns around boreholes, or dispersed patterns on plains where shallow wells could be dug.

Thus, the government programmes for water provision have been dictated by the natural potentialities such as favourable geological structure and superficial deposits. Besides these physical factors, the criteria for water provision involve the consideration of the potentialities of the area, population density, livestock numbers and nearness of the area to permanent water sources.

The government became aware of the environmental deterioration around water points as early as 1937. Committees investigating this problem recommended the implementation of land use and soil conservation measures, and water was used as a tool for the conservation of soil and natural resources (Soil Conservation Report, 1944). Thus a conscious programme for water provision started with the aim of opening new points to relieve the pressure from degraded areas. With increasing awareness of the water supply problem, the Land Use and Soil Conservation Department was established in 1956. By 1971 the solution of water problems became a national issue that needed drastic measures--hence, the Anti-Thirst Campaign.

THE WATER SITUATION IN THE SUDAN

According to calculations made in 1975, the annual drinking water requirements for human and animal populations amounted to 310 million cubic metres, of which 64 million cubic metres were available, recording a deficit of 246 million cubic metres. This means that rural areas need more water to meet the minimum requirements (Sammani, 1977).

In Khartoum Province and the Northern region it was found that nearly all settlements were served within a radius of 5 kms from the source (Sammani, 1977). Settlements away from the Nile depended, for their supply, on shallow wells. In the Eastern Region (Kassala and Red Sea Provinces), the main sources were boreholes, shallow wells and hafirs. The distribution of boreholes is restricted to certain localities with favourable geological conditions. In the Central Region, the water supply situation is far better. Here people can choose from a wide range of sources including the Nile, canals, hafirs, shallow wells and filters, and a large number of houses are supplied with pipes. In Kordofan and Darfur regions water shortages are still acute, and people supplement their supplies by using water-

melons or depend on water transported by tankers.

WATER CONSUMPTION AND USE¹

In rural areas decisions about water become part of the rhythm of daily life. The housewife who can turn a tap is spared this concern, but for those who have no piped water in their houses there are decisions to be made as to whether to buy it from a water vendor or to carry it herself. Consequently, women's role in water collection is very much dictated by the water situation in the area, and the type of source available. Where the water source is found inside a village, but there is no distribution system, most of those involved in water collection are women and children. The same may be said for villages with no water sources, villagers have to walk long distances, and the number of women taking part in this journey is small.

To illustrate these generalisations, three communities were studied with regard to water collection, water use and water management. Khartoum Province was taken to represent riverine communities, Gezira to represent communities in irrigated areas, and East Kordofan to represent traditional communities. In these communities the sources of water are diverse (Table 1).

Table 1: Percentage of households using the different sources in the dry season (N=1000)

Source	Province		
	Khartoum	Gezira	E. Kordofan
Boreholes (water yard)	22	10	70
Shallow Wells	20	9	23
Filters	-	14	-
Hafirs (wet season)	5	-	7
House connections	34	31	-
Canal (wet season)	2	12	-
Stand pipes	20	24	-

Table 1 shows that while large numbers of households use improved sources, a substantial number also resort to canals and shallow wells which are unimproved.

In some areas more than one source may be available, so one of them is considered the main source.² The reasons behind using the main source are varied, and include: (a) permanency; (b) nearness to the house; (c) ease of obtaining water; (d) cost; (e) perception of quality.

¹The information used in the following pages is taken from a large study carried out by Dr. M.E. Abu Sin, Ustaz Mohamed El Hassan El Tayeb, and the writer. This study was sponsored by the I.D.R.C. The results will be published soon.

²Second and third sources are used in case of breakdowns.

Table 2: Reasons for using the main source (N=1000) (percentage)

Reason	Province		
	Khartoum	Gezira	E. Kordofan
Only source	8	23	44
Near to the house	36	13	39
Easy to get	15	13	9.5
Cheap	22	-	7.0
Clear (healthy)	18	35	2.5

From Table 2 it is clear that nearness of the source to the house is a main factor for choice if there is more than one source. In Kordofan, sources are limited, so people have little choice.

Although water from the borehole is used for many domestic purposes, there is still evidence that other sources are used mainly for non-drinking purposes. This feature is very clear in the wet season when water is more available and easy to obtain.

It seems that a large number of respondents in Khartoum and Gezira are aware of the relationship between water and diseases. Generally, surface water supplies and shallow wells are subject to faecal contamination whereas deep boreholes, when properly maintained, are well protected from contamination. Yet it is found that even in well-managed boreholes contamination of water occurs either in the container or in the zeer (storage vessel). In some boreholes where people and animals use the same trough, contamination happens in the trough. Open and unprotected shallow wells and hafirs are usually contaminated.

Water consumption

The amount of water consumed per household is influenced by the number of people living in a household and the season (Table 3).

Table 3: Amount of water consumed per household in the dry season (percentage)

Amount (Tins)*	Province		
	Khartoum	Gezira	E. Kordofan
1- 4	15	6	27
5- 9	44	21	36
10-14	24	39	19
15-19	11	15	13
20+	3	14	2

*The average tin holds four gallons of water.

Water collection

Water is brought to the house by different methods. In rural

areas, generally women and children are responsible for water collection and other domestic services (Table 4).

Table 4: Who brings water to the house (percentage)

	Khartoum	Province Gezira	E. Kordofan
Wife	10	17	27
Husband	8	3	25
Children	14	4	39
Wife and children	9	-	-
Pipe connections	34	35	-
Vendor	6	13	8

It is clear that all members of the family are involved at different levels of water collection, consuming much family time, effort and income. Those who buy water from water vendors do so for different reasons, such as having no family member available, children at school, or having relatively high incomes and urban outlook.

Family members involved in getting water may make a number of trips to the source if it is near, but if they live away from the source, as in E. Kordofan, they make one trip every two days or so. In these cases traditional co-operation plays an important role in reducing the burden.

Table 5: Time spent for one trip for water (percentage)

	Less than half hour	More than half hour
Khartoum	34	49
Gezira	46	22
E. Kordofan	47	48

The majority attribute the time wasted to distance and queuing caused by the pattern of opening hours (early morning and late evening), inefficiency of management, low pumping capacity, stoppages, and general deterioration of the taps and troughs.

The type of container is equally important in reducing the frequency of visits to a water source: goat skins and twin plastic jerrycans are used over long distances compared to buckets and single jerrycans which are used for short distances.

PERCEPTION AND CHOICE

In areas where more than one source is available, water collectors choose the source according to their perceptions of its merits. Some people perceive the source they use as clean and healthy; others measure it against the efforts and financial

costs involved. The words clean and healthy are used to mean the same thing: if the water is not muddy, it is clean, and if it is clean, it is healthy.

Quality is measured against the physical properties of water, good quality water is clean, clear and from an underground source. When water is clean and clear, it is safe. Unsafe water is of canal origin and dirty in colour. Most of the inhabitants in Khartoum Province, or Gezira, think that people may get sick if they drink stagnant, saline or unclean water, so choose the sources they feel are cleanest (Table 6).

Table 6: Sources of drinking water (percentage)

Source	Province		
	Khartoum	Gezira	E. Kordofan
Shallow well	23	4	23
Hafir	11	-	7
Canal	5	12	-
Wateryard	20	9	70
Stand pipe	2	23	
House connection (borehole)	34	32	
Filters	-	8	
Filter (stand pipe)	-	9	

WATER MANAGEMENT

Water in rural areas is controlled and managed either by the government, represented by the Rural Water Development Corporation, or by the village council. Three persons are responsible for running the water yard--a clerk, a guard and an operator. The local body instructs them about water charges, the time of opening and closing, and reporting breakdowns or stoppages. This management system, however, is now facing many problems: inefficiency, frequent breakdowns, and lack of maintenance.

Although the borehole seems to be the preferred untreated water source, it is not as effective as it might be in serving the social, economic and health needs of their respective communities. The reasons for this are twofold:

1. management and hours of operation are not flexible, and lead to long queues--a waste of productive time;
2. queuing and distance to the water yards increase the cost of water to the consumer, and this discourages the use of improved sources when an alternative does exist.

To remedy this situation some local inhabitants suggest that the village council is a more suitable manager, if it is given government assistance for maintenance costs. Others think that boreholes will be more efficient if they are handled by a private contractor under the supervision of the village council.

THE FUTURE

It is clear that the water supplied to rural areas is not enough for healthy living. A new approach to rural water supplies is needed, one which is capable of meeting the needs of the community. Greater involvement and public participation in water provision from planning stages to completion is required because what is perceived by the planners as best may not be acceptable to the users. Community choice must be taken into consideration.

Water provision must be directed along two lines: (a) short-term objectives--to supply the most needy; (b) long-term objectives--when water provision may be used both as a tool for development and to bring about environmental changes.

The management of the water system must be given closer consideration, and must achieve the aim of local participation. It needs greater flexibility.

The lack of safe, accessible water is part of the general low standard of living and level of development in rural areas, and the women and children suffer most because of their low status in the community. The fact that children and women are the main water collectors must be taken into consideration in designing the borehole.

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WATER DECADE PROJECTS FOR THE TROPICS
BASED ON TRADITIONAL PURIFICATION
METHODS OF SUDANESE WOMEN

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INTRODUCTION

Surface water from rivers, intermittent streams, ponds, artificial rain lakes and shallow wells is the most important water source in many areas of tropical developing countries. These unprotected traditional water sources are exposed to contamination by dust, vegetation and all kinds of micro-organisms throughout the year. With the arrival of the annual monsoon, or rainy season, the conditions become worse. The water receives an additional heavy load of inorganic matter due to erosion as well as decaying vegetation, animal wastes and domestic sewage washed into it by the rains or flooded rivers. Not only does the water become unpleasant in appearance, on account of its high turbidity and yellow to dark-brown colour, but the health risks involved in its consumption also increase.

Women in different countries in Africa and Asia have been the initiators of various simple domestic treatments of muddy and evil-smelling waters. Although these methods have not so far been able to compete with modern waterworks operations, as regards the complete removal of microbes, they nevertheless achieve very important improvements in the physico-chemical and bacteriological water quality.

The objective of this paper is to highlight the special role which Sudanese women have played in traditional water purification in the past, and how it is now planned to utilise their skills and experience within the framework of the Water Purification Project for the benefit of both the Sudan and other countries with similar environmental and socio-economic conditions.

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REASONS FOR THE SPECIAL CONCERN OF SUDANESE WOMEN FOR WATER TREATMENT

The Northern Sudan was culturally linked to Pharaonic Egypt. Christian Nubia, in turn, was exposed to a further cultural influx from Byzantium and Greece. Therefore it also seems to be likely that certain technologies which were in use by the ancient Egyptians, or were introduced by Greeks or Romans, spread not only to the frontiers of Upper Egypt but also reached the northern part of the Sudanese Nile Valley before they were introduced to any other part of Africa.

Galenos (about 200 A.D.) described how the Egyptians filtered their water through earthen jars, but he did not mention whether this was an indigenous technology or a treatment which they might have learned of from the Persians and Greeks. This method also reached the Sudan and was still in use in Wadi Halfa before the erection of the High Dam (Jahn, forthcoming). In villages along the Nile in the Northern Sudan and the Gezira Province, where clarified water is consumed during the flood season, the women who take care to carry out this treatment at present always refer to this practice which was handed down from their mothers and grandmothers.

Water is the most important drink for the rural Moslem population of the Northern Sudan because the Koran forbids the consumption of intoxicating beverages. Islam also demands ablutions before each of the daily prayers, and a purifying bath after marital relations. Therefore, the need for water, and the desire that it should be pure and clean, is much greater in communities where religion is taken seriously.

In the Blue Nile Province, for example, the majority of rural women from ethnic groups such as the Berta, Ingassana, Uduk or Burun are as yet unconcerned with any assessment of water quality. They drink any turbid and polluted water which they find, and may even laugh when told that such poor quality water can be purified. Only women belonging to the households of the religious and tribal elite make attempts at domestic water treatment. Usually these strata of the society call themselves "Funj", which is not the name of a particular tribe but a typical sign of "cultural Arabization" (James, 1971).

ENVIRONMENTAL FACTORS

For people living along the White Nile, which has a colloidal milky opaque turbidity throughout the whole year, it was probably not possible to see any hope that such water could be made clear. The Blue Nile and the Main Nile, on the other hand, carry very clear water during the dry season when the concentrations of suspended matter become less than 100 mg/l as compared with an average of 8000 mg/l during part of the flood season. This change could have been an environmental stimulus for the women to look for possible ways of purifying the water of their river. Village women from the northern riverain Sudan

or the Gezira Province actually define the optimum quality for their drinking water as being like "clear Nile water during the dry season".

A similar environmental stimulus seems also to be found in mountainous areas where the inhabitants draw their water supplies from different sources. For example, at the beginning of the rainy season women from the Rufa'a Arabs, who live close to Jebel el Querabin (Blue Nile Province), collect the precious clear rain water from rock reservoirs, with much difficulty, because, in their opinion, this is the best type of water.

THE UTILISATION OF TRADITIONAL EXPERIENCE FOR THE TARGETS OF THE WATER DECADE: WATER AND HEALTH

The majority of rural women in the Sudan are, as yet, not much concerned about the hygienic handling of water. Where the women do carry out domestic water coagulation most of them so far have no health considerations in mind. They hate the appearance of turbid water that has an ugly, dirty colour, or the evil smell of water contaminated by decaying vegetation, animal wastes and other pollutants. Clarification is an objective stimulated only by aesthetic factors, or may also be perceived as a duty in response to religious teachings which stress "cleanliness as part of worship". During the periods of poorest water quality some of the women discover an association between "bad water" and disease, or "negligence regarding water treatment" and disease. Some forget these lessons again as soon as the water appears to be better, as far as they can judge with their senses. Yet, in the past, during the flood season, untreated Nile water was the cause of diarrhoea, dysentery and the Nile skin rash.

The merits and limitations of traditional water coagulation with the materials used in the Sudan, in comparison with modern waterworks treatment, have recently been discussed in detail in a manual (Jahn, forthcoming). In the following, only limited data will be given as an example to show how water clarified by simple and cheap traditional methods compares with the high quality standards recommended by the WHO, and what particular parameters from the African environment need to be attended to in this context.

TURBIDITY

The retention of infectious agents is higher in turbid than in clear water because all kinds of pathogenic micro-organisms (protozoa, bacteria and viruses) can form complexes with the suspended particles or become engulfed by them. In case of imminent epidemics turbid waters are liable to cause a failure of disinfection because the efficient chemical cannot reach the pathogens (Hoff and Goldreich, 1977). This means if the authorities only distribute chlorine tablets, or bleaching powder, to be added without pre-treatment to turbid natural waters, the effect will be poor. For urban water treatment we have, at

present, the following recommendations:

	Highest desirable level	Maximum permissible level
WHO standards for turbidity	5 units	25 units
USA standards	1 NTU (=Nephelometric turbidity units)	5 NTU

Traditional water coagulation can yield the following improvements:

	Turbidity	
	Raw water	Treated water
Nile water treated with <u>Moringa oleifera</u> seed powder (200 mg/l)	2500-6500 FTU (= Formazin Turbidity Units)	after 1 hr: 3-9 FTU after 20 hrs: 1-2 FTU

The results after one hour were obtained with laboratory jar tests where fast mixing of the coagulant with the raw water was applied. With hand stirring, which is the only feasible method for rural women, the same clarification results can be obtained, but it may take two to three hours. The reading after 20 hours is based on field studies in a village. Similar results can be achieved with clarifying clays, but they need higher optimum concentrations (2-6 g/l) and an even longer time for complete turbidity removal. Neither the clays nor this plant material change the pH of the water.

In conclusion, proper use of the indigenous coagulants yields the turbidity removal which is required according to the WHO recommendations. Their slower action is still within reasonable limits, and research is currently going on to optimise the technical details for efficient water treatment at the household level. As a particular reference to local Sudanese standards it may be mentioned that a turbidity of 8 FTU for Khartoum tap water has been measured in 1980 in two random tests in April and September. The average value is 2-3 FTU.

BACTERIOLOGICAL WATER QUALITY

According to WHO recommendations drinking water is considered as safe where: number of coliform bacteria equal 1/100 ml.

It is known from many experiments conducted in different countries that efficient water coagulation also yields an important removal of bacteria, virus, protozoa and helminth ova (cf. Jahn, forthcoming). As far as E.coli is concerned, coagulation alone does not result in complete elimination. This can only be achieved by chlorination. Turbidity removal by alum or Moringa seed powder goes parallel with the removal of micro-

organisms. Clarification of water by the coagulants to residual turbidities of only 2-3 FTU was found to result in both cases in a reduction of the total coliforms to 150-200 per 100 ml. (Jahn, forthcoming). These figures are not satisfactory according to WHO standards, but they are low in terms of present African standards of water quality. Untreated muddy surface waters may contain 50,000 to 200,000 faecal coliforms per 100 ml. Besides, there is not even any guarantee that people who are supplied with piped chlorinated water will not contract severe water-related diseases by drinking water from their jars.

Unhygienic removal of water which is exposed to filthy unwashed hands, or to domestic animals, results in gross contamination of water stored in the traditional Sudanese clay jars and has been blamed as a cause of gastroenteritis in small children. The counts for E.coli in samples collected in houses in Omdurman exceeded, in several cases, 18,000 per 100 ml. and part of these coliforms were found to be pathogenic (Erwa, 1977). We are now also engaged in investigating in detail the promising properties of Sudanese clarifying clays to remove virus from turbid and "clear" natural waters (Lund and Jahn, forthcoming).

In the "Mar del Plata Action Plan" which set out the goals of the Water Decade, the health impact of water has been given particular emphasis (Abdel Mageed, 1979). A spread of scientifically revised traditional water coagulation offers great improvements of water quality at a low cost. If these methods are taught together with guidelines for more hygienic handling of water they will be important both for communities which can hope to get boreholes and piped water after some years, and for those which will remain dependent on traditional sources of surface water. In addition, these methods will also be of great value for communities which are left temporarily without public water supply services due to the lack of spare parts, lack of fuel, or lack of expert manpower to make repairs.

WATER AND SOCIAL DEVELOPMENT

In certain areas of the Butana, Blue Nile Province, or Western Sudan where the available water is of very poor quality, the rural population is not only suffering from the lack of this basic need, but also has no access to public services and social progress. The government often has difficulty in recruiting teachers and staff for small medical centres from other parts of the country for distant villages. The most neglected and deprived sections of the community, in such situations, are the women and the girls. Men may be absent for long periods and find better facilities outside their home villages. They are also entitled by tradition, regularly, to visit bigger markets, and if they are suffering from any sickness which still allows them to move, they can receive treatment in other places.

Bad water cannot only be connected with persisting illiteracy and the isolation of women, but also the lack of even the most

basic medical facilities, which leads to great problems for them at, for example, childbirth or during illness. It may also contribute to the gradual weakening of the whole family by malnutrition. Where water from deep wells can be bought from trucks, the resulting economic burden also affects mainly the women and children. To save money, the expenditure on food is cut down, meals are omitted or the diet consists only of the cheapest stuff; millet or even its substitutes among wild grasses, roots from climbers which must be soaked for days to remove toxic substances, and a broth prepared from dried herbs. This is particularly the case if the husband is absent. Not even crops which are grown by the people themselves on rain-fed lands should be eaten, since it is considered better to sell them as water must be bought during part of the year.

Our self-help programmes to be carried out by the women on a household level cannot solve all the water difficulties which exist in rural Sudan, but, if there is a proper awareness of possible simple treatments for surface water, and the local ecological conditions are favourable for digging more rain ponds or shallow wells, such water sources could be utilised, at least temporarily, until more expensive water supply systems can be provided.

WATER, WOMEN AND TECHNOLOGY

Among the items which have been discussed by the initiators of the Water Decade are the infrastructural constraints. It has been recently realised both by the donor nations and by authorities in the developing countries that many water improvement programmes have failed on account of inappropriate technologies.

Our programme, however, is based on methods which the rural people have discovered themselves. The first field studies during the flood season in 1974 were combined with some laboratory assessments (Jahn, 1976). Research on the traditional methods was subsequently carried out both in the Sudan (Jahn and Dirar, 1979) and also in Germany (Rösch and Jahn; Kasperek and Jahn; Barth, et al., forthcoming), and Denmark (Lund and Jahn, forthcoming). Two European collaborators are also women: Susanne Müller (organic chemistry) and Ebba Lund (water virology). The suggestions I have tried to make for the transfer of laboratory experience to the daily requirements of water treatment in Sudanese rural households concern both improvements in equipment, provision with the most suitable coagulants and optimising the existing techniques.

As described in detail in the above-mentioned manual (Jahn, forthcoming), we also need, for this purpose, to revive some traditional crafts of African women which have already died out in many Sudanese villages, such as pottery, tanning and coiled basketry work. Water jars, made from burnt clay, are the cheapest flocculators and storage vessels for treated water for the sedentary population. Nomads and people living in temporary huts during harvest seasons might use substitutes: vessels made

from animal hides or coiled basketry fitted with inlaid plastic bags. Special stirrers for more efficient mixing of the coagulant with the raw water, tools for hygienic removal of clarified water such as home-made calabash ladles and taps or syphons attached to the traditional clay jars, must all be tested both with respect to their technical benefits and shortcomings, and as regards their compatibility with the skills and preferences of the village women or nomads. We have also started to design more efficient jar covers and jar holders which can be made from local materials, and even partly manufactured by the women themselves (Jahn and Omar, forthcoming). However, each modification of the traditional procedure can only be recommended if it really provides better water quality and hygiene, and if it can help to reduce the bacterial contamination. Thus, detailed field analyses of water quality are necessary.

WATER PROJECTS AS WOMEN'S PROJECTS

If Sudanese women have been the traditional experts in simple water treatment methods, they now deserve special encouragement and financial support to contribute their share towards the goals of the Water Decade. Certain functions can be entrusted to women of status in a village, such as teachers, midwives, social workers, wives of the tribal and religious leaders, or the local representatives of the Sudanese Socialist Union. Women of this type have to learn how to carry out simple "village jar tests" with buckets, spoons and tea-glasses, in order to make a determination of the optimum concentration for the coagulant to be used in the particular village in relation to the turbidity of the raw water.

In the case of Nile water, such a test should be performed once every week because the load of suspended matter increases gradually, reaching a maximum and then declining again. Sudden storm rains, on the other hand, will cause drastic temporary increases of turbidity. By simple calculations the results of the village jar tests can be translated into terms of the "number of seeds" or "number of spoons" per "safiha" (tin of about 20 l capacity) and if the women have been informed about the capacity of their water jars (2 safihas, 2-1/2 safihas, etc.) the coagulant doses they have to apply can be calculated and advice concerning them spread verbally.

Village elite women can also assist in teaching others how new tools should be used, how the speed of stirring can be learned by pronouncing a certain formula, and how water must be handled in a more hygienic way no matter whether it has been treated or was "clear" from the beginning. Rural women can even be asked to cultivate the trees themselves which are needed, such as "shagara al rauwaq" (Moringa oleifera) to ensure a continuous supply of an efficient coagulant.

There are already encouraging indications that Sudanese women are keen to co-operate in realising the target of better water supplies to the rural areas, and that the local women welcome

and appreciate what is planned for them. Yet much work is needed; many more experiments must be made to test the suggested methods in the laboratory and at village level concerning both practical and pedagogical factors. From the positive results, as well as the failures realised during studies in a few "model villages", more general implementation programmes for a district or a province can be issued. With suitable adaptations to differences in environment, the work can then be gradually extended to wider and wider circles. We also have already made plans to introduce, as a second stage, small village water treatment plants for schools, government offices, markets, etc., which should operate with local coagulants and should be run by women (Jahn, forthcoming).

A movement in which the specialised training and skills of university women, and the greater understanding of the leading rural women, is united in a common effort to raise the health standards in the mud houses, grass huts and tents of the illiterate, or only basically educated, women by teaching about water treatment and water hygiene, can be also created outside the Sudan. At present Sudanese women are the pioneers for such a project of global importance and we can only hope that they will continue to work hard and feel their great responsibility both towards the Sudan and towards fellow nations in the tropical belt.

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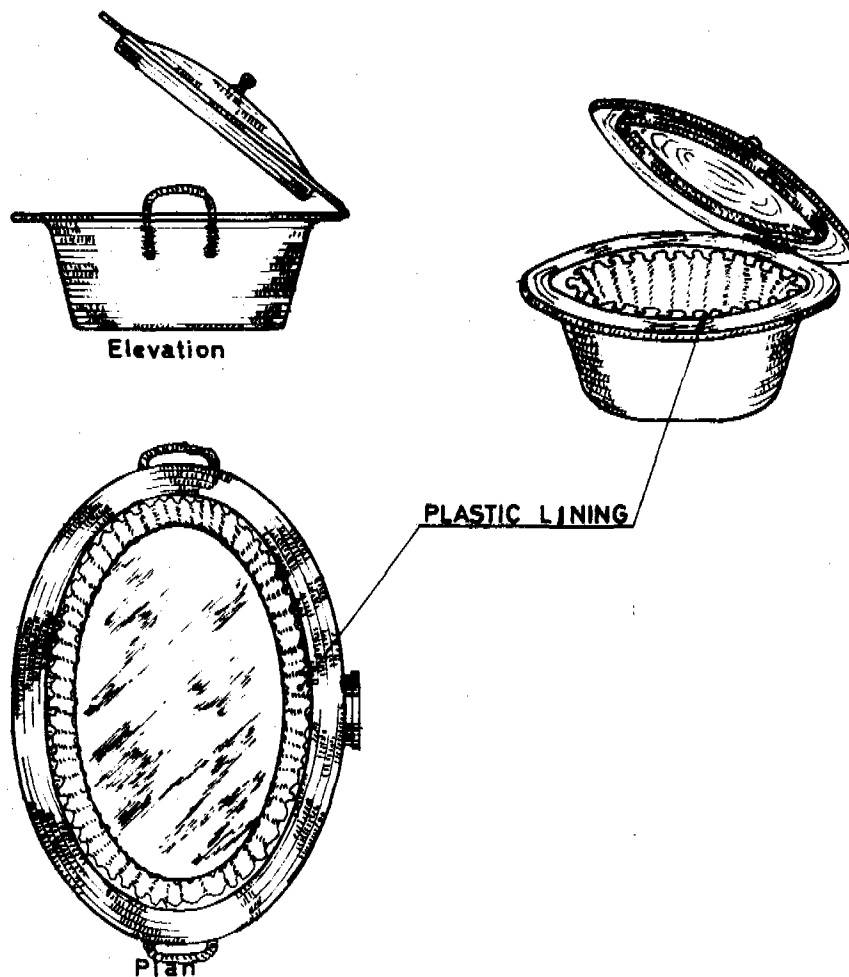
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BASKET FOR WATER STORAGE



THIS METHOD ADAPTS THE TRADITIONAL BASKET TO BE USED BY NOMADS FOR STORING WATER.

WATER COLLECTION AND USE:
A VILLAGE CASE STUDY

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The following paper reports on a field study undertaken during December 1980, the purpose of which was to obtain a profile of water use and consumption in a non-urban area of Sudan. This profile includes the sources of water, average water consumption, women's role in collection and treatment of water, and the differences in the above based on family socio-economic status.

BACKGROUND

The village chosen for this study is known as Alty and lies an hour's drive south of Khartoum on the western bank of the Blue Nile in Gezira Province. The population, numbering eight to ten thousand, is composed of members of a number of Arab tribes, including Rufaa, Kawala, Mahas and Jaaliyyin. There are a number of schools in the village--elementary, intermediate secondary for girls, and a Koranic Institute for the boys. In addition to the mosques and one hospital there are several small shops. There is no co-ordinated water supply system in the village, so that each household or institution must make its own arrangements which are highly variable.

The local hospital, for instance, although equipped with qualified staff (a physician, medical assistant and trained midwife), a laboratory and wards, has no water supply at all. Well water is located in the Koranic Institute, some distance away, and limited supplies are brought in for the physicians' use. Apparently the hospital zeers have been broken, hindering the daily delivery of water from the Nile. Needless to say, this situation has had dramatic effects on the hygiene conditions in the hospital.

At the Institute the water is raised by a diesel pump which takes half a gallon of gasoline to pump the daily supply for 250 students and staff in residence there. The mosque also has a well, operated by motorised pump, but when it is broken water is brought from the Nile. (Availability of water is important in Islam as daily prayers are preceded with ritual ablutions.) In the schools water is brought by water sellers from the Nile. As the market operates only a few hours a day, and other shops are attached to residences, the market area has no water supply.

Individual families either collect the water themselves or use water sellers. This is explained in detail below.

METHOD OF THE STUDY

In order to get an overview of the water situation in the village meetings were held with leading members of the community--teachers, the social worker, the midwife, and women of some leading families. We also spoke with the Imam of the mosque, and the medical assistant. Following these meetings we selected 36 houses randomly from three different sections of the village. Accompanied by three teachers from the local school we administered a questionnaire inquiring about their use and collection of water. While the interviews were being conducted we also carried out informal observations both at the river bank where water is collected and inside the house, particularly the number, type, and condition of the zeers (clay water jars).

WATER SUPPLY

Water sources

There are two sources of water in the village: the Nile and wells. The Nile is the primary and favoured source, and its water is drunk all year round. There are two wells in Alty: one from which water is raised by hand, and another with a motorised pump. When the pump is operating nearby houses and the mosque receive piped water. Unfortunately, for most of the year the pump does not work, either because it is broken, out of petrol, or there is no money for fuel, parts, or maintenance.

Water transportation

There are two professional water sellers in the village, but they are unable to supply all the houses, so school-aged boys (10 to 15 years) take part in daily trips. Both the water sellers and the school boys carry water in khourgs on the back of donkeys. (The khourg is a water skin made from cow's or goat's skin with a capacity of about 100-120 litres.) The water vendors rub the skin on the outside every two weeks with gutran (tar) to preserve it. This tar is extracted from coloquint seeds which have been found to contain carcinogenic substances (Jahn, 1980).

Women and girls also draw water from the Nile, usually in pails, safihas (tins of 20 litre capacity) or plastic buckets which they carry on their heads. Except for vendors, men do not share in water collection, as this is considered the domain of women and children.

WATER CONSUMPTION AND COSTS

Although water use is variable among different households--ranging from 20 litres per person per day to 7.5 litres--the average rates of consumption in Alty are given in Table 1 below.

Table 1: Average daily water consumption in Alty

Variables	Socio-economic status of households	
	Low income	Middle income
Number of adults	4.6	4.3
Number of children	4.2	3.6
Household size	8.8	7.9
Per capita water use	12.8 (litres)	20.3 (litres)
Household water use	112.6 (litres)	160.4 (litres)

Costs of water

The costs of one khourg of water during the dry season in the village are 25 piastres, compared to 50 piastres during the flood season when there is a heavy current in the Nile and it is difficult to get down the banks. Compared to costs for water in the city this is relatively expensive (Table 2).

Despite the fact that the quality of water is poorer, and that the labour required to obtain it is considerable, the costs of water in rural areas is appreciably higher than in urban areas. For instance, the minimum monthly water charge in Khartoum is ES 2.00 whereas in a centre like Alty the average household would pay from a minimum of ES 7.75, depending on the season and the monthly consumption. For a middle-class family in the wet season, the cost of water would be as high as ES 24. (Table 2).

Table 2: Average monthly costs for water in rural and urban areas

Households	Water use (litres)	Rural area*	Urban area**
		ES	ES
Low income	3,378		
dry season		7.75	2
wet season		15.50	2
Middle income	4,812		
dry season		12.0	2
wet season		24.0	2

* 1 khourg contains 110 litres and costs ES 0.25 in the dry season and ES 0.50 in the wet season.

** In Khartoum the price for up to 20 m³ of water is ES 2.00 (one cubic metre is equal to 1,000 litre)

WATER STORAGE FACILITIES

The most common containers used for storing drinking water are zeers, traditional clay jars which range in price from ES 1.00 to ES 6.00, depending on the size. Water used for

laundry, bathing and washing of utensils is stored in large petrol drums or plastic barrels. Most middle-income families have a special room (mazira) attached to one part of the house where two to three medium-sized zeers are kept. Another zeer is kept in the women's quarter near the kitchen. In lower-class families only one or two zeer may be kept in the house.

The outside of the zeers are often cleaned with bricks or charcoal to keep their original colour. We observed a wide variation in hygiene practises regarding maintenance of these water containers. During the floods the water contains much more sediment than in the dry season, thus requiring that jars be cleaned frequently. This may be done by removing all the water with a bowl or cup, discarding the sludge in the bottom, and scrubbing the inside with a local rope (habl), two kinds of brushes (lifa made from a tree sponge and mwqushasha made from palm leaves), and soap. The majority of women (65 per cent) used the rope, one-third the brushes, and only 4 per cent used soap. The cleaning is important as any residue of sludge contaminates the next lot of water poured into it.

WATER TREATMENT

During the flood season Nile water is very turbid and most women are careful to clarify it. Some women even strain it first to remove dirt, insects or plant material. When asked about the reasons for treating water, most of the women said they wanted the water to be clear; one-fifth wanted it clean of foreign material, and only 3 per cent mentioned concern about disease.

Several different types of coagulants may be used: those of soil origin, soda or cement, and dough from millet grains. While most of these were known by some of the women interviewed, they had had most personal experience with one type--tin asfar rauwag. There are three types of coagulants of soil origin: yellow clay, tin asfar rauwag, found along the shore of the Nile; grey-brown clay, tin akhdar, brought from the Nile at Mahas Qutrang, and a soil dug up when excavations are done for latrines or buildings.

The most popular type is the tin asfar rauwag, as it is easily obtainable by the women and girls before the onset of the flood season. They collect it in amounts large enough to last a few weeks, and dry it in the sun to enhance its life. Most water is clarified with this substance (Table 3), while water for washing clothes may be clarified with soda as it is believed to whiten them. Soda is never used for drinking water because it causes a salty taste.

The method of clarifying the turbid water is as follows: the dried clay is crushed with a mortar or stone and added, in varying amounts, to a small amount of water to make a suspension which is poured onto the surface of the water in the zeer. The women wait a few minutes, then use the water. Based on our

Table 3: Household uses of clarified water

Type of coagulants	Frequencies of Use (%)				
	Drinking	Washing clothes	Washing utensils	Bathing	Animals
Tin asfar	83.3	52.7	58.3	52.7	8.3
Tin akhdar	16.6	8.3	8.3	8.3	2.8
Soda	-	33.3	19.4	19.4	2.8

experiments in the laboratory at Ahfad College, the women did not have an accurate sense of the time necessary for floc formation and complete clarification. The coagulants used take up to an hour to be effective.

CONCLUSIONS

The following table summarises the water problem in Alty (Table 4).

Table 4: Summary of water problem in Alty

What is going on	Results in
1. Insufficient number of professional water sellers.	Shortage of water supply even to the hospital.
2. School-aged boys work as water sellers.	Interferes with their school work.
3. Time spent waiting to receive or clarify water supplies.	Need for water makes people reluctant to wait further for it to be clarified.
4. Water expenses.	Households cut down on water use which may affect health and hygiene. Inconvenience in schools and public institutions.
5. Inefficiency of motorised well pump.	Contributes to overall availability, and hence, costs of water. Inconvenience and greater pressure on water sellers.
6. Water-skin sacs which are rubbed with tar.	Water takes on tar flavour. Health risk due to carcinogenic substance in tar.
7. Careless drawing of water from the Nile by water sellers.	Water pollution from animals unless water is collected upstream.
8. Women fail to clean and cover their <u>zeers</u> .	Improper use may cause fatal waterborne diseases.

RECOMMENDATIONS

Based on our observations of the water situation, we would make the following recommendations regarding organisation of the water supply system, and improvement in the quality of potable water.

1. To organise a system for water supply:
 - a. each part of the village should contribute towards a salary for the professional water seller for collecting water;
 - b. the men of the village should build a road to the Nile to facilitate the carting of barrels of water so they can transport large amounts of water in a short time;
 - c. men should take part of the responsibility for the water supply, and be trained to repair and maintain the motorised well pump so people do not have to depend on other sources of water;
 - d. a rural committee should organise and obtain a simple mechanical system to bring water closer to houses to reduce costs of water.

2. To improve the quality of water:
 - a. quality of water becomes worse if boys collect it rather than mature men because boys cannot lift the buckets clear of polluted muds. It is better to collect the water upstream;
 - b. to make the leather of the khourg smooth, instead of using tar for rubbing; it is better to use a mixture of bees wax and oil, or substitute a water sac made from water-proof cloth;
 - c. to minimise the contamination of water in water jars, handling water should be done by using a special ladle. The ladle should be kept away from dust, flies and children;
 - d. to avoid multiplication and growth of organisms, as soon as water is clarified it should be transferred to a separate cooling jar;
 - e. rural women, particularly educated ones, should be trained in general sanitary care especially of zeers, such as cleaning the zeer every day, placing it on an elevated platform, using well fitting covers.

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HAZARDS OF WATER USE

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In a recent communication from a United Nations agency it was mentioned that thirty thousand people, half of them children, die daily of water related diseases, three out of every five lack adequate clean water, three out of four lack sanitary facilities as rudimentary as bucket latrines, and roughly 80 per cent of illnesses in the poor Third World are due to lack of water (Newsweek, February 23, 1981, p. 46).

Women, especially in rural societies, most often shoulder the burden of fetching water for their families. They, and the young children accompanying them to water sources, are subjected to a variety of health hazards, not the least of which is due to the consumption of such water. Storing water in dirty containers, and the unwise disposal of water, is also hazardous to human health. The dangers of contaminated water use occur either out of the home, or in it.

OUT OF THE DWELLING CONTACT

Women in various parts of the country walk long distances on daily trips to water sources to fetch water for drinking, bathing and washing. Before bringing their filled jars, pots or buckets back home they stay at the water site gossiping, washing their clothes, having a bath or swimming, especially in the Nile. Such waters are not completely safe as snail, intermediate hosts of schistosomiasis, amoeba and giardia organisms and other worm eggs (e.g. ascaris and cholera organisms) are usually abundant, especially in stagnant water or near the river banks where current is slow. This is noticeable in the rural parts of the irrigated Gezira Scheme, and along the White and Blue Nile banks. Such water-borne diseases mostly affect children due to their lower immunity, which leaves them susceptible to various infections.

Working or living near water courses flowing over rocks and boulders brings the people near the hazard of contracting Onchocerciasis (River blindness or Jur blindness) where its vectors (i.e. different species of Simulium (black flies)) find pleasant breeding places. Women and young children may expose themselves more by going close to the rivers to fetch water. Dense river vegetation, as in Southern Sudan, is an ideal

breeding site for Glossina species (Tsetse flies), vectors of human trypanosomiasis (sleeping sickness). Malaria, yellow fever and Filariasis (elephantiasis) are diseases transmitted by different species of mosquitoes including Anopheles spp., Culex spp., Aedes spp. and Mansonia spp. which breed at water sites.

Development schemes and new settlements, if not carefully planned, expose people to disease to which they are not resistant. New agricultural projects in various parts of the country bring together a heterogeneous sector of the population looking for jobs; with different levels of immunity among them, disease outbreaks are not uncommon. For example, in sugar cane growing areas, cotton plantations and sorghum fields, mosquitoes breed easily and spread malaria, and in rice fields schistosomiasis and leptospirosis are not uncommon.

HOME CONTACT

The difficulty of finding ways of purifying and keeping water safe creates additional health risks. Water, if kept in open pots and other containers in the house, makes a good breeding site for mosquitoes. Spilled water moistening scattered organic matter in the house, particularly when water given to animals is spilled on their droppings, creates a good medium for house flies to breed and expose the inhabitants to such diseases as cholera, amoebiasis, conjunctivitis, different fungal and bacterial illnesses. If hygienic practices are not used around bathrooms or latrines (pit and bucket latrines) such diseases will be more prevalent.

PREVENTION

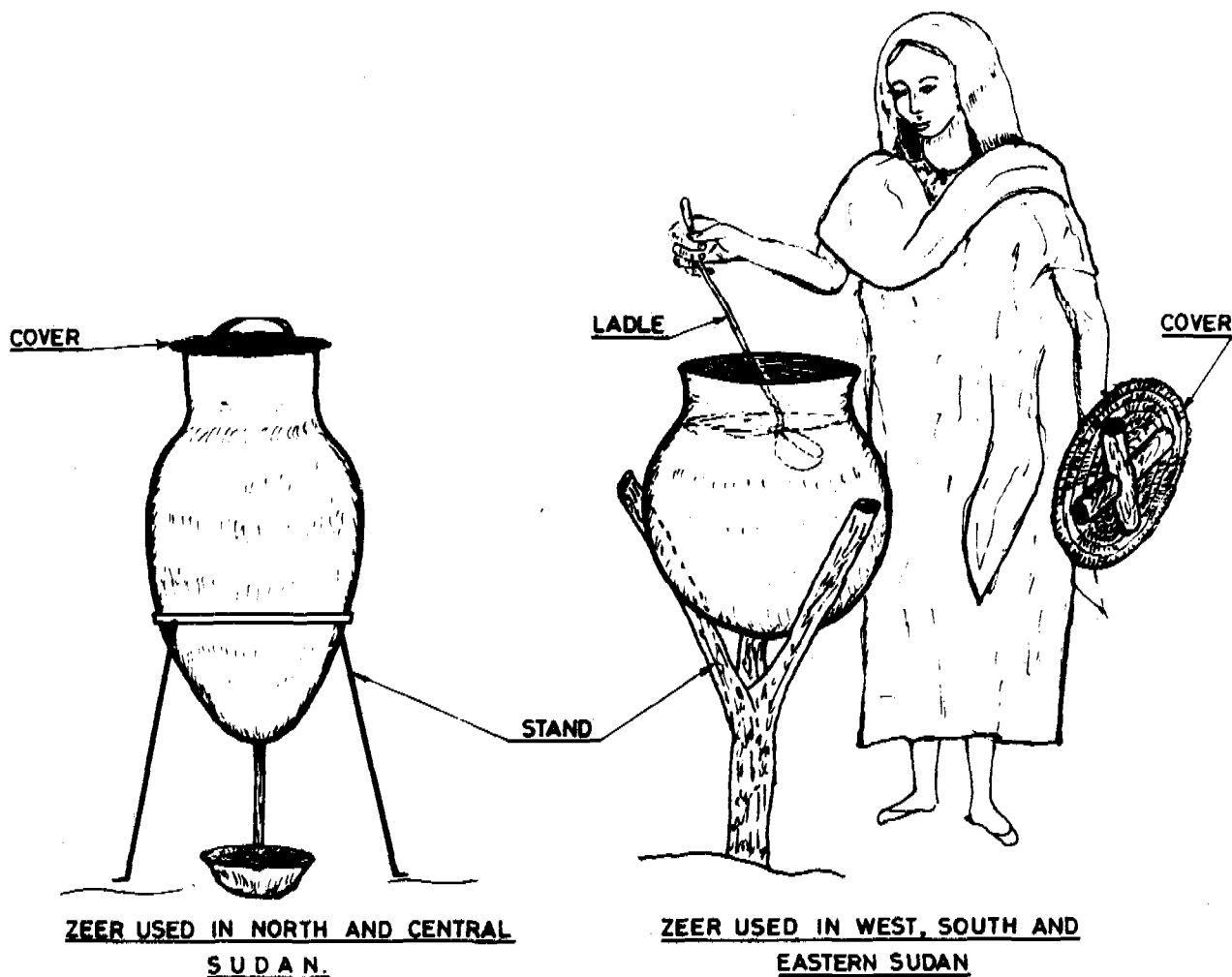
Since it is not feasible to expect that tap water can be supplied widely in Sudan at this time, due to scarcity of water and mobility of the nomadic people, the best way to avoid water-borne diseases is through education, especially among women. This should aim at:

1. preventing vectors of diseases to establish and multiply. Women at home should know how to eliminate the breeding sites for insect vectors of diseases, such as removing ditches and pits before throwing away water;
2. eliminating vectors by use of different physical and chemical means. Also encouraging mothers to go to clinics for treatment of cases as early as possible will reduce the disease incidence and eliminate carriers;
3. good housekeeping and hygiene. Boiling water and storing it in clean containers reduces the incidence of gastrointestinal tract infections which is a problem for young children in particular;
4. preventing circumstances suitable for transmission of

diseases to develop. Defecation and urination near water courses is dangerous, people should be encouraged to use latrines or pits away from dwellings. Water should not be collected during times when diseases are most commonly transmitted; for instance, to avoid sleeping sickness, it is preferable not to collect water at the early morning or evening periods when the tsetse flies are most active.

The most effective safeguard against water-borne diseases will be the widespread education, especially of the women, showing them the simple but effective methods that can be used to safeguard their family's health. Such methods are discussed in detail in the following paper.

TRADITIONAL WATER STORAGE.



WOMEN AND WATER IN WESTERN KORDOFAN

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The study of Rhad el Silik village community in Western Sudan, upon which this summary is based, is part of an ILO-funded pilot project on "Decentralized Management of Rural Water Resources". Although case-specific, the findings of this study have been extended, for the sake of discussion, to show how rural women are neglected, in general, by development.

One objective of the study was to investigate the access to control, at the village level, over the uses and benefits of water resources. The study found that, in this respect, women have a very peripheral position even though they are the major group in the community.

This paper examines two research hypotheses:

1. although women may come from higher and lower socio-economic groups, as a group they constitute the least advantageous section of the population when it comes to access to resources;
2. that at least part of this inferior position is due to an unresolved conflict arising out of socio-cultural and environmental contradictions.

The western region of Kordofan has a basic problem of inadequate supplies of water. This makes living styles very vulnerable to changes in the supply of water. This is expressed in two ways in the life of the community: (a) the different patterns of living that one community has to adopt with the changing season; and (b) the changing adaptations to the problem vary from village to village. These patterns and styles of living are determined mainly by the duration, amount, proximity and certainty of available water supply.

The major economic assets of the Western Kordofan region are rain-fed cultivation of dura (sorghum), ground-nuts, gum arabic and animal husbandry. The area is predominantly arid with a short rainy season when the water supply is in sufficient quantity. The long dry season presents quite a contrast to the activities, movement and mode of group co-operation. The villages fall into one of the following categories:

1. Settled communities all year round. Cultivation in the rainy season is practiced in addition to various trading activities in fuel, water, poultry, and other rural commodities in the dry season. A permanent water supply only makes such way of living possible. Animal husbandry is widely practiced by all households. Some degree of trading activities and provision of social services are also common in such villages, and many get promoted to the status of central villages where crafts flourish and more urbanisation is exhibited.
2. A transhumant migratory movement of two kinds is practiced: part of the household moves, with their animals, to urban centres, or the men and boys wander from one place to another wherever they find a chance for their animals to be watered.
3. There are other villages where, in the dry season, the household engages in daily trips to fairly distant water centres. The bulk of the male population either migrate to mechanised agricultural schemes in the Nuba Hills or go after their animals in the quest for water. Various economic activities are practiced to earn cash income beside the production of cash crops and the sale of animals. In such villages, settlement is permanent, but most of the time and energy are employed in the daily process of obtaining and providing water sufficient for drinking purposes and animal watering.

All these different modes of livelihood hinge on two factors: the abundance of water supply in the short rainy season, and the degree of shortage of water supply experienced in the dry season.

The above three patterns are not only dependent on the amount of rainfall, but also on the type of water supply. The improved types include 'hafirs', government-installed boreholes and water tankers. The traditional ones include man-made and natural rain pools, Tabaldi tree reservoirs, flood-season water courses, shallow wells, and simple water basins. The improved systems, of course, provide a greater volume of water, but only when properly managed and when fuel is available for the pumps.

Changes in the village economy usually take place when an improved water supply is introduced and the distance to it shortened. The closer the village to a permanent water supply, the more settled is the life of the villagers, and the more productive the farming practices and bigger the herds of animals. A good water supply results in better social educational and health services, and marketing and co-operatives, and, consequently, higher standards of living.

THE ROLE OF WOMEN

The life of an individual is structured culturally in a way that corresponds to the basic values and needs of the group, be

it family, clan, lineage, or village at large. A woman has a defined socio-cultural role for the different stages of her life. The social status of a woman is that of being dependent on a male, be it husband, father or brother. She is dependent in such matters as labour, ownership of property, inheritance, marriage, and all major decisions. The male guardian protects her rights in society and can veto her decisions.

This may wrongly imply that women have no economic role in society. Obviously the harsh economic environment dictates that all the labour force of the community be employed to provide the basic needs. Rural women of Western Kordofan have a role in production that equals and often exceeds that of men. The women, according to the customary division of labour, are the subsistent farmers, in addition to their role as housekeepers and drawers of water. Cash crops and animal breeding activities are men's domain. Gum Arabic and ground-nuts are the export and cash crops and men gain all of the income from producing these. Thus, women are forced into a role where they have no opportunity to earn an independent income.

Improved water supplies at certain points have resulted in larger animal herds which means that the men are away from the local farms for longer periods. This means also that a greater differential in the income of men and women arises because all the animal sales go into the men's pockets.

To provide some cash the women remaining at home engage in petty trade like the making of fuel, pottery, baskets, mats and dairy products. Goats are another source of cash income.

This need to engage in still other activities besides farming, household chores and water collecting, places an increased strain on married women and often results in insufficient attention being given to the health and well-being of their children.

An even worse situation arises when the women and children left behind in the dry season migrate to centres where water is easy to obtain--the "damaring" centres. Here the women often become a source of cheap labour for the urban population, and the long hours of work often result in further neglect of the children.

In conclusion, the study, so far, reveals that the improvement of water supply, while bringing greater benefit to the community as a whole, tends to widen the gap in income between men and women because the latter cannot utilise the monetary benefits which come from improved water supply applied to cash crops. Also, the improved water supplies in distant places mean that the men are away from their villages for longer periods and a further burden falls on the women while the men are deriving larger incomes from their increased herds. Thus, as customary law gives few property rights to women and gives her no independent decision-making power, she will not be able to derive any fundamental benefits from improved water supplies.

COMMENTS ON "WOMEN, WATER AND ENVIRONMENT"
SESSION

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All of the papers presented in this session illustrated, in one way or another, the complexity of the problem associated with water supply, especially in rural areas of the Sudan. Dr. Yagoub outlined the different sources of water used throughout the country and I would like to elaborate on this by presenting some figures on the water points under the Ministry of Energy. As you can see from Table 1, the total number of boreholes and hafirs increased 309 per cent from 1966 to 1981 while the number of workshops and maintenance centres rose by 700 per cent.

In addition to the government's efforts to provide more water points, a number of other international agencies are also establishing and improving water supplies throughout the country. For example, UNICEF has been very active in this area, beginning with a water supply project in Wau in 1976, the aim of which was to drill 1,400 boreholes with handpumps by 1982. A second UNICEF-assisted project at Kadugli in Southern Kordofan hopes to drill 200 boreholes by 1982 and rectify 140 hafirs and establish filtering systems. (UNICEF, 1980).

It is important to realize, as UNICEF has done, that the provision of water supply alone is not sufficient - on-going maintenance is the key to safe water access. As the women from Ahfad College pointed out, in their village case study, when there are no spare parts, benzine, or anyone able to repair the machinery, people are forced to return to the other unsafe sources of water. Demand that exceeds the supply capacity at any one site also creates difficulties. For instance, in the Rahad Agricultural Scheme villages the population has outgrown the projected levels with the result that, rather than wait long hours in line for the treated water, people turn to the canals which are heavily contaminated with bilharzia and other water-related diseases.

Table 2 shows the different classes of water-related diseases and their effects on health and productivity. All of these diseases are endemic in the Sudan, so the importance of giving people access to safe water supplies cannot be over-emphasized. In fact, as you are aware, we are well into the

Table 1: Rural water points installed by the Sudanese government, 1966 and 1981.

Region	1919 - 1966 ¹				1967 - 1981 ²			
	Boreholes ⁴	Hafirs	Main Workshop	Maintenance Centre	Boreholes	Hafirs	Main Workshop	Maintenance Centre
Kordofan	117	236	1	1	410	200	4	16
Darfur	46	64	1	2	322	62	4	13
Central ³	37	119	1	-	1300	84	4	9
Northern	-	-	-	-	161	-	2	5
Eastern	9	92	1	1	234	27	4	6
Khartoum	12	-	1	-	180	6	4	1
TOTALS	221	511	5	4	2607	379	22	50

¹ From 1919 to 1966 these water points were under the jurisdiction of the Land Use Department

² From 1966 on, they have been under the Rural Water Corporation

³ The water points in the Gezira Agricultural Scheme have been added to the Central Region.

⁴ Boreholes refer to small diameter wells fitted with pumps at the surface.

Source: Rural Water Corporation, Ministry of Energy, Sudan. 1981.

Table 2: The impact of water-related diseases on health in developing countries.

	Infection	Infections thousands /year	Deaths thousands /year	Average no. of days lost per case	Relative disability*
WATER-BORNE DISEASES	Amebiasis	400,000	30	7-10	3
	Diarrhoeas	3-5,000,000	5-10,000	3-5	2
	Polio	80,000	10-20	3,000 +	2
	Typhoid	1,000	25	14-28	2
WATER-WASHED DISEASES	Ascariasis (roundworm)	800,000-1,000,000	20	7-10	3
	Leprosy	12,000	Very low	500-3,000	2-3
	Trichuriasis (whipworm)	500,000	Low	7-10	3
WATER-BASED DISEASES	Schistosomiasis (bilharzia)	200,000	500-1000	600-1,000	3-4
DISEASES WITH WATER-RELATED VECTORS	African trypanosomiasis (sleeping sickness)	1,000	5	150	1
	Malaria	800,000	1,200	3-5	2
	Onchocerciasis (river blindness)	30,000	20-50	3,000	1-2
FECAL DISPOSAL DISEASES	Hookworm	7-9,000,000	50-60	100	4

* 1 means the sufferer is bedridden; 2 able to function to some extent; 3 able to work; 4 experiences minor effects.

Source: United Nations, 1980.

International Drinking Water Supply and Sanitation Decade, proclaimed by the United Nations. The issues that are to be emphasized in all water projects are the following: rural emphasis and community participation, education and communication support, training personnel, choosing the right technologies and maintenance. All of these points have been raised in the papers of this session. For instance, Dr. Jahn stressed the important role women can play in improving water quality using simple local technology and materials. Greater emphasis, however, needs to be placed on preventive education as well. While we can provide good quality water, the preservation of it can only be achieved when women and their families know how best to handle it to avoid pollution.

Few of the papers, however, mentioned the distance between the water supply and the households using them. One major aim of the Decade is to provide uncontaminated water within a reasonable distance. This is a very crucial factor in freeing women to engage in income-generating activities and giving them better health. A study done on the impact of available safe water in the Wau Project found a decrease in illness and a saving of six hours a day for each woman (Russel, 1979). This demonstrates the need to involve women in future water supply planning since they are the ones most directly affected.

In the Sudan, as its contribution to the Water Supply and Sanitation Decade, a National Action Committee has been formed of members from different government ministries and international agencies to plan and co-ordinate activities. Of course, women's associations will also be asked to sit on the committee. I will also undertake to convey to the Committee the points and issues that have been raised during this workshop so that we can translate your hopes for a better future for women and their families into a reality as soon as possible.

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PART III.

WOMEN AND THE LIVING ENVIRONMENT

ENERGY IN THE SUDAN: AN OVERVIEW

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In this paper I will present the current picture as regards energy production in the Sudan and its effects on the environment. I will also indicate how women can be involved in future decisions regarding energy use.

ENERGY SOURCES

Presently the main sources of energy in Sudan are imported oil, locally produced woodfuel, and, to a much lesser extent, hydroelectric power. The quantity of oil imported in 1979-80 consisted of one million tons of crude oil, refined at the Port Sudan refinery, plus two hundred thousand tons of processed oil products. Oil products and electricity, generated thermally and hydroelectrically, constitute the only commercial or conventional sources of energy in the Sudan, and amount to 23 per cent of the estimated total energy consumed in the country in 1979-80. Non-commercial, or non-conventional energy in the form of fire-wood, charcoal, agricultural residues, grasses and animate power contributed 77 per cent of the total energy consumed in that year.

Conventional energy

Of the two conventional energy forms used, petroleum products contributed 98 per cent and electricity 2 per cent (Sudan, National Energy Administration, 1980). Petroleum products supply virtually all modern sectors of the economy with their energy requirements, including that used in transport, industry, processing and mechanised agriculture. For the last five years there was an annual increase in consumption of petroleum products averaging 6.3 per cent. In industry, the annual growth of petroleum products use averaged 9.6 per cent and ranged between 4.9 and 6.7 per cent in other economic sectors in the same period.

Electric power generated contributed 2 per cent of the total commercial energy and amounted to 890 g.w.h. in 1979-80, out of which 26 per cent was thermal and the balance hydroelectric.

Non-conventional energy

Non-conventional energy in the form of woodfuel, agricultural

crops residue, and animate power contributed 77.3 per cent of the total energy consumed in 1979-80. The share of each source was as follows (Sudan, National Energy Administration, 1980):

<u>Woodfuel</u>	<u>75.12%</u>	<u>Agricultural residues</u>	<u>1.37%</u>
Fire-wood	69.13%	Crop residues	0.78%
Charcoal	5.99%	Animal refuse	0.59%

HOW ENERGY USE AFFECTS THE ENVIRONMENT

Petroleum products

Sudan pays annually between 80 and 90 per cent of its total foreign exchange resources in purchasing petroleum, and even this is not enough to satisfy energy needs (World Bank, 1980). High prices and shortage of petroleum products supply have the following effects on the environment.

Use of petroleum products in Sudan is limited in both time and space. Fifty-five and a half per cent of these products is used in the national transport system, so air pollution from such emissions as SO₂, CO, CO₂, aldehydes and sulphates, which are the major pollutants of petroleum products, are thinly dispersed and do not, so far, constitute a threat to human, animal or plant life. In the case of industry, where 15.7 per cent of petroleum products is used, there may be a cause for concern, since industry is concentrated in a few places and air pollution is possible. Again, in irrigated and mechanised agriculture, there is a seasonal threat of air pollution during land preparation and cropping season. In future, pollution from fossil fuel combustion from large electric generation, and from automobile emissions, will assume greater importance in urban centres (United Nations Environmental Programme, 1980).

Woodfuel

The second effect of petroleum products is an indirect one and reflects on land use. The fact that petroleum products are expensive, and not widely available, is pushing the country into more dependence on wood and vegetable fuels, the results of which are serious environmental impacts on cultivable lands (United Nations Environmental Programme, 1980).

The total amount of fire-wood consumed in 1979-80 was estimated to be 10.65 million tons. Nearly 98 per cent of this quantity was utilised as household fuel, either in domestic services or bakeries, both in urban and rural settlements. About 2 per cent of the total fire-wood consumed was the only available fuel for rural industries such as brick burning, lime burning, pottery, tobacco curing, and production of steam for processing of vegetable oils, etc. In urban areas, large quantities of charcoal, approximately half a million tons, were also consumed, bringing the total amount of wood removed from the forests to over 13 million tons. This huge utilisation of

woodfuel already has had its impact on the environment: the desert creep, soil degradation, increased aridity, and salinity, lowering of water tables, and low productivity of the soil are the results of removal of trees as a protective cover for the soil.

Wood is also wasted when produced as fuel and when consumed. Harvesting equipment and tools used result in a high percentage of wood remaining unused in the forest. Charcoal production, with primitive types of earth kiln, burns most of the wood into ashes and gases, and only 8 to 12 per cent of the wood is recovered as charcoal. During consumption the open fire system, which prevails all over the country, only makes use of 4 to 6 per cent of energy released from burning fire-wood. The charcoal stoves used in Sudan have an efficiency as low as 15-18 per cent. So production and consumption methods of woodfuel lead to wastage of a substantial amount of the resource. Burning of wood in such huge amounts also leads to the release of large quantities of heat which, in itself, is a harmful air pollutant. CO_2 is also released in the atmosphere in big quantities.

Furthermore, clearance of large woodlots, as happens in Sudan, are some of the causes of the great run-off of rain-water, resulting in floods that lead to filling of reservoirs, as happens annually now in Damazine Lake, and causing interruptions in electricity generation. Floods also contribute to reduction in cultivable land.

The dependence on wood as a fuel in Sudan also deprives the population of other important uses of wood such as building materials and handicraft elements.

Hydroelectric power

Hydroelectric power is poorly developed in Sudan: out of the 3370 M.W. potential available, only 250 M.W. or 7 per cent is utilised. The electricity generated now from hydro-power is in the range of 690-700 g.w.h. or almost 78 per cent of the total electricity produced in the country. The dams of Damazine, Sennar, and Khashm El Girba, which serve the double purposes of irrigation and power generation, have some negative effects on the environment. These dams have become dominant forces affecting physical, biological and socio-economical systems in the regions where they are installed, and far beyond them. The man-made lakes have their effects locally on climate, water quality and human settlement. They have downstream effects on flooding, communication and sedimentation. Aquatic, terrestrial, and zoological aspects are also affected. The introduction of continuous irrigation created a habitat favoured by some disease organisms such as the snails transmitting bilharzia.

Wind energy

Wind energy systems were introduced in Sudan in the years 1950-53 to pump water for small villages in Gezira province. Two hundred and fifty windmills were operating up to the early sixties at a capacity of 900 g.p.h. per mill. These mills were deserted and replaced by diesel engines for reasons of increased population in the villages and their demands for more water which the windmills could not provide. Scarcity of spare parts and inadequate maintenance further accelerated their demise.

PROJECTS PLANNED TO DEAL WITH ENERGY PROBLEMS

The projects planned to deal with energy problems in Sudan can be grouped into three categories:

- i) conservation of energy through efficient production and consumption methods;
- ii) promotion of new and renewable sources of energy;
- iii) reduction of use of petroleum products.

The projects in the field of conservation and efficient use of energy aim at the full maintenance and rehabilitation of oil processing and transporting systems to minimise use of oil. They also aim at obtaining higher qualities of fuel. These projects, therefore, will deal with problems concerning Port Sudan refinery, Sudan pipe-line, and the transport system, including roads, rivers, railways or air. With these projects also go improvements in storage and distribution systems, regionally and sector-wise. Improvement in electricity generation by solving siltation problems in Damazine, maintenance of the transmission lines and improvement in Buri Station will also be undertaken. Other parts of these projects deal with the improvement of production and consumption methods of woodfuel as firewood and charcoal. Better equipment for felling wood and modern types of kilns for charcoal production are being considered. Modification of the present charcoal-using stove (mangad) is also included.

Development of biomass

As for the projects concerned with promotion of new and renewable sources of energy, the following projects are under study:

- i) increased afforestation practices, particularly around large consuming centres like Khartoum Province;
- ii) utilisation of agricultural residues. The total agricultural residues available now to be utilised as fuel are estimated to exceed three million tons annually. This can be utilised through: direct combustion, e.g.

bagasse, cotton stalks, dura stalks, etc.; fermentation to produce alcohol (ethanol) which can be blended with gasoline to reduce consumption of gasoline by up to 20 per cent; (molasses, a by-product of the sugar industry, will be the major raw material for this project); anaerobic fermentation to produce methane (biogas) using Nile weeds and animal dung.

Development of electricity

Mini-hydropower systems are being discussed to make use of the available potential without getting into large and costly schemes. The mini-hydropower system can be started on existing running water and be developed continuously according to need. Electricity produced thermally will be developed through Energy Project III which aims at strengthening the Buri Station and installations of two other stations in Khartoum North and Atbara in the hope of securing adequate supplies of electricity, particularly during the seasons when it is scarce.

Development of solar energy and wind energy systems

Work has already started in the Energy Institute to develop the following systems: solar stills for large applications; low-cost water heaters and cookers; flat-plate steam generators; solar cooling systems; solar drying.

The National Energy Administration is formulating plans to extend solar systems in the fields of water pumping and electricity generation. Studies to extend the technology of wind energy for water pumping in Darfur and Northern Provinces are underway.

HOW ENERGY PRODUCTION AND CONSUMPTION AFFECT WOMEN

Since women constitute 50 per cent of Sudan's population, their role in every field of life is important. The power and influence of women in shaping the thoughts of their children and men on matters that lead to change and improvement is of tremendous importance. Women have to be involved in a more direct and meaningful role in the whole development process of the country. They could be effective in reshaping our society to bring immeasurable benefits to the population (UN/ECA, 1975).

Integration of women in development efforts in order to promote the full use of the combined human resource of male and female for development of the country is the keystone for our development. Women have to take a share in planning and execution of national development projects. In some projects, women may even play a bigger and a more important role than men. For example, conservation of energy and efficiency of use at the household level is the responsibility of women alone. In projects that are closely related to energy use, such as elimi-

nation of malnutrition through increased food output, adequate supplies of fuel for home use, adequate amounts of clean water, availability of light in the home, learning modern means of agriculture in order to reduce energy use, save labour, and to improve farming and rural life, women's role becomes even clearer and more important.

Women's participation in all the above-mentioned subjects will lead to minimisation of wastage of both women's potential and energy wastage in production and consumption. This will finally lead to better health conditions and better family economics. Participation of women in the conservation of energy, the improvement of cooking stoves, and reduction of pollution will add more luxuriance to our landscape and desert creep will be checked.

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WOMEN'S ROLE IN DEFORESTATION

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In some areas of the Sudan the cutting of trees is an important economic activity for both men and women. Using the central region of Northern Kordofan Province as an example, I will illustrate, in this paper, the active role women play in environmental deterioration through their domestic, income-generating and agricultural tasks.

The extent of acceleration of deforestation in the Bara area of Northern Kordofan is demonstrated in the contrast between areal photographs taken in 1963 and in 1976. In the former year, tree growth was dark and thick near the village perimeters. These perimeters covered about 32 per cent of the total area of study, and were encountered between one-half to one kilometre from the settlement sites. By 1976 photographs showed only sparse vegetation and this on only 9 per cent of the total area, found five to eight kilometres from the villages (Lamprey, 1977). The reasons for this rapid reduction in forest cover are discussed below.

AGRICULTURE

Rain-fed cultivation is the basic activity of the female sector, as well as being the oldest type of land-use in the area. Removal of trees, shrubs and bushes is practised by women to clear land for cultivation purposes. While some women participate in agriculture with their families, many have their own holdings: in fact, it is estimated that holdings owned by women have increased almost nine-fold in the last fifteen years (Ibrahim, 1978). Cash crops, such as oil seeds and hibiscus sabdarilfa (from which the beverage karkadeih, widely drunk in the Sudan, is derived) have been planted on a large scale, extending the area under cultivation as well as the length of the growing season. As a result, even the acacia senegal trees are felled in spite of their economic value for the production of gum arabic. (The Sudan is one of the largest exporters of gum arabic in the world.)

FUEL

Another reason for the cutting of trees in the region is for fuel. Kerosene, which was more widely used in the past, is now

very difficult to obtain, so most people have reverted to wood and charcoal. Of the people I spoke with in the area, 16.4 per cent said they were engaged in this activity. The females in a number of tribes--the Kababish, Gilaidat, Baza, Nawahia and Awlad Agoie--play a vital role in deforestation for fuel purposes. These women gave a priority list of the selected trees based on their burning properties. Within the acacia family, the hashab tree is highly preferred due to its durability and strong fires. One kentar (equivalent to one donkey load) of hashab can last for ten days, while one kentar of laot--which is the least preferred variety--will not last for more than four days. Heglig, on the other hand, is not desirable due to its thick smoke, although one kentar will last five days; marikh, which burns cleanly, will not last more than three days.

The first areas to be felled by the women are at the perimeter of the town, and these are gradually extended. The average distance to the wooded areas increased almost eight times in ten years. The period prior to the rainy season is the peak felling time, and the wood is stored to be sold at high prices in remote areas. The method of harvesting differs for the men and women: the men pull the higher branches down with ropes, while the women cut the lower branches with axes. (Regeneration is much quicker at the upper part of the tree than where it has been chopped.) About 85 per cent of deforestation is done with axes, and 90 per cent of the trees are felled while green to give longer lasting fires.

The wood is tied in bundles weighing about one-half kentar and carried on the woman's head. During the 1960's the women used to make five to eight trips per day from the village to the wood-lot carrying wood on their heads, but between 1970 and 1978 only two to three journeys a day could be completed, using donkeys or camels. Table 1 shows the weight and heat yields of the two types of loads.

Table 1: Weight and energy content of wood collected

<u>Unit of firewood</u>	<u>Kentars</u>	<u>Kilograms</u>	<u>Kilocalories</u>
1 donkey-load	2	88.8	284,160
1 head-load	0.5	22.2	73,540

SALT EXTRACTION

Wood is also collected as fuel for the salt extraction process in the gaat* area. With a salt concentration in the 45 to 55 per cent range, salt production has become important. Hardwood varieties, such as commiphera africana, combretum species, and cordia abyssinica are used to evaporate the brine. In order to produce one barrel of salt weighing 250 kilograms, one kentar of wood is required. The salt is used mainly for animals and

* gaat is the plural form of gaa which means a shallow, salty well.

and appreciate the beneficial results that such protection brings. A nationwide campaign to create a sense of conservation seems to be a most effective remedy in conjunction with the co-operation of officials with their technical skills.

5. Cultivation practices should be prohibited north of latitude $13^{\circ} 30'$ N, where the area is marginal and suffers from a sparse plant cover.
6. A large-scale shelterbelt scheme in the northern fringe of the region, as a protection for the rain-fed cultivated areas, should be developed. Selected tree species adapted to the prevailing climatic conditions of the area should be planted to limit the areas under cultivation. Consideration should be given to difficulties and handicaps encountered during the installation of the El-Bashiri pilot project.
7. Large-scale afforestation should take place to provide the growing population with fuel requirements. This planting should follow a certain cycle without harming the soil, and consequently organised wood-felling will replace the random deforestation activity practiced in the area. It must be recognised that the introduction of advanced modern technologies, such as the application of solar power as a source of fuel, is far from being practical in these areas. The high degree of illiteracy, coupled with the unwillingness to accept alternative modern devices, are the basic factors behind the persistence of primitive methods for such long periods. On the other hand, wider availability of kerosene would reduce the demand for wood.
8. There is a serious lack of knowledge among women regarding the environment, its resources, and how to protect it. A sensitive environmental awareness is greatly needed by women, as it is of vital importance in protecting the natural vegetation cover which will ultimately help in minimising soil deterioration and the desertification hazard in the area.
9. Construction of permanent houses from the available non-wood local materials should be encouraged. The soils of the area are rich in clay and lime which are resistant to the external climatic conditions and have a longer durability.

The adoption of an ideal land-use strategy is of prime importance in the area which is rich in various development potentialities. This will enable the inhabitants who are involved in different activities to enlarge their enterprises, increase their unit output and improve their standards of living.

FUTURE RESEARCH

Limitations and handicaps encountered in doing such research

include the absence of detailed land-use maps, as well as recent aerial photographs. Also, the topography of the landscape, and the poor transportation, present an acute problem particularly in areas with heavy sand accumulation. Records concerning the former size of the holdings, cultivation cycles, former consumption and yield per unit area of crops, are also lacking. Dependence on the informants' memory to recall the approximate figures and dates is not very satisfactory. The level of education among women is low, which makes it difficult for them to change their practises.

Research of an environmental nature has been recently tackled but many other areas still need to be investigated. A close assessment of the role played by forest products is of vital importance in the savanna belt of the Sudan. The region should be divided into smaller units to be studied thoroughly as case areas. Studies of life-span, resistance and regeneration of different tree varieties should be tackled. Most importantly, perceptual studies on the environment should be encouraged. The final results of such analysis will help to guide future conservation policies and developmental strategies at both local and national levels.

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RURAL ENERGY AND THE ENVIRONMENT:
IMPACT OF WOMEN IN SEMI-ARID SUDAN

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INTRODUCTION

Wood, charcoal, animal dung and crop residues are the dominant fuels for the rural people in most of the developing countries. These are preferred because they are usually cheaper to use and are locally available. Often they can be obtained at no more cost than the effort of gathering them, whereas commercial fuels, when they are available, are usually costly and generally involve the additional expense of stoves and similar equipment to burn them.

Woodfuel and other traditional energy resources provide at least 80 per cent of all energy, other than human and animal energy, used in the rural areas of developing countries. In the Sudan, wood-based energy resources provide about 73 per cent for the whole country, but in rural areas it provides up to 96 per cent of energy consumed. Although domestic energy needs vary with climate, family size and cooking habits, this total dependence of both urban and rural populations on traditional energy (non-commercial) resources is putting great pressure on rural resources (environmental impacts). There is clearly a dual economy in the Sudan's energy sector, viz. the needs of the modern sectors and urban consumption, and the needs of traditional rural areas. There are problems in both energy sectors. Difficulties of financing oil imports are paralleled by the difficulties of maintaining an adequate resource base for wood and rural traditional energy sources.

Population growth leads to the destruction of forests, and in some cases to the removal of all trees and scrub cover: the frequent coincidence of deforestation and desertification is no accident. As supplies of wood become scarce, providing fuel for the household becomes an increasingly arduous burden. Progressively, more rural labour has to be diverted to gathering wood, dung and crop residues.

More important, perhaps than the question of rural labour, is the drudgery and fatigue that such work imposes and its health effects. The burden of supplying fire-wood and other traditional energy falls on the rural women. Young girls and women in rural areas spend hours from dawn to sunset gathering fuel-wood,

dung and crop residues for the family evening fires.

The theme of this short paper is the set of problems associated with women, energy use patterns, and likely ecological impacts in rural Sudan.

STUDY AREAS

Two areas in rural, semi-arid Sudan were chosen. The Umm Buweisa region in the White Nile Province, as an example of a low rainfall woodland savanna on sand, and the Kalkada area in the Nuba Mountains of Southern Kordofan, as an example of a low rainfall woodland savanna on clay.

The two areas resemble each other in many respects, although the Nuba Mountain area lies in a richer environment, whereas the socio-economic system of the White Nile area is affected by the developed system of the sedentary riverine settlements, the nearby urban centres, and the relatively developed transport system to the urban areas of Dueim-Kosti-Khartoum.

Umm Buweisa

The Umm Buweisa village is located in the Southwestern part of the Ed Dueim district. Physically the area is characterised by a system of stabilised and longitudinal sand dunes, with patches of clay deposits in low areas. The village itself is located on one of the dunes. The area is part of the semi-arid lands, and the vegetation is composed of acacia desert scrub, with few trees that have survived. The dominant species is the drought resistant acacia nilotica, which provides the major fire-wood resource.

The nearest cluster of trees or forest is about 13 kilometres from the village. The species found scattered over the dunes include a few Kitir (acacia melifera) and Sammar (acacia tortilis) stands. Because the village is well known for its abundant water supply (mainly surface wells), the area is heavily grazed and there are signs of intensive wood removal.

The total number of households is 50. All the houses are the traditional grass-thatched huts. These are conspicuously small in size and few in number, an indication of the scarcity of building materials. About 10 per cent of the houses have latrines or private bathrooms. The total population of the village, based on 6.9 as the average number in each household, is 350 persons, 50 per cent of whom are women and young girls. The energy consumption survey showed that the average monthly income was about ES 65.00 for a family of nine persons, while the range was ES 35.00 for the lowest group and ES 140.00 for the highest. The income is derived from selling surplus crops, labour and cotton picking. The women usually make some money when they migrate seasonally to cotton fields.

Kalkada

The Kalkada region consists of a mixture of gentle hill topography and clay plains cut by a number of khors. It, therefore, provides a favourable site for human habitation. The area is also part of the semi-arid zone, its vegetation is characterised by rather short grasses and tree communities consisting of Acadia albida, Balanites aegyptiacum, Ziziphus and Cambretum, which provide the fire-wood resources. Within the settlement only dom-palm trees, some shade trees and the forestry plantation are found. The other natural tree assemblages are found in relatively thick stands about 1-1.5 kilometres away from the settlement. The total population is estimated at about 750 persons, with an average household number of six persons.

The economy of the Umm Buewisa village depends on (a) rainfall agriculture (seasonal); (b) few livestock; and (c) seasonal migration for cotton picking in the Gezira and White Nile pump schemes. Other minor jobs include well digging and lining, herding and hut building.

Almost all these activities are the responsibility of women in the Kalkada area. Moreover, they cultivate the house-farm (jibraka), share in cultivation on distant fields, process merissa and practice other handicraft and small industries at home such as jar making and the soap industry. In fact, adult females are engaged in working the whole year round. The males, on the other hand, are idle most of the dry season.

Although the two areas are well supplied with water, the livestock ownership is very low compared to other areas in rural semi-arid Sudan. This may be explained by the fact that animals, other than goats, do not play an important role in the socio-economic system of the Tiera-Nuba, the main inhabitants of the Kalkada area. In the Umm Buweisa region, over-grazing and environmental deterioration may be another explanation.

ENERGY USE

Umm Buweisa

Fire-wood, charcoal, crop residues and dung are used for cooking and making tea and coffee; diesel oil is used for lighting. Diesel oil is usually obtained from a nearby village for about 40 P.T. a bottle; the average family using about two to three bottles per month. Kerosene disappeared from the area seven years ago.

As most of the families are poor, charcoal is either bought at 50 P.T. per tin (7 kg.) or made locally by women using primitive methods. Crop residues are usually umm brembite (bullrush), collected by landowners near the White Nile and sold locally. Also dura stalks are used after they have first been used for thatching huts. Animal dung is widely used by women

for cooking, especially kisra. On the average, about three tins per day are used.

Seventy-five per cent of the households interviewed stated that fire-wood is usually collected by women who go out early in the morning on their donkeys and travel distances of up to 13 kilometres. First the dry parts are collected, then branches are cut off, and finally the whole tree is cut. One donkey load (55-65 kilograms) would last one family of seven persons about two days when it is combined with other fuels.

Kalkada

In the Kalkada area, on the other hand, fire-wood is the more important source of fuel. Ninety-five of the people interviewed revealed that they are either totally dependent (68 per cent) or, to a large extent dependent, on fire-wood for household purposes, in the sense that it accounts for more than 50 per cent of their fuel needs (26 per cent). It serves all household purposes such as cooking, merissa-making, heating, if necessary, and repelling biting flies. Moreover, owing to the limited cash available and the difficulty of obtaining kerosene and gasoline from legal outlets, together with the increasing prices of both, fire-wood is becoming more important than other sources, even for lighting purposes. About 80 per cent of the respondents use fire-wood for lighting.

Fire-wood collection is here also a totally female activity as males regard it as degrading. The women usually collect only the dry dead wood or wood fallen as a result of termites, wind, thunderstorms or running water. From the individual and environmental point of view this way of gathering wood is very rational: no green or living trees are cut and the weight of the load, which must be carried on the head, is much lighter. Similarly, the women collect and burn the charcoal that is produced by the wood used in cooking and recycle it for further consumption. In the rare cases when wood is cut, only the small and medium branches are taken, since their tools are not capable of chopping mature tree trunks.

The collected fire-wood is usually tied in bundles sufficient for a head load (ras), each of which consists of 15-20 branches of 1-2 metres in length and an average of 10 cm. in diameter. The bundle is then transported on the head from the area of collection to the village, a distance varying from less than one kilometre to two kilometres. Although all dead, dry or fallen wood may be collected and used, the preferable species are talih (acacia seyal), sahab (Anogeissus lieocarpus), babanus (Debberzia melonoxylon). They give more heat, remain burning for a longer time, give more charcoal as a by-product, and less smoke. Talih, in particular, is bearable. In fact, the burning of talih by married women for its scented smoke (dukhan) is a widespread tradition in the arid areas of the Sudan, although not a popular one among those of the study area in particular. The other two types of wood, moreover, can easily be broken into

small manageable pieces when dry, a matter which facilitates transportation and handling.

Because of the availability and the ease of procurement of fire-wood, neither dung nor agricultural residues play any role in household energy in the area. In the same way, charcoal does not play an important role in household energy in the area, except for residues left from wood fires. In the rare cases when it is produced in the village both wood collection and/or cutting and burning are the work of the female. Small amounts are usually produced, usually less than half a sack, and it is mainly directed towards the local village market and the weekly market, usually in nearby service centres.

Whereas wood collection or cutting and burning is the woman's activity, children, especially girls, are also engaged in selling it in the nearby markets. Again talih and Sahab lieocarpus are preferred for the same reasons mentioned above, and because the charcoal produced is easily burnable, gives relatively few ashes, and does not give out irritating sparks.

STOVES

In both areas, Kalkada and Umm Buweisa, the open hearth stove, made of stones, brick or clay, is the main cooking stove. In Kalkada, 96 per cent and in Umm Buweisa 60 per cent of the households possess and use such stoves. The rest use Kanoun as well, and only a low percentage use the Kanoun alone. Both types share almost the same disadvantages: being inefficient and dangerous for fires and escaping fumes. Although the efficiency of both is very low, that of aladaya is much lower than that of the Kanoun (4-6 per cent as compared to 15-25 per cent depending on the type of Kanoun).

OTHER WOOD USES

Another finding that came out of the study in the Nuba Mountains is that, contrary to common assumptions on rural energy, rural household energy use is not the primary agent of destruction of wood resources. This is illustrated in Table 1

Table 1: Annual consumption of wood for various activities, Nuba Mountains

Activity	Per household (m ³)	Per capita (m ³)
Farming	30.0	5.0
Building	2.4	0.4
Wood for fuel	9.5	1.2

Source: Fieldwork in Nuba Mountains, 1980.

which shows that farming activities (that is, the clearance of

land for agriculture principally) actually removes more forest than collection of fuel wood.

OVERVIEW AND CONCLUSIONS

When we look at resource use, particularly energy consumption, as a whole, we see that it is related to other important aspects of the social system, as shown in Figure 1. The input into the system is the demand of the household, which is governed by family size and income. Depending on the availability of the resource, access to it, and its cost, the individual may have alternative choices. The choice of one or more sources of energy has, in turn, different effects on the environment, such as deforestation, soil erosion, etc. Eventually re-growth rates are affected which may alter use patterns and so on. This inter-relationship is demonstrated in the above two examples.

From these two cases we can say that the rural female population, as a major energy consumer, when faced with shortfalls in fossil fuels, will increasingly turn to available organic materials to meet their energy needs. In light of this, and in the absence of conservation and forestry developments, environmental deterioration is inevitable. On the other hand, from the individual's point of view, use of these forms of energy is highly rational within their financial and geographic limitations. Given this propensity, therefore, if other forms of energy were more widely available and affordable, and/or if conservation measures could be introduced in the area, it should not be difficult to involve women in them fully.

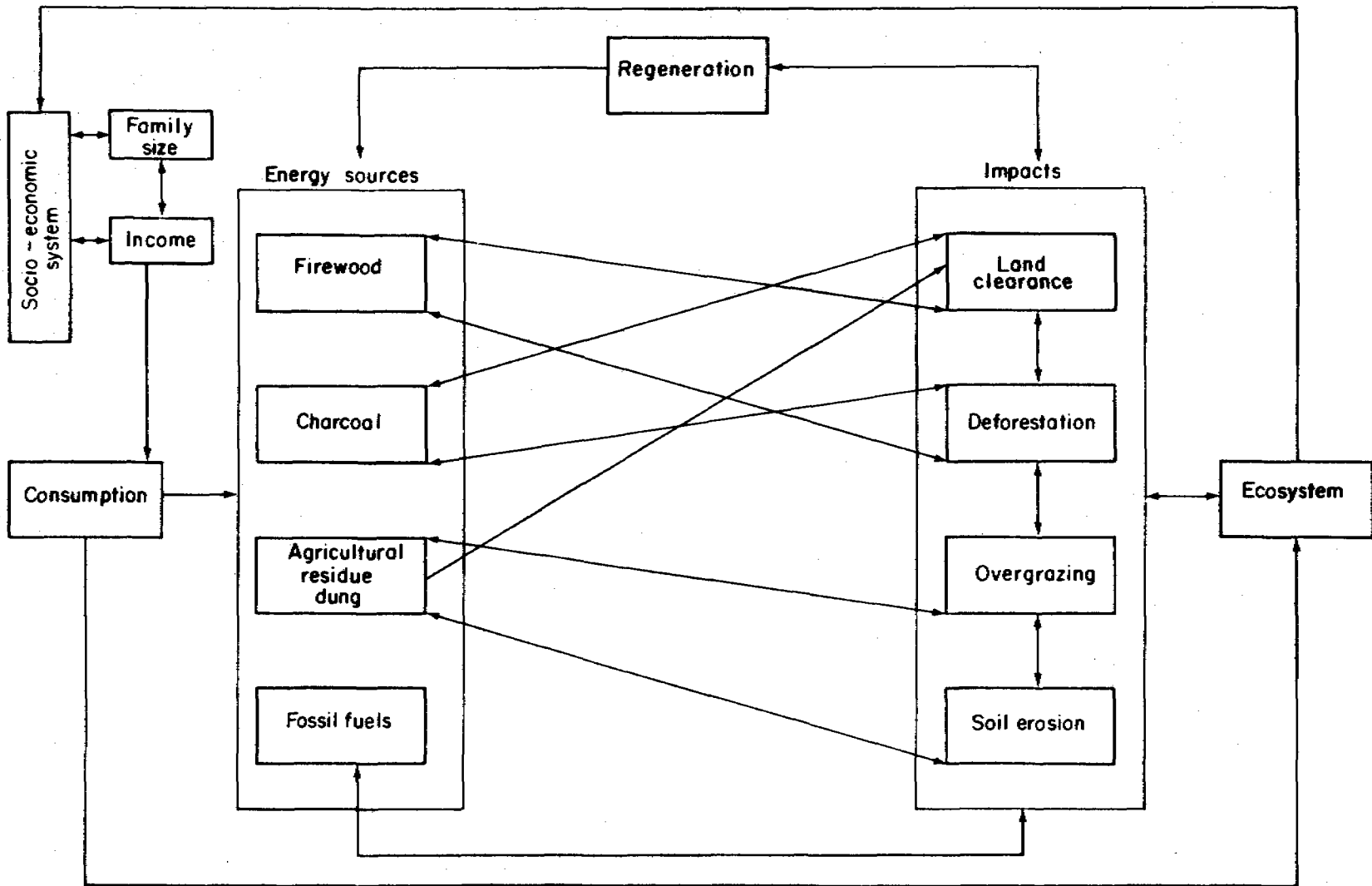


Figure 1. Rural energy use and its environmental impacts

IMPROVEMENT IN THE TRADITIONAL CHARCOAL STOVE:

THE DEVELOPMENT OF APPROPRIATE TECHNOLOGY

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As demonstrated in a number of the foregoing papers, wood is the primary source of fuel in the Sudan, as it is both available and inexpensive. Yet these factors that make it a logical choice at the individual level, have had severe consequences on the environment. These consequences threaten both the source of supply and the human and wildlife that depend on wood. Consequently, the development of a technology that would substantially reduce the strain on the woodlands, currently under intense pressure, could have an enormous impact on the well-being of the country as a whole. With this purpose in mind, we conducted a series of experiments to improve the efficiency of the canoun - the traditional charcoal stove used by the bulk of the population.

Although wood fires are used in some parts of the Sudan, charcoal is generally preferred and used when it is available. Charcoal offers a number of advantages over wood: it is easier to transport, store and distribute; it burns more efficiently, is less polluting and has a calorific value two to three times that of raw wood. The overall aim of the research was to maximize the advantages of this fuel by improving the design of the stove in which it is most commonly used. Specifically, our objectives were to: minimize waste in the consumption of fuel; maximize the heat obtained from the fuel used and utilize local materials.

DESIGNING THE STOVE

In re-designing the traditional stove, we had to take into account a number of parameters affecting the performance of stoves generally. In the first place, the mode of heat transfer is important: in all stoves, heat is transmitted by convection (the rising of the heated air) and thermal radiation (the electro-magnetic spectrum emitted at the surface of the stove). Secondly, the actual combustion of the fuel, both at the starting and running stages, needs to be taken into account.

*This research was carried out at the Faculty of Engineering at the University of Khartoum under the supervision of Dr. Yahya Hassan Hamid.

These factors were used to modify the stove in the following ways: sufficient air had to be allowed in to permit a high burning and ignite the charcoal; that is, there has to be a reasonable distance between the bottom of the pot and the firebed to facilitate the combustion process. A secondary air supply is provided by making openings at the flame level to permit a more complete combustion of the fuel. Insulation of the sides and bottom of the stove reduce the amount of heat lost through radiation. Preheating of air further improves efficiency by reducing heat loss and improving combustion. This is done by forcing the air feeding the combustion chamber across the hot walls which are so constructed as to facilitate this heat exchange with the air.

A preliminary design with the above characteristics incorporated was developed, and a stove utilizing preheating rather than insulation was constructed. Two slightly different prototypes were made: one using broken brick particles as an insulator and the other with a distance between two layers of mesh wire to act as insulation. Preliminary experiments comparing these designs with the traditional stove, showed that the charcoal lasted longer in the former and there was relatively little heat loss. From here we went on to more scientific experiments which will be described below. First, the two stoves in question will be described.

Design A (Figure 1) The traditional stove is made from a square tin with one large opening at one side and two smaller openings at the sides. The fire grate is of thin iron strips (about $\frac{1}{2}$ mm. thick) and there are two carrying handles at the top.

Design E (Figure 2) The improved stove is made from two concentric cylinders of steel sheet metal. The inner cylinder (25 cm. in diameter) supports the fire grate as well as support-bars for the pot. The outer cylinder, acting as a protective wall against outside air drafts and providing thermal insulation, rests on the support-bars. These bars extend to the outside forming handles for lifting the stove.

COMPARING THE DESIGNS

A number of indicators were developed so that we could measure the actual differences between the two designs. These indicators were as follows:

- i) Time:
 - a) the time taken to attain a uniform firebed,
 - b) time taken to bring water to the boil
 - c) time taken to consume the charcoal.

- ii) Temperature (using a mercury thermometer)
 - a) of the gases
 - b) of the water
 - c) of the surface of the stove

iii) Mass (using a balance):

- a) of the charcoal before and after burning
- b) of the water before and after boiling.

A performance ratio was obtained by dividing the mass of evaporated water over the amount of the utilized charcoal and this was considered as a rough measurement for the performance of the stove.

$$\text{Performance ratio: } n = \frac{\text{Mass of evaporated water (gm)}}{\text{Mass of used charcoal (gm)}}$$

The efficiency of the stove was calculated from the output which was obtained as a ratio of the useful energy (energy to boil water plus energy needed to evaporate the water) over the energy supplied by the charcoal (mass of used charcoal X the calorific value of the charcoal)

$$\text{Efficiency} = \frac{\text{Useful energy} \times 100}{\text{Input energy}}$$

DIFFERENCES BETWEEN THE DESIGNS

The traditional stove tends to inhibit the flow of hot gases around the cooking pot so that some of the hot air is wasted. The new design, on the other hand, allows for maximum contact between the hot gases and the pot without reducing radiation exchange. This is done by enclosing the fire and eliminating the effects of outside air drafts.

For a uniform fire and complete combustion, the air supply has to be constant and adequate in all parts of the firebed. This is not fully allowed for in the traditional stove as the air is supplied from one large opening on one side whereas the new stove is designed to provide a uniform and adequate supply of air.

Heat loss from the surface of the stove plus the impact of air drafts increases directly with the height of the stove. Consequently, the modified stove is only 24 cm. compared to 45 cm. for the traditional stove.

Materials

The improved stove is less expensive than the traditional one because its materials are more durable and available. The latter is made from metal sheets currently used directly by a number of industries while the former relies on recycled tins from industries that are now reverting to plastic containers. Only the firebed of the new stove is made of a replaceable material (chicken wire) although we recommend that a stronger metal with the same size of opening be used instead.

Production

A comparison of the inputs required to manufacture the two stoves is given below:

Variable	Traditional Stove	Improved Stove
Materials	Local - recycled tins	Local - unused steel sheets
Manpower	Limited skills required	Limited skill
Time	Can be made in a few hours	Takes slightly longer to make
Production operations (cutting, riveting, etc.)	Limited	Limited
Cost to buy	LS 2	LS 5
Cost to operate/month	LS14	LS10

Consumption and Costs

Based on data obtained from field work done on the two stoves, we determined that the average consumption of charcoal per family per month is two sacks with each sack weighing 40 kg. Given that there is a 7% difference in the efficiency of the two stoves (see Table 1), the daily consumption of charcoal using the improved stove will be reduced as follows -

$$7/18 \times 100 = 38.8 \text{ gm}/100 \text{ gm of charcoal.}$$

If a family, using the traditional stove consumes 2.67 kg/day (80/kg/month) with the traditional stove, then with the improved stove it will use -

$$\frac{2.67 \times 18}{25} = 1.92 \text{ kg/day}$$

the monthly consumption will be

$$30 \times 1.92 = 57.6 \text{ kg/family/month.}$$

Therefore, the saving of charcoal per month will be 80 - 57.6, or 22.4 kg/month. If a sack of charcoal costs LS 7 and each sack weighs 40 kg, each kilogram of charcoal is worth 17.5 pt. A family using a traditional stove will pay 80 x 17.5 pt = 1400 pt/month, compared to 1008 pt/month (57.6 x 17.5) with the improved stove. In total, this is a saving of LS 3.92 per month for each family.

Table 1: Average efficiency of traditional and improved stoves.

Type of stove	Charcoal energy inputs (A) ¹ (kilocalories)	Useful energy outputs (B) ² (kilocalories)	Efficiency of stove (B/A x 100)	Time to boil water (minutes) ³
Traditional	3,906	716	18.3	18.3
Improved	3,843	970	25.2	18.1

¹Based on a fire starting with 800 gm of charcoal, the traditional stove burned 558 gm and the improved stove 549 gm. 1 gm charcoal = 7 kcal.

²Useful energy is energy used to raise the temperature of water (3075 cc) to the boiling point plus energy used to evaporate water.

³From the initial temperature of 24 degrees C.

Source: Investigation of Domestic Energy Use and Introduction of an Improved Charcoal Stove in Rural Areas
Shadia N. E. El Sayed et al., University of Khartoum, 1981.

ENVIRONMENTAL IMPACT OF THE IMPROVED DESIGN

Based on the above calculations, if 10,000 families were using traditional stoves, consuming 800,000 kg of charcoal monthly, they would be using 224,000 kg more than a similar number of families using the improved stove. If we translate this into the amount of wood used, we can better see the environmental impact this new technology will have.

Assuming a recovery factor of 15% for charcoal production in Sudan, the quantity of wood saved is

$$\frac{224,000 \times 100}{15 \times 1000} \quad 1493 \text{ tons/month OR } 17,916 \text{ tons/year}$$

PUBLIC ACCEPTANCE

In order to determine the viability of the new design, a field study was undertaken in the village of Al Fetiehab where women were asked to try the stove. The following comments were given by the women on the advantages of the stove: It had a shorter starting time than the traditional stove and consumed only 15 pt worth of charcoal compared to 50 pt. The cooking time was reduced by 1/3. The larger openings of the fire grate made it easier to dispose of the ashes. The disadvantages cited were that the openings in the grate are too large, allowing charcoal to fall, thus resulting in waste; the space for the cooking pot is too small and the fire grate is not very durable. Also, some modifications could be made to allow kisra (a flat 'pancake' made of dura flour and eaten like bread) to be made on the stove.

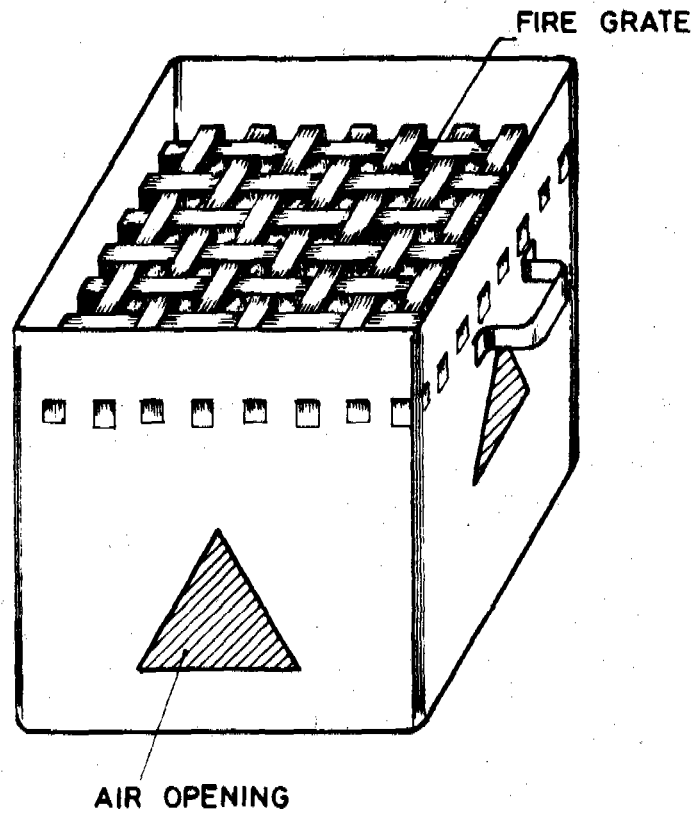
CONCLUSIONS

Not only would mass production and use of the improved stove save individual families money, it would reduce the consumption of charcoal, thereby saving much precious woodland. For example, it is estimated that 36,000 feddans of rich savannah forest are destroyed annually to supply the three towns in Khartoum (Mukhtar, 1978). An even larger area, three to four times that size, would be needed if the cutting were done in poorer areas. The end result of the shortage of forests will be the extension of the desert, disturbance of the natural ecology, shrinking of grazing land, and diminution of wildlife. Serious consideration should be given to the immediate and widespread production of this improved intermediate technology.

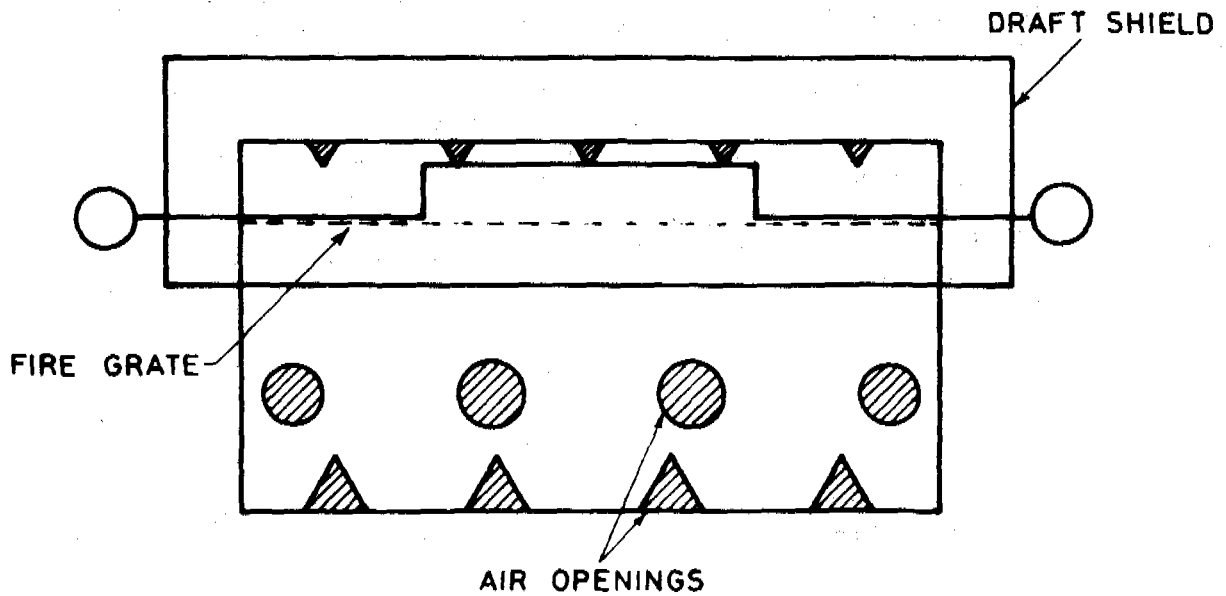
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A DIAGRAM OF TRADITIONAL CHARCOAL STOVE
(STOVE DESIGN A.)



A DIAGRAM OF IMPROVED STOVE
(DESIGN. E.)



COMMENTS ON "WOMEN AND LIVING ENVIRONMENT"
SESSION

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The papers presented in this session reveal a number of valuable points regarding the link between women and the natural environment. The paper by Sayed Mohamed Mukhtar demonstrated the heavy reliance on wood fuel in relation to other energy sources in the country. This was illustrated in the case studies presented of villages in various areas of the country: Western Sudan, White Nile and Nuba Mountains. In all of these regions, women engage in the fuel collection and consumption and the authors brought forward some important information about these activities. Sayeda Suad Adam Ibrahim noted that both men and women participate in deforestation and hers was the only paper to emphasize the valuable role that people's attitudes and perceptions have on their use of resources.

The paper by Abdel Bagi a/Ghani, and Anwar Sheikh El Din is particularly valuable as it examines the behavioural pattern of wood collection at the household level. The authors raised the argument that, contrary to most views on this subject, women's activities are rational within the constraints of their social situation. Similar studies are needed in other parts of the country to facilitate comparison and to guide national planning and conservation policies.

The paper by the participants from Ahfad College addresses an issue crucial to the conservation of resources: the efficient end use of the resource. Not only will this have beneficial results on the environment, but also for the households using them in terms of saving labour and money. Such a device is 'appropriate technology' in the true sense of the word: it is suitable and timely for the situation in which it is being used as well as being an intermediate step toward a more developed technology in the future.

One conclusion that can be drawn from this discussion of the fuel 'crisis' in the Sudan is that the solutions can be found on many fronts: substitution of other products, conservation and more careful harvesting. One approach that is being tried here is that of woodlot management - tree farming close to villages to eliminate long trips and the effects of cutting on the surrounding countryside.

PART IV.
WOMEN AND FOOD
AGRICULTURE

THE ROLE OF WOMEN IN THE PROCESS OF DESERTIFICATION IN WESTERN SUDAN

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This paper endeavours to highlight the role of peasant women in areas prone to desertification to cater for the whole family, especially in the transitional phases succeeding drought, famines and loss of live-stock. Suggestions will be made to improve the conditions of women's work, to provide nutrition for their families without doing too much destruction to the fragile natural resources of the semi-arid environment.

WOMEN'S ROLE IN MILLET CULTIVATION IN THE GOZ BELT OF WESTERN SUDAN

One of the typical scenes a traveller encounters in Western Sudan (Kordofan and Darfur) in the rainy season is that of women peasants, with their babies tied on their backs, doing field work. About 90 per cent of those working in the millet fields are women. Before one asks oneself why men are less co-operative there and what they are actually doing at that time, let us look into the nature of millet cultivation, its use and method of consumption.

Millet is the main source of nutrition for the peasant family in Western Sudan, especially the northern belt, which is endangered and already partly stricken by desertification. Women grind the millet grain, in most cases, using the oldest method known since the dawn of history. They rub the grain between two stones, kneeling on the ground holding the upper roundish stone with both hands, rubbing it to and fro on the larger plate-formed stone lying on the ground. The flour is used for preparing different kinds of food. Women bake large, thin flat loaves of bread called kisra. In most cases they do not eat bread at all, but they cook a kind of pudding called asida. For flavour they pour mulah on it, which is a kind of sauce made of okra (bamia), eka (Hibiscus esculentus), dried meat (sharmut) and hot spices.

Although this description sounds very tasty there are some disillusioning facts concerning this nutrition; 1) it lacks many vitamins which should be obtained from fresh vegetables and fruit; 2) it lacks variation because it is eaten daily; 3) most peasant families eat only once a day, but, owing to the shortage of millet towards the end of the dry season, the portions

diminish gradually; 4) owing to the storage of millet (in shafts in the sand called matmura) it tastes stale and somewhat rotten. In addition, considerable amounts of sand naturally find their way into the millet pudding as a result of how millet is stored, ground and cooked. The lot of the peasants in Western Sudan is by no means a happy one, if one considers the conditions of nutrition.

The Darfur women are well-known for making millet beer which is called marrissa or baghu. This thick beer is quite nutritious. Although the women brew it, the men consume most of it, for it is considered a man's drink, even though it is forbidden in Islam to drink alcohol. The For feel they cannot do without marrissa especially if they are travelling. Their wives give them a goat's skin full of it for the road.

Millet cultivation is looked down upon by men in Western Sudan as feminine work. It is supposed to be degrading for men to practise it. Lately, this disposition has been a little modified so that poor men, who are struggling for subsistence, do accept the idea of doing some kinds of field work. For instance, they would do some weeding but no threshing, which is a harder task. Men have also begun to help in sowing by digging the holes, while women follow and bury some grains into these holes. But digging shallow holes into the loose, sandy soil is exerting work. Using the common long-handled digging tool, men need not even kneel, as their wives do when laying the seeds and covering them with soil. Men have managed to choose the part of work they like and leave to women what seems less agreeable.

The case is similar in Jebel Marra where the For men in Sunt undertake to look after the orange orchards, while women have to cultivate millet, sorghum, tomatoes, onions and garlic, which requires harder work than irrigation and picking oranges.

What are the reasons which led to the development of such unjust traditions in the distribution of work? A superficial judgement would be to say that men are lazy and women industrious by nature, or that women are generally under-privileged in those societies and therefore have to do whatever necessary work men abstain from doing for various reasons.

Nevertheless, there is some truth in these accusations and they fit in well with the world-wide discrimination of women even in the most developed societies. Indeed this applies in Western Sudan not only to the agricultural environment, but also to the urban one. In Darfur, there is no job, however hard it may be, which women refrain from practising. There women work at digging wells and in all kinds of construction work, which requires bodily strength, such as carrying stones, sand and water.

MARRIAGE CUSTOMS AND CULTIVATION

With the gradual pacification throughout the country, and the

sedentarisation of pastoral nomads, men became more or less unemployed. Women, on the other hand, have always looked after field work which was formerly a subsidiary economy, besides animal husbandry which was mainly practiced by men. With the loss of herds during the droughts which have occurred in this century, cultivation became the main source of subsistence for a majority of the population. This laid a heavier burden on women, for they have been obliged to increase the area cultivated to produce the whole amount of food needed by the family.

It is remarkable in Western Sudan that young men show interest in acquiring land only when they get married; that is to say, when they secure labour (wives). Once married, the young man goes to the village chief (sheikh or omda) and asks for a piece of land to cultivate. He gets as much land as his wife can till. If he marries a second woman he acquires a new piece of land from the sheikh, for each wife has to have her own cultivation (zar'a). In some cases, where the young family is still dependent on the man's parents, the young wife spends a year or two helping her mother-in-law with the field work.

FOOD PRODUCTION

Women cultivators have been severely affected by the process of desertification which has drastically decreased the productivity of land in the last few decades. As the amount of millet required by each member of the family is more or less the same, women have to increase the area cultivated, either when more children are born or when land productivity diminishes as a result of soil deterioration (Ibrahim, 1978a). The author's field research in Darfur revealed that an average family of five to six members requires 1400 kg. of millet annually. In 1980-81 the price of millet and dura ranged between ES 20 and ES 30 per sack (90 kg.) in Western Sudan. This means that the average family consumes millet for ES 270 (14 x 25) annually.

Poor families, which comprise no less than half of the population, lack sufficient cash resources to buy grains. Thus, they are compelled to grow their own millet or starve. Owing to the low productivity of desertified land (about one sack, or 90 kg. per acre on the average) each family has to cultivate about 15 acres to meet its demand of grain (cf. Table 1). A woman alone, however, is unable to cultivate 15 acres. She can cultivate up to seven acres if helped by one of the children. This would mean that the family's stock of millet would run out after half of the year and that the family would face starvation. In fact, this is a recurrent tragedy in Western Sudan (Ibrahim, 1978c).

The ways women bridge these nutritional crises are varied, but include hardship. The most common way is to reduce millet consumption to the least possible minimum. No more than one meal is taken a day. Semi-starvation prevails. The family sells the last goat it has. Women go to the mountains and valleys to collect wood or hay to sell on the market. This

Table 1: Millet cultivation and consumption per family in Darfur

	Area cultivated in acres	Yield acre/kg	Total yield kg	Consumption kg	Deficit kg
Northern Darfur (semi-nomads)	7	83	581	1525	944 (62%)
Central Darfur (sedentary)	14	95	1330	1410	80 (5.7%)

cutting of the last trees of the thorn-scrub savanna is one of the final stages of desertification in the area.

THE CONSEQUENCES OF RAINFALL VARIABILITY FOR WOMEN CULTIVATORS

The variability of precipitation, which is typical of the Sahelian Zone, has a far-reaching impact on the lives of women cultivators there. The annual fluctuation of the amount of precipitation, and the high variability of the distribution pattern of rainfall within each rainy season, leads to uncertainty concerning the crop situation. So women cultivators are obliged to clear, till and sow a large area, and then decide some weeks later which parts have received enough rain to make them promising. These parts are then weeded and looked after till harvest time. In dry years, even larger areas are cultivated to secure the needed amount of millet for subsistence. More desertification takes place just in the very years in which the natural ability of nature to regenerate itself is impaired by drought. In these cases, the amount of work done by women is considerably increased, and their participation in enhancing desertification becomes greater (Ibrahim, 1978b).

One interesting correlation in this respect is between rainfall variability and polygamy. A questionnaire run by the author in Darfur revealed this strange relationship. When asked how they managed to satisfy their demand for millet or sorghum in a certain dry year (1976), men who had more than one wife almost invariably answered that one of their wives brought in good yields. The explanation of these differences of grain yields within the same season and within the same area is that rainfall in that semi-arid marginal tropical zone reveals high local variability, especially at the beginning and at the end of the rainy season. Clouds gather and give a heavy afternoon shower, while the sun may be shining two kilometres away. One often notices that two rain gauges in the same town, but a few kilometres apart, give quite different readings on the same day.

Generally men choose their different wives from different villages, or different parts of the same village, perhaps to avoid conflicts. Often each wife remains living in her home village, or quarter of origin. Even if the man brought them together in one compound, each of them would still have her own plot of millet at a considerable distance from those of the other wives. These distances are naturally created, even within the area of the same village, because the newer wife usually procures a plot on the fringes of the village cultivation area, as nearer plots are occupied by older villagers. Consequently, the older wife usually has a plot near the village.

This wide distribution of the plots of the same family fits in well with the local variability of precipitation in that climatic zone. In other words, polygamy provides more chance of survival for the man but not necessarily for the women and children. Mutual help between the different wives in time of need is not to be expected; instead, rivalry prevails. Only indirectly can some help flow through the man to the poorer part of the family. However, one should not overestimate the role of polygamy in the rural economy, as the statistical average of men who have more than one wife is only 10 per cent. In rural areas of Western and Southern Sudan the percentage is higher. The significant issue is that each wife is made responsible for the livelihood of her part of the family, including her husband.

The greater consequence of rainfall variability is, however, the forced migration in times of drought disasters. This is quite common among the Zaghawa women in Northwestern Darfur. During the last dry climatic phase, since 1968, in which precipitation decreased by about 60 per cent in relation to the foregoing wet phase (1950-1967), cultivation became impossible in Dar Zaghawa. The annual mean of precipitation changed from 260 mm. to 140 mm. from the wet phase to the dry one. Women cultivators were obliged to leave their tribal region and migrate southwards during the rainy season to work as millet cultivators in the more humid zone, some 200-400 km. south of their homeland. On this seasonal migration women usually take their children with them and form groups, each belonging to one village or area.

After agreeing with the owner, they cultivate plots of land, the former also providing seeds. In some cases, these migrant women are engaged only for weeding or both weeding and harvesting. In the meantime they guard the crop against grazing animals, and they scare birds and locusts by drumming on empty tins. After reaping and threshing the grain the working women receive their portion of the yield. This varies from one-third to one-sixth. The name of this portion being ushur (tenth) may indicate that in former times labourers used to get only one-tenth of the crop. In any case, landlords are still exploiting women as cheap labour.

Considering the fact that that type of land, in most cases, actually belongs to the State, and those "landlords" have only

the right of use, and that they would not have it cultivated if it were not for the availability of cheap labour, it is quite an unfair business. Women carry their portion of millet and return, with their children, at the end of the rainy season, to their home villages. There, they try to feed their families all through the long dry season of eight months. As for men, they occupy themselves with looking after some animals, or working at one of the irrigation schemes in the Nile area.

THE NEW BURDEN FOR WOMEN AS A RESULT OF THE SETTLEMENT OF NOMADS AND SEMI-NOMADS

One of the consequences of desertification is the settlement of nomads and semi-nomads. Settlement, however, has brought about more work and more responsibility for women. Sedentarisation means more dependence on cultivation, which is traditionally the work of women. In nomadic life women contributed to the economy of the family by milking the cattle, making butter, cooking to preserve it (semn), and finally selling milk and its different products on the market. In the rainy season they used to grow millet or sorghum on a limited scale, if they led a semi-nomadic life. The settlements of nomads, on the other hand, have been associated with economic and social degradation in most cases, due to the loss of animals and wealth.

This loss made man unemployed, and set most of the burden of catering for the family on the shoulders of women for the traditional reasons described above.

SUGGESTIONS TO IMPROVE THE WORKING CONDITIONS OF WOMEN IN THE AREA AFFECTED BY DESERTIFICATION

Considering the fact that women suffer more than men as a result of environmental degradation of the semi-arid zone of the Republic of the Sudan, one of the important objectives of combating desertification, and its impact, must be to improve the situation of women there. Apart from the recommendations made in the UN Plan of Action to Combat Desertification of 1977, further recommendations have to be made, and immediately implemented, to relieve the heavy burden laid on women in these areas. For many of the projects directed against the causes and consequences of desertification are of a technical agrarian nature, which give little or no attention to the flagrant inequality between men and women in the societies in which these projects are being carried out. The following recommendations are tentatively made as a start for further suggestions of effective measures to help women in the rural semi-arid environment of the Sudan.

1. Public information media, such as radio, TV, Party information organs, and schools, should teach men how to help their wives and make them realise that it is the duty of

the man to take the greater part of the responsibility of feeding his family.

2. Appropriate technological methods of cultivation should be developed in order to make the cultivation of land easier and more productive.
3. The prices of millet and sorghum must be controlled on the rural markets to stop the manipulation and exploitation exercised by merchants. This could be partly achieved by organising a low profit making corporation which would undertake the storage of grain in times of cheap prices, and its marketing when prices begin to go up.
4. Water supply should be improved so as to relieve women's work of fetching water from the wells over long distances. Simple technical improvements, such as using hand-pumps or donkeys and camels for drawing water from wells could be easily introduced before a final solution could be found.
5. The problem of rural energy should be solved before it becomes too late, i.e. before the tree stock of the Sahelian Zone disappears completely. Intermediate solutions should be found before oil is explored or solar energy used, for all these are long-term solutions. At present, measures could be taken to improve the production, transport and marketing of fire-wood and charcoal. Simple energy-saving ovens should be developed and introduced to replace open fires.
6. In areas prone to desertification, or already stricken by it, alternative income sources to cultivation should be found. Handicrafts should be taught to rural women so that they can practice some home industries, such as making carpets, weaving mats and baskets of straw and palm leaves, sewing and needlework. Also, leather work from goat's skins should be developed.

It is certain that changing traditional dispositions is both difficult and requires a long time. But one must start at least by identifying the problem and making the people concerned realise that there is a problem at all. Although women in rural societies are discriminated against, as amply as described above, they are hardly aware of that fact. Even if they realise that they are suffering, they do not perceive the causes and are, therefore, unable to identify any proper solution. Men, on the other hand, are neither interested in knowing about the problem nor in solving it. Even if they are principally convinced that something must be done they are not willing to change the traditional order. When asked why he did not allow his wife to sit and eat with him, a Rezeigat man of Western Sudan asserted that she would not even dare to drink water in his presence. When asked if he liked his wife at all, he made it clear that liking her and eating with her were completely different subjects. His wife was brought up like that, and she

herself would never dream of breaking tradition. In fact, it is a great issue to decide whether it is wise at all to interfere and disturb a traditional society without offering a solid and comprehensive alternative. Single and isolated changes might be more harmful than no change at all.

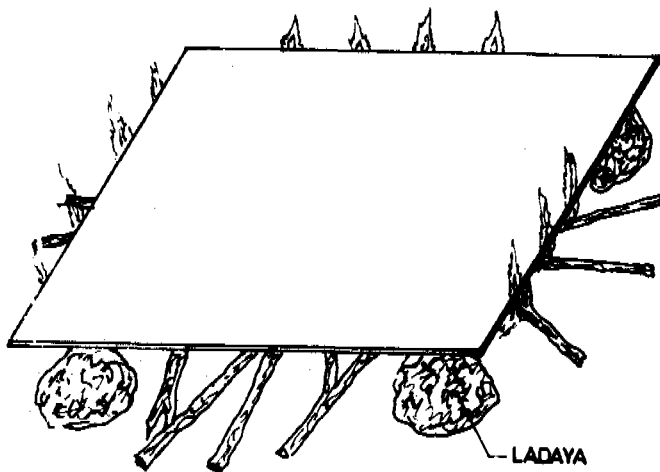
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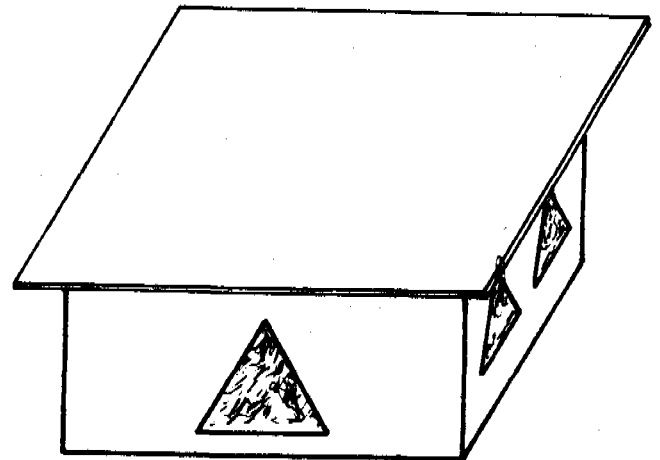
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TRADITIONAL METHODS OF COOKING (KISRA.)



STEEL PLATE ON WOOD FIRE
AND FOUR (LADAYAT.)



STEEL PLATE ON CANOUN

WOMEN'S CONTRIBUTION TO THE ECONOMY THROUGH AGRICULTURAL WORK

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In this paper I will examine the role women play in agriculture and the value of their work to the family budget in monetary terms. I will also touch briefly on a few other areas related to women's participation in agriculture.

WOMEN IN AGRICULTURAL PRODUCTION

Women are much more visible in the traditional as opposed to the modern sector of agricultural production. This is best illustrated among the livestock producers, such as the Baggara and Kababish tribes where men's time is taken up with pasturing the cattle, moving with them and guarding them at night, so leaving crop production by day to the women. Similarly, in other areas of the country, women are actively engaged in farming.

Table I summarizes a number of factors related to women's activities: the tendency to be most active in particular areas - threshing and winnowing crops - while the men are more involved in such jobs as cutting trees and transporting the crops to market. Also, compared to their participation in cash crop activities, women are more likely to work at tasks for food crops.

This emphasis on food production is further illustrated by the fact that among twenty-five families surveyed in two villages in Eastern Equatoria - Nimule and Lova - which were headed by women, all cultivated at least one food crop, while only 68 per cent also had a cash crop. Even women involved in animal husbandry concentrate on the aspects that provide nourishment for the family - milking or making butter.

EVALUATION OF WOMEN'S WORK

Although women, as indicated in earlier papers, are the main contributors to the family unit in terms of their participation in all aspects of its life, their work is not generally regarded as 'productive' in the economic sense. For instance, recent figures show women's labour force participation in the Sudan to be 12 per cent compared to 94 per cent

Table 1: Percentage of participation of family households in cash and food crops in southern provinces by types of operation and sex.

Operations	Wives' participation		Husbands' participation	
	%		%	
	Cash crop	Food crop	Cash crop	Food crop
Cutting trees	25	30	75	75
Clearing bushes	30	25	65	70
Burning scrub	65	80	30	20
Turning the soil	25	25	80	75
Furrowing & mounding	35	25	70	70
Planting seeds & cutting	30	80	80	80
Hoeing & weeding	90	65	90	45
Harvesting crops	85	90	80	25
Scaring away birds	45	65	-	10
Transporting crops	95	65	90	80
Burning stalks	65	65	90	15
Threshing crops	60	75	30	25
Winnowing crops	50	75	10	25

Source: Mahasin Khider, Fieldwork survey in Nimule and Lova, 1975.

for men. (Population Reference Bureau, 1981). Yet we all know that their input is considerable and extensive, and some indication of the price of their work would show its actual worth.

One commonly used method for evaluating household activities is the 'replacement method' by which the housewife's work is assigned the same wage rate as a servant. But this approach ignores the fact that many women could earn considerably more in the labour force, based on their experience, education and skills. Furthermore, if we consider the quality of the work provided by a wife or mother compared to that of a hired helper, the salary should reflect this. To take these factors into account, I developed an alternative procedure by calculating the average wage for a sample of 46 women working at a variety of jobs (Table 2). This works out to LS 4.27 per day or LS 0.53 per hour. If we assume a 10-hour day of house and fieldwork this comes out to LS 5.34, in contrast to LS 1.25 for a servant (based on a monthly salary of LS 30). Using this calculation, it is evident that the woman's contribution to the family budget could match or exceed the man's.

While I would hasten to point out that the figures used in this example are rough and need to be refined through larger, cross-sectional samples, I do think it illustrates my point regarding the considerable investment women make to the family economy and the extent to which their work is undervalued.

Table 2: Survey of salaries for women across selected industries by month, 1981.

Location	No. of women	Total salaries per month LS	Average salary per woman per month LS
Haggar CTF	10	1972.50	197.25
Sudan soap factory	10	871.75	87.17
Post & telegraph office	10	789.15	78.91
Crop protection unit - Ministry of Agriculture	10	1213.75	121.37
Different shops & offices	6	1050.45	175.07
TOTALS	46	5897.60	128.20

EDUCATION FOR AGRICULTURE

Despite the fact that the majority of working women in the Sudan are involved in agriculture, and this is a sizeable proportion of farm labourers, they continue to be restricted to the bottom end of the wage and skill scale. Little effort

has been made to up-grade them so that they can improve their working condition and monetary returns. For example, if we look at the enrolment of women in Shambat Agricultural Institute, University of Khartoum between 1954 and 1979, we see a total increase from 0 to 21, compared to a rise from 27 to 116 for men over the same period. From my own observations, it is not uncommon for a male with lower marks to be accepted over a female with high marks. This perpetuates a situation in which women's contribution to agriculture, except at the lowest level, is limited.

FUTURE PROSPECTS

Under the circumstances described above, the modernization of technology will eliminate women's contribution to agriculture altogether. For, as manual work is replaced by machinery, women's role will diminish, and, if the non-agricultural market cannot absorb these displaced workers, they will return to the home and the man will become the sole family supporter. In many cases, the family income will be reduced and women will be denied the option of working outside the home. Yet if women were more fully integrated into the system, the advent of modern technology could signal the improvement in her working conditions rather than the opposite. I would suggest that the problem is the capitalist mode of production which forces women out of agriculture. If a socialist mode were to prevail, then the future of women in agriculture would be bright.

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FOOD PRODUCTION PROJECTS FOR RURAL WOMEN

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Recognizing the contribution rural women make to agriculture in the Sudan, the government has initiated measures to improve their status and bring them more benefits from development through training in food production. It is hoped that, by improving land utilization and women's skills, they will be able to earn additional income through sales of their produce. While these projects are still at the pilot stage, I would like to describe their operations to give you an idea of current efforts to raising women's economic position through farming improvements.

Specifically, the objectives of these projects are three-fold: to raise family incomes through rural women's activities; to train village leaders and to introduce new nutritional habits. In order to accomplish these aims, two approaches have been taken, one is poultry raising and the other is cultivation. Four villages on the west side of the White Nile - El Shegala and El Terrace south of Khartoum, and Zeberab and Mohmodab north of Khartoum - have been selected as the initial sites. With the help of a FAO consultant, we began the feasibility study by contacting women leaders at the city and village levels, examining existing food production activities in the area and forming groups of resource people and briefing them. Then the women were selected and trained.

VEGETABLE FARMS

The land for this project was donated by the Gammuia Agricultural Scheme - 5 feddans in Shegala and 2 feddans in El Terrace. This land is divided among 22 and 20 women respectively. At the outset, women were trained in basic agricultural practices including land preparation, sowing seeds, irrigation, fertilizing crop, rotation and harvesting. This was supplemented with courses from the Ministry of Education and orientation on nutrition, cooking, food preservation and general family health.

During the summer season (May-October, 1980), the women raised vegetables. By the winter they were beginning to sell their products in the local markets.

POULTRY RAISING

Altogether five women from the villages of Zeberab and Mohmodab are involved in the poultry-raising experiment. Each woman was given a cage of fifteen square metres (at a cost of LS 430) plus 150 chickens and feed. A veterinary doctor provides services and training.

FUNDING

All costs of both phases are covered by the project budget, given below, which will operate as a revolving fund to increase the number of participants once the original members begin to pay back their loans from the proceeds of their sales.

Project budget* -	
	\$US
Personnel	47,000
Subcontracts	7,500
General operating costs	6,500
Supplies and materials	24,000
Equipment	20,000
Fellowships	<u>10,000</u>
	<u>115,000</u>

* including the FAO contribution.

The Sudanese government has supplied staff, buildings and facilities, drivers and transportation and a revolving fund for further credit.

ASSESSMENT

Based on our limited experience with this type of project to date, I would make some suggestions regarding future modifications.

- No expansion of poultry raising should be done unless capital costs can be considerably reduced.
- Extension of vegetable gardening should be considered in three more villages in the area.
- Raising of milk cows should be examined for future trials as an alternative to the poultry raising.
- Similar projects should now be tried in other regions of the country, learning from the experiences gained so far.
- Support should be given to the women involved in agricultural extension projects such as these to form co-operatives.

WOMEN'S ROLE IN AGRICULTURE
IN RURAL KHARTOUM PROVINCE

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INTRODUCTION

Analysis of the problems facing women in Sudanese agriculture might be most revealing if pursued through a conceptual framework that seeks to identify obstacles in social structures which obstruct women's involvement and integration in the development process. Some of the most important factors are listed below and shown in Figure 1.

1. The types of agricultural activities in which women are involved ranging from the pure subsistence economy, where female labour accumulates an enormous amount of physically demanding tasks that have to be carried out under highly primitive conditions, to the pure commercial economy where women occupy increasingly subordinate positions. Moreover, the introduction of modern techniques for the promotion of export crops through tenancy arrangements coupled with the expansion of selective technical innovations in mechanized rain-fed agriculture has led to the diversion of labour from food production, the reduction of land available to women for food crops and has shifted the burden of cotton thinning, weeding and picking largely to women.
2. Family size conditions the productive activities in which the household may engage and is one of the determinants of household consumption.
3. Farm size is another variable which accounts for variation in women's productivity.
4. Migration patterns influence female productivity particularly in cases of permanent male migration resulting in additional pressures to utilize female labour with limited gains in the socio-economic status of women.
5. The provision of modern farming inputs may often lead, among other things, to a rise in women's work-load frequently coupled with a reduction in women's access to, and control of family income.

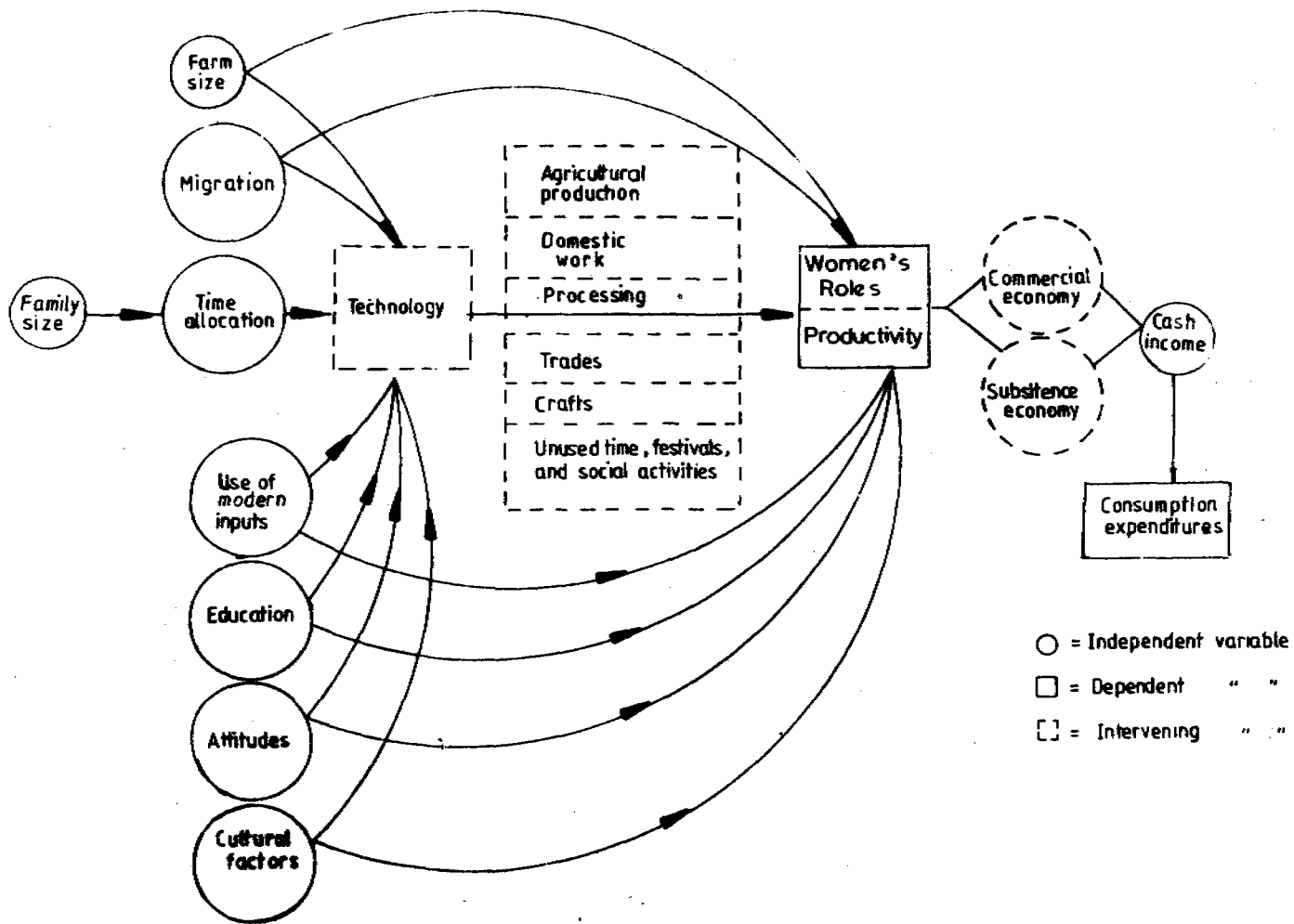


Fig. 1 Major factors affecting women's roles in sudanese agriculture

6. The low rate of literacy among adult women and the sexual inequality in the educational participation of children is a major barrier to women's integration in development.
7. Training opportunities also condition the adoption of improved agricultural techniques and accordingly influence productivity.
8. Cultural factors including religious beliefs, marriage practices, family structures, kinship systems and legal codes are a strong determinant of women's positions and roles in various ways.
9. Attitudes toward women are one of the major constraints on women's equal participation in employment, wages, decision-making and education. This is also reflected in male domination and sense of superior status, because of the patriarchal family. The preference for male children is still the rule. A girl from early childhood is considered inferior, needing protection from others, mainly males.

WOMEN IN RURAL KHARTOUM

We will examine how these factors influence women's agricultural activities in rural Khartoum Province. In El-Dabb village a great number of women participate in agricultural work and some of them are solely responsible for managing their holding. In contrast, the participation of women in agricultural work in the second village, El Naya, near El Geili, is almost minimal.

The researcher spent considerable time with the women farmers, visiting their houses, eating with them and observing their activities in the field and within the households. During the period of the research it was also possible to get in contact with the extension agents who are working in El-Naya village in a pilot extension programme aiming at the encouragement of women to take an active part in agriculture and home-gardening.

Background information on women

Most of the women interviewed were married; some of them were widows. This latter group is fully responsible for running the household and the farm. The majority of women interviewed (65 per cent) are between 25-35 years of age, the remaining 35 per cent being between the ages of 35 and 54 years. El-Dabb village has many women who are old, and who act as de facto heads of households. Very few women went to primary school, and the majority in the sample had no education. The average number of rooms per house is three; about half of the women have separate kitchens and bathrooms. Most of them have a private latrine. The housing situation in the villages is generally adequate and there is no great demarcation between the houses in these villages and the houses in urban areas.

It is a noticeable feature that the majority of houses have adequate furniture and some modern facilities like refrigerators, and gas cookers, although television sets are more prevalent in El-Naya than in El-Dabb.

It has also been observed in both villages that women are active participants in various aspects of social life, e.g. members of the women's union, consumer co-operatives and rural councils.

AGRICULTURE

The size of the holdings in this study varied from one to four feddans. The majority of farmers in these villages cultivated vegetables, fodder crops and onions. The following section examines the division of labour focusing on the female activities which influence women both as heads and non-heads of households. Also, the productivity of women-dominated households is investigated as well as their consumption patterns.

Table 1 shows the participation of women in agricultural activities according to whether or not they are heads of households. In summary, the men dominate the first six operations, including the preparation of fields for cultivation, ploughing, hoeing, harrowing and weeding, while the women play a greater role in planting, harvesting and processing activities which include threshing, cleaning and winnowing.

Table 1: Reported participation in agricultural activities by household category and sex in rural Khartoum.

Agricultural operation	Women heads of households	Women non-heads of households	Total			
			women N = 30 %	men N = 15 %		
Cutting trees	2	-	2	6	14	93
Cleaning bush	5	2	7	23	15	100
Burning shrubs	5	2	8	26	15	100
Ploughing	5	3	8	26	9	60
Making furrows and mounds	4	2	6	20	11	73
Planting seeds and cutting	4	8	22	73	15	100
Hoeing & weeding	11	4	15	50	13	86
Chasing birds	11	6	17	56	14	93
Harvesting crops	15	8	23	76	15	100
Transporting crops	10	1	11	36	13	86
Burning stalks	14	7	21	70	6	40
Threshing	15	8	23	76	1	6

Source: Rural Khartoum Socio-economic Survey, by the author, 1979.

Another characteristic feature is that women who head households play a greater role in the agricultural decision-making, such as, the purchase of agricultural inputs, the timing of agricultural activities and disposal of agricultural inputs, than women who are not heads of households. Nonetheless, some of the latter women showed considerable knowledge of the kinds of crops grown, the difficulties encountered in their production and the cash received.

The author has come across five cases where the women interviewed volunteered information on such issues. This suggests that in many families agricultural decision-making is arrived at by joint consultation between the two partners.

In other households interviewed, agricultural decision-making is wholly dominated by the man, usually among farmers who are rich. Accordingly, in female-dominated households, women play a major role in the agricultural decision-making process, while in the case of middle-class farmers and rich households agricultural decision-making is arrived at by joint family consultation or the absolute decision of the man respectively (Table 2).

Table 2: Agricultural decision-making by household category,

Type of decision	Number (N = 30)	Per cent
Women taking major decisions	14	46
Women taking joint decisions	6	20
Women not taking any decisions	10	33
TOTAL	30	100

Source: Rural Khartoum household survey, December, 1978.

Besides the various agricultural operations carried out by the three categories in the sample, we worked out agricultural productivity using regression model so as to compare the productivity of women who are heading households and men. We selected three variables such as farm size, family size and type of household.

To test this hypothesis twenty-four households were selected from rural Khartoum - with fourteen households headed by women while the remaining households were headed by men. Productivity was highly correlated with farm size, while for the rest of the variables it was not highly correlated. For the second variable, which is family size, the relationship was not significant. This can be attributed to the fact that the farm

size was too small to absorb all family members, and being near to urban centres, the farm population can find full-time or part-time jobs elsewhere. For type of household, productivity was highly correlated with female-headed households.

NON-AGRICULTURAL WORK

In addition to their work on the farm, women are also involved in other income-generating activities related to agriculture (Table 3).

Table 3: Women's participation in non-farming activities in El Naya and El-Dabb villages, Khartoum province.

Activity	Women's participation % (N = 24)
Processing	70
Feeding animals	43
Marketing of animals and animal products	10
Marketing of agricultural products	10
Handicrafts	70
Women's clubs	24
Self-held activities	43
Leisure time activities	53

Source: Field-work survey May, 1975

The majority of women interviewed were involved in handicrafts such as making fans, mats, etc., as well as sewing and embroidery. In El-Dabb village more than half of the women make mats while only a few women sew clothes or embroider. In El-Naya village, on the other hand, relatively more women are involved in sewing and embroidery, and many of them joined the home economics programme to acquire more experience. The products from handicrafts, mostly mats, are sold by the woman herself in the village or sometimes in the market in Khartoum north. In such cases the woman keeps the money for herself.

The housekeeping is under the control of women; child-care is shared by women and older daughters. Women and young children fetch firewood sometimes or, in most cases, it is bought. Some households have water facilities, otherwise water is fetched by the woman with the help of her daughters.

All households eat at least two meals a day, and some take a small evening meal. The general pattern of food consumption in the villages of rural Khartoum, is that men, women and children eat separately. When men are home for breakfast they are served first and get the best quality of food.

WOMEN IN TRADITIONAL AGRICULTURE

In the traditional sector, women's contribution to agriculture is greater because the environment is harsher, technology is absent and no facilities exist to ease the drudgery of the repetitious work performed by women such as water and fuel portage and the grinding of grain which would be considered as economic activities when performed in urban areas.

In the traditional sector the role of women is complementary to men. Even though they contribute to the cultivation of cash crops, access to modern productive inputs such as seeds and fertilizers tend to be dominated by men. In this situation women have little if any control over cash earnings and subsequently they attain subordinate positions.

Modernization of agriculture through colonial and neo-colonial enterprises has led to a decline in women's position despite rising participation rates. Marginalization and the trend towards wage earnings as opposed to self-employment and the exploitation of women as a source of cheap labour marks the development of capitalism in agriculture. Also, the hiring of impoverished women among the poorest stratum of the rural population to work for the richer tenants reveals the growth of classes and labour processes under capitalist relations. Furthermore, many women lost their traditional jobs in rural areas as a result of the destructive influence of neo-colonial development on the traditional aspects of women's participation in trade and artisan household crafts. The arrival of cheap imported goods to replace handicrafts have lessened women's income opportunities.

Another variable that had a direct impact on women's participation is availability and ownership of land. Generally, women for no reason, are denied access to land except in very rare cases, as in the case of the death of the husband. As a consequence, many women either work as unpaid family labour or resort to wage employment if opportunity permits.

Migration patterns might also have an adverse influence on women's work, as heavy male migration increases the work-load of women in the traditional areas. Changing roles in agricultural production might, as well, bring about social and cultural changes with significant effects on productivity. The seasonal migration of the able adult males from the regions of traditional agriculture to the old and newly developed schemes leaves the women to do most of the agricultural work and all the cultivating of food crops. Women had to rely on themselves for feeding and housing the rest of the family.

In a study conducted by El-Amin, in the mechanized rainfed agricultural schemes in Habiba it was found that the majority of the households surveyed were subject to a continuous drain of both males and females to work as agricultural labourers in these schemes. This adversely affects the productivity of

subsistence farms and women become increasingly burdened with greater responsibilities.

Traditions and cultural beliefs are at times serious impediments to fuller participation of women in the economy. One of these customs is that which does not allow women to be in contact with males who are not members of her family. In some regions of the Sudan, especially in the central regions, the attitude toward the work of women is one of disgrace probably because of deeply embedded Islamic traditions, unlike the situation in other regions of the country. Another tradition which may affect the chances given to women in employment is the accepted norm that males are financially, materially and morally held responsible for the female members of their families.

EDUCATION AND TRAINING

Formal education is one of the important factors which determines the level of employment. Women's education in the Sudan, as in other African countries, still lags behind that of boys. Table 4 shows the gap in girl's education in both the urban and rural areas in the Sudan.

Table 4: Literacy rates by sex and location.

	Total population	Urban population	Rural population
Sudan - both sexes	31.3	53.4	24.6
Male	44.3	65.5	37.7
Female	18.0	38.9	12.2

Source: Department of Statistics, preliminary results of 1973 population census.

From this analysis, an investigation of the actual contribution of women in the various agricultural and other related activities was examined. Such information reveals the magnitude of women's participation as well as the different factors that affect women's contribution, such as regional, temporal, sectoral and class variations in their work-participation patterns in rural Sudan. The results obtained from this analysis will provide insights on the role that Sudanese women will play in agrarian development and transformation of society.

ALTERNATIVE TECHNOLOGIES FOR CONSERVATION AND
FOOD PRODUCTION IN SOUTHERN SUDAN

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In this paper two categories of technology are presented:

- 1) those that require only locally available materials and can be constructed or utilized by one person alone. Some innovations specifically for women are also included;
- 2) those that require a few non-indigenous inputs and are more suited to adoption by a group of people working together.

Before any of these technologies should be presented for actual field consideration and implementation, they should of course be carefully screened.

Examples of technologies falling in the first category include, but are not limited to, the following: contour plowing/ridging and planting; water direction, retention and collection; composting; mulching; increased use of animal fertilizer; thorn or cactus fencing; tree planting for windbreaks, fruit, shade, fencing, wood supply; and, in some areas, ox-plowing.

Even without on-site testing, it can be seen that these techniques have certain definite advantages for both the environment and the farmer. The techniques of contour plowing/ridging and planting and those of water direction, retention, and collection all help to minimize the very serious problem of erosion which is common in the Southern Region. The rains come suddenly and in a downpour, so run-off and erosion begin before proper penetration of the soil has occurred. Often a long or short drought will follow during which all but the most drought resistant crops die, because so little moisture is retained in the soil. Mulching can also reduce erosion and prevent drying out of the soil so that more plants might survive the periods of drought and irregular rains.

Waste disposal is normally carried out by burning, which has the quality of being sanitary and not attractive to rats. But it does waste the natural resource of vegetable waste materials which could very profitably be put to use to fertilize the crops and to improve the quality of the soil by adding much needed

organic matter. A well kept compost pile is also quite sanitary and non-offensive.

Animal waste is another resource which is underutilized in some areas at present. As reported in the study of Kajokeji farmers (Carter, 1980), some farmers make no use of it at all. It can be added to the compost pile or applied directly to the soil. In areas where dung is burned to keep away flies and mosquitos, its use as fertilizer might be resisted. Another use to which this resource might be put is as a cooking fuel - a practice found in many other parts of the world.

Destruction of crops by domestic animals is a frequently voiced complaint, especially in areas of higher population density. In other countries, such as Mexico, thorn and cactus fencing are widely used and could be applied here in areas where people remain longer than two years in one homesite.

Tree planting perhaps requires a more concrete sense of the future than is prevalent in many areas, but if a campaign such as "Arbor Day" in Kenya could be launched, soon everyone would reap the benefits. Those whose migratory patterns make them reluctant to invest in permanent improvements to be enjoyed by others would soon find themselves the beneficiaries of others' labours as well.

The primary advantage of all the above techniques is that the inputs are available. No currency, local or foreign, is required. They can be implemented by one person or family alone or in conjunction with others, and the benefits accrue directly to those who employ them. They reduce the waste of scarce natural resources, and preserve and enhance the natural environment.

In addition to the above technologies which are suitable for women in their capacity as cultivators, there are some alternative technologies which could facilitate women's work in other areas and improve the environment. One of the biggest non-farm labour bottlenecks in the lives of women is that of grinding grain. There are several ways of approaching this task. The most widespread is for the woman to kneel on the ground and grind the grain on a flat stone using a smaller stone in her hands to crush it. Another common method is to pound the grain in a wooden mortar. The preference is generally for very finely ground flour, so grinding can take a very long time. All of the respondents in a Sudan Council of Churches study (1978) favoured the establishment of grinding mills in their villages, so it seems there is a desire to reduce the amount of time spent on this task. There are several diesel grinding mills in the Region, but they are often not functioning due to insufficient maintenance, frequent breakdowns, lack of spare parts, and absence of adequate supplies of diesel fuel and the means of transporting it. Technologies to be considered which do not require so many unobtainable inputs might include hand grinding mills and animal powered mills. A few hand mills are

being imported into Yei on a very limited trial basis. With the increasing prevalence of donkeys, especially in Juba, perhaps animal powered stone grinding mills such as those long employed in Europe could be tested. A few oxen have been trained in animal traction at the Rumbek Agricultural Training Centre. These oxen could be used for grinding grain as well as for pressing oil from seeds.

Household water is an often overlooked resource. The bath shelter could be positioned so that the run-off water would flow into the garden. Instead of discarding the water from bathing children, and washing hands and dishes, the woman could use it to water trees and vegetables. Modern houses with piped water should have a grey water system built in so that it could be used for gardens to beautify the urban environment instead of overflowing the sewer systems or septic tanks.

In the kitchen there are several things which can be made to conserve fuel and thereby retard deforestation. Cooking pots should be covered to conserve heat. Foods which require long cooking should be soaked in advance, boiled for half an hour, and then be put to continue cooking in an insulated hot box which requires no fuel and can be easily constructed from locally available materials. A woman can build and use a raised fireplace which is more fuel efficient than an open fire and has the added advantage of preventing children from burning themselves. She can also remove unused fuel at the end of cooking and extinguish it so that it can be used again later. And of course kitchen as well as farm waste can be composted.

A partial list of slightly more complex technologies which would meet the needs of small farmers, male and female, and be compatible with preserving the environment, might include solar dryers, the Danish no-fuel water pump, and methane digesters for producing cooking gas and high quality fertilizer. These technologies require a one-time-only input of non-indigenous materials, but last a very long time with minimal maintenance, and are completely independent of petroleum fuel.

One of the major causes of the hungry season which just precedes the harvest is that although a family may have produced enough grain for its needs, much of it is lost in storage. If it were more thoroughly dried, such as is possible in a solar dryer, less would be lost in storage. Solar drying also makes accessible, on a year-round basis, the nutrients of seasonal vegetables such as sweet potatoes, tomatoes, and green vegetables. A solar dryer could be built and used by a family if plastic sheeting were available in the local markets.

A methane digester is currently operating on a demonstration basis in Torit, Eastern Equatoria Province, under the auspices of Norwegian Church Aid. Cattle droppings and vegetable wastes are fed in. Natural bacterial breakdown occurs. The products are odourless methane cooking gas and a sludge which is an extremely high quality fertilizer. Because a fairly

large quantity of material must be fed in on a regular basis, a methane digester is best sited in an area which has a number of cattle whose droppings are not fully utilized under the present system. Widespread use of methane cooking would reduce fuel wood consumption and slow the rate of deforestation. Continued use of its fertilizer output would increase soil quality and fertility and would thereby increase crop yields.

A no-fuel water pump, developed by the Danes, is currently in operation at Rejaf near Juba. It provides irrigation water for a tract of vegetable gardens which now thrive during the dry season. The no-fuel pump floats in the river and is powered by the flow of water. Thus it is not effected by changes in the water level. Villages near rivers could make good sense of these pumps, if they were more widely available, to cultivate crops during the dry season and to facilitate the task of women water carriers.

The methane digester and the no-fuel water pump require initial inputs larger than that available to most smallholder farmers. However, the program of co-operatives is well established within the Region and could provide a focus for funding, construction, training, and use.

The very simplicity and low-cost qualities of these technologies present an obstacle to their adoption. Many donor agencies, ministry officials, and farmers alike have become seduced by high cost grandiose "development" projects and flashy complicated gadgetry and machinery. Even though the disadvantages of those systems are well known, many people feel that locally available techniques are somehow inferior, even when they are more suitable and effective, and that their use is somehow demeaning. Therefore, most of these techniques are not advocated by extension services, nor are they being practised or tested at research stations. This waste of available resources is difficult to condone.

MEASURES FOR CHANGE THROUGH THE INVOLVEMENT OF WOMEN

As more and more women in the Sudan become educated, more of them will, in one capacity or another, find themselves in the role of change agent. This may be in the more traditional roles as homemaker, nurse, or primary teacher, or in newly opening fields such as agricultural extension agents, university professors, or politicians.

Even a woman not employed outside the family structure has a tremendous capacity for preserving and improving the environment in and around her home. Often many areas, susceptible to environmental amelioration, lie in the traditional realm of women's work. Many of the technologies suggested in the previous section, such as composting instead of burning weeds, fall into this category. (Of course in many areas the social system would require modification before women could assume

their most effective roles, but that is not the subject of this paper.)

Another area in which a woman at home has a great deal of influence is in educating her daughters and sons to use environmentally sound procedures. She can even influence her husband by quiet example. When he sees that her vegetables grown in compost enriched soil grow better than his or their neighbours', he is likely to become convinced. The long-term effectiveness of a committed woman in this realm of influence is greatly underestimated.

In the village, neighbourhood, or town setting, concerned women can meet together regularly for support and inspiration and to design programmes that would be suitable for their locale. They can join together to exert influence through both the traditional and modern systems to encourage town policy makers to establish environmentally sound procedures such as

1. continuing forest plantings to provide wind shelter, shade, future wood supply, and protection against erosion and desertification;
2. laws controlling the grazing of animals in towns and gardens and provisions for their enforcement;
3. development of whatever appropriate technologies are suitable in that location, whether one of those already mentioned or some others.

Women can also establish, or utilize more fully already established programmes for training young girls which stress environmental concerns. The International Girl Guides provides an excellent vehicle which can be tailored to meet the needs of each specific situation. Church programmes for young people can also be used.

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PART IV.
WOMEN AND FOOD
NUTRITION

CURRENT PROGRAMMES IN NUTRITION EDUCATION

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It is estimated that, in the Sudan, 50 per cent of the children are suffering from malnutrition and this is reflected in the high infant mortality rate of 141 per 1,000. While World Bank (1981) figures cite the daily food requirements consumed as 93 per cent, this does not indicate the tremendous distribution and ignorance problems that result in nutritional shortages throughout the country. On the whole, women and children are most susceptible to health problems resulting from lack of proper food. The average life expectancy for females in the Sudan is 49 years and it is estimated that one-half of non-pregnant and two-thirds of pregnant women suffer from anemia. High fertility rates mean that it is very difficult for women to regain their strength as babies come too quickly; the birth rate in the Sudan is 48 compared to 15 in developing countries. Endemic diseases such as malaria and intestinal parasites as well as stress and fatigue resulting from heavy work loads and lack of rest further aggravate the problem and put greater demands on their bodies for adequate nutrition. Without better education, this problem cannot be solved.

In many cases, it is possible for people to be well fed, but food taboos - such as the one that says eating eggs inhibits children's ability to talk - social customs - such as, letting the males in the family eat the meat when it is scarce - and lack of knowledge of how to prepare locally available foods, all contribute to the problem. In order to rectify this situation, the government, with the help of a number of international agencies, has established a nutrition education programme in the Sudan.

SCHOOL GARDENING AND NUTRITION EDUCATION

The school gardening and nutrition education programme was initiated in 1964, sponsored by the Junior Canadian Red Cross and under supervision of FAO. The Ministry of Education took over the complete supervision of the project assisted by nutrition experts from FAO and UNDP from 1971 to 1976. Since the inception of the project, the School Gardening and Nutrition Education division (SGNED) has successfully maintained close collaboration with the Ministries of Health, Agriculture, and

Information, the local government and higher education institutes, Faculty of Agriculture, University of Khartoum and political and social unions.

The SGNEC comprises the following sections:

- a) Curricula and preparation of nutrition education pamphlets and guidebooks.
- b) Audio visual aids and handicrafts.
- c) Rural education (gardening and poultry raising).
- d) Library, radio and television.
- e) Nutrition education section, covering:
 - i) In-service teacher training (all levels).
 - ii) Village guides.
 - iii) Kindergarten guides for Ministry of Education and other ministries.
 - iv) Community development guides and social workers for other ministries.
 - v) Rural women.
 - vi) Urban women.
 - vii) Cooks and kitchen workers from boarding schools.

Thus it appears that School Gardening and Nutrition Education Division is not engaged in nutritional problems only, but is deeply involved in the development process in rural as well as urban areas.

In 1972 activities were extended to provincial levels through fifteen provincial centres and 115 sub-centres (53 in Northern Kordofan province, 42 in Gezira province and 20 in Khartoum province).

In 1978 FAO assisted the division by establishing two provincial centres and strengthening Northern Kordofan provincial centres. The programme is aided by radio programmes in nutrition education, distribution of pamphlets, posters, delivery of lectures, debates and exhibitions.

The SGNEC main centre in Khartoum is the national centre, receiving trainees from other ministries. Provincial centres follow a similar pattern but adapt themselves to prevailing conditions of their respective provinces.

There are different categories of trainees and for each type there is a special curriculum of courses. Table 1 below gives types and numbers of trainees reached by the programme over the past eleven years.

Table 1: Category and number of trainees in nutrition education.

1969 - Dec. 1980			
Type of trainees	Khartoum (main centre)	Provincial centres	Total
Teachers of junior, secondary and elementary schools	1035	-	1035
Other teachers	362	-	362
Village guides	944	1277	2221
Kindergarten guides, health visitors and community guides	574	115	689
Urban women	641	2035	2676
Rural women	11198	11881	23079
Cooks and kitchen workers	6	806	812
School feeding programme supervisors and assistant supervisors	63	-	63
TOTAL	14823	16114	30937

Source: School of Gardening and Nutrition Education,
Ministry of Education, 1981.

The staff

A technical staff under a director teaches in the main centre in Khartoum. Graduates of two-year courses at the Nutrition and Rural Education Section of the Extra Mural Studies at Khartoum University assist in delivery of lectures as well as running the provincial centres. Specialists of Ministries of Health, Agriculture, Food and Natural Resources, help deliver courses and give practical work to the five-month course of junior secondary and primary school teachers. Under each provincial centre there are a number of village sub-centres run by village nutrition workers - "village guides." In these sub-centres rural women are trained in applied nutrition, vegetable growing, poultry raising, handicrafts and health education.

NATIONAL NUTRITION PROGRAMME

This pre-school nutrition programme is carried out at the Maternal and Child Health sections of the Health Centres in Khartoum, Kassala, Red Sea and Gezira provinces. Every child receives four pounds of dried skim milk powder and two pounds

of oil every month. The food distribution is used as an incentive to bring in the mothers who receive nutrition and health education on weaning, vaccinations and hygiene. The children are weighed at the same time so that the mothers can see their progress. One measure of the success of this programme is the fact that now in some centres, even without the food inducements, attendance is 65 per cent.

Another indicator of success is the proportion of children in the programme with better levels of nutrition. We recently completed such a survey and the results are given in Table 2 below. As you can see, although the percentage of children in the normal category declined somewhat between 1976 and 1979, the proportion in the second and third degree categories (the more severe levels of malnutrition) declined more substantially.

Table 2: Degree of malnutrition in children enrolled in pre-school programme 1976 and 1979.

Degree of Malnutrition	1976 Children		1979 Children	
	Number	Per cent	Number	Per cent
Normal 100-90%	1,722	35	3,856	25
First degree 89-75%	2,218	45	10,974	72
Second degree 74-60%	972	20	491	3
Third degree 60-0%	4	0.1	-	-
TOTAL	4,916	100	15,321	100

Source: School of Gardening and Nutrition Education, Ministry of Education, Sudan. 1981.

REGIONAL FOODS

The geography and climate of the Sudan is such that there is considerable variation among different regions in terms of the locally available foods and different cultural preferences and methods of preparation. Seasonal changes determine the types and form of food used and one of the aims of the nutrition programme is to show women both how to cook local foods that are nutritious, and how to preserve food available fresh in one season so that it can be enjoyed at other times of the year, particularly when most other food is also scarce. As an example of the variations throughout the country, I have included a number of relishes eaten in different regions and their ingredients.

SOME PATTERNS OF RELISH PREPARATION IN SUDAN

Western Sudan

This is the driest part of the country in many parts, so dried seeds and vegetables are used most of the year, and even leaves of local trees (tabaldi).

The relish here may consist of the following:

1. Mulah lubia : lubia + oil + onion + dried okra
2. Mulah roab : onion + oil + ground-nuts + dried okra + roab (fermented milk)
3. Mulah sesame : roasted sesame + onion + dried okra
4. Mulah tabaldi: dried tabaldi leaves + ground-nuts + onion + fresh or dried meat
5. Mulah aradaib: aradaib juice + dried okra + onion + oil.

These relishes are eaten with sorghum or millet porridge.

Southern Sudan

The bread in Southern Sudan is mainly sorghum porridge. Some types of relishes used by the Dinka in Upper Nile province are:

1. Dried fish relish: dried fish without bones + green or dried okra + ground-nuts.
2. Green anait (local tree) leaves + meal + ground-nuts.
3. Fresh fish boiled in water + salt.

The onion is absent in all relishes mentioned above.

Central Sudan

Umtakasho is a relish used in some areas of Gezira province and it consists of dried leaves of Jute-mallow, mulkia + salt and water only. We can raise the nutrient content of this relish by adding some types of beans or ground-nuts.

Northern Sudan

Here people live near the river and depend upon irrigation for their farming practices so greens are available throughout the year, although there is a shortage of animal products. High prices limit meat consumption so here the relishes are cooked without meat.

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WOMEN AS NURTURERS: PRESENT AND FUTURE

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First of all, I would like to introduce some observations made during the implementation of two projects focused on rural women in Sudan, that I have been following up for FAO until January, 1981. These are only observations - not the ultimate conclusion of an in-depth research - which, coupled with previous observations and findings in other African countries, can lead only to hypotheses and suggestions. I would then like to discuss them with your own experience and deeper knowledge of Sudan, also because I feel it is a dangerous exercise for an alien eye to draw firm conclusions too quickly from few observations.

INCOME GENERATING ACTIVITIES FOR RURAL WOMEN PROJECT

The aim of this project is self-explanatory: to generate or to increase incomes for village women by assisting them in food production, namely, in poultry raising or vegetable gardening.

The idea of the project rose from the fact that although women are very active in agricultural production in Sudan, they remain largely outside of the extension and bank credit systems.

According to the Agricultural Bank of Sudan, for example, no more than two rural credit loans to date have been granted to women by the Bank, and these two loans were granted in Khartoum Province.

This obviously represents the main obstacle to the development of their activities. Furthermore, the development process will lead to an expansion of agricultural credit and if the women remain out of it, this credit system will turn out to be the main element of discrimination, along with other elements of "modern" development.

The "raison d'être" of this income-generating project is to provide credit directly to rural women, so that they can establish or improve income generating activities in the field of food production. It was as well assumed that an increase in

the household food production was bound to induce an improvement of the diet, both directly (by the consumption of part of the production), and indirectly, as a consequence of an increase in the family purchasing power.

The project started as a pilot project, in four villages¹ not far from Omdurman. The money reimbursed by the women is supposed to constitute a "circulating" fund, to be used for the expansion of the project. Before the start of the project the women were already active in agriculture, helping their husbands on the farms, and also responsible for goats and sheep and poultry care.

NUTRITION EDUCATION CENTRES

The Ministry of Health has estimated that fifty percent of the children between birth and 4 years of age suffer from some degree of malnutrition in Sudan. Besides poverty, a main factor of malnutrition is that mothers are not always aware of: i) the needs of their children (especially during the weaning period), and ii) the best use they can make out of the foodstuffs available to them.

The purpose of the Nutrition Education Centre, which is an old project of the Ministry of Education, is precisely to teach mothers to get the best out of what they can have, and to produce what their families need to reach an adequate diet.

The future centre and sub-centre directors are trained at the Province Co-ordinating Centre. Beside nutrition education per se, they are taught how to assess the nutritional situation of "their" area (which is generally the same village or district where they come from) on the basis of observations and simple questionnaire surveys. The questionnaires are always sent to the provincial headquarters for checking and verification of the "diagnosis."

Afterwards, the instructors teach the mothers the appropriate basis of hygiene and nutrition (according to the nutritional deficiencies found during the survey), simple recipes to improve the output of the available foodstuffs, and - where water is available and consumption of vegetables and fruit is insufficient, as in most areas of Sudan - simple techniques for vegetable gardening. To date, there are more than a hundred nutrition education centres and sub-centres scattered in 10 provinces.

MAJOR OBSERVATIONS

Shortage of time seems to be the main limiting factor for rural women's activities in Sudan. Mothers coming to the nutrition education centres, or village women considering

¹ Namely: Mahmoudab, Zeberab, Shigeilah, El Trace.

whether to participate or not in the food production activities proposed by the other project, all seem to take consumption of time as their main criteria for decision. Some of them, for example, refused to increase substantially their poultry raising business because they had small children and nobody who could help to take care of them. Others refused because they were very much involved in assisting their husbands in farming irrigated plots.

As a matter of fact, there are a number of competing activities in the daily and seasonal schedule of rural women: child care, housekeeping, water and wood collection, assistance to their husbands for agricultural production, own agricultural and food production, food processing and storage, cooking, marketing, animal care, house building in some regions. Knowledge about the time allocation of rural women - which differs in the various ecosystems of Sudan and varies according to the season - is at present very limited and should be an essential component of the preliminary studies conducted for the project design of the income generating activities project for rural women, and of nutrition education programmes. Time-allocation studies would help the project designer to select the participants who are truly able to commit time for active participation, to choose a starting time, and to plan the project activities accordingly.

Second, if some activities are found to "waste" much of the time or of the energy of the concerned women, the introduction of appropriate technologies (grinding mills, drying nets...) should then be built into the project. From the beginning it would allow a better planning of nutrition education activities (to be carried out during the dry season); food distribution for children, if any, should instead take place during the rainy season, when women have less time to dedicate to child care, because of their heavier work in farming.

But the most important fact is that the women's activities are competing in terms of time allocation, which means that the establishment of one activity can be detrimental to other ones, if no time-saving devices are introduced. This is demonstrated in several of the papers in the first section of this publication which discuss various educational and income-generating projects already undertaken in the Sudan.

Let us go back to the food production project, and particularly to the vegetable production project, which allocated four feddans of irrigated land to some 40 women. In the two villages in which it started - El Trace and Shigeilah - we had seen evidence of vitamin deficiencies, especially amongst the children. After the first season, it was found that an insignificant part of the vegetable production was consumed by the women's families. The amount which was sold was much larger than the amount needed to be sold in order to pay back the loan,

so people from the Nutrition Education Centre were asked to come along and start training the women. It was only after this co-ordination that a number of women increased substantially the household consumption of vegetables. The poorest women, however, although they had participated in the same training aimed at convincing them that an increased consumption of vegetables would have been beneficial to the health of their families, continued to convey the same share of their production to the income-generating market.

This illustrates a number of well-known considerations:

- i) the need for cash is, at present, the priority for rural poor families;
- ii) rural development problems must be tackled from a multi-directional viewpoint: an increased food production or an increased income do not mean necessarily an increased food consumption, if it is not co-ordinated with nutrition education.

Even then, where the condition of poverty is too acute, both actions together may be not enough. It is here where rural poverty must be challenged in order to get nutritional improvements. Again the need for an accurate definition of the target group, or groups, and the factors that dictate their lives becomes essential.

Another example of the need for an integrated approach was given by the implementation of the food production project. The production activity itself was quite a success very soon and it was felt so by the women. They were performing all production operations, except for the cleaning and fencing of the land, which was done by their sons. But it was very difficult to have them control the operations which precede and follow the production, such as selection and purchase of the inputs, and marketing of the production. There was for them a strong tendency to have these tasks performed by the men of their families.

We should not be too quick to conclude that this is an example of the backwardness of Sudanese village women. Sex-related roles exist everywhere and most of the working women in Europe prefer to have their husbands tackle the bank or the electrician.

ACTION AND RESEARCH

Observations and discussions should lead to action. What can be done to improve the activities of the rural women in Sudan, in the field of food production, food processing and nutrition?

It has already been said in the first part of this paper that action towards rural women should be multidirectional and include comprehensive extension, appropriate credit, better

access to inputs, improvements of the technologies for the production, processing, storage, transport and cooking of food, and for other time-consuming activities.

The objective of the technological improvements is to save women's time and energy (i.e. by introducing grinding mills or hand carts) or to reduce environmental deterioration (i.e. by using mud and straw stoves). Action should also promote nutrition education in order to improve the quality of weaning food and the utilization of the available foodstuffs; and to reduce food wastage and deterioration. In this respect, the introduction and wide use of simple mud and straw stoves would be worthwhile. In the desert-threatened parts of Sudan, since they save around half of the wood necessary for cooking and need only one day of labour to build. UNICEF is trying to encourage their use in Ethiopia and there are plans to have them used in the Nutrition Education Centre and sub-centres of Northern Kordofan.

"Rural women" as a concept is too vague to allow effective action. The activities and difficulties of the women in a rural society are very different according to the socio-economic group they belong to, within the society. Even within a given area, an accurate disaggregation of the "rural women" must be conducted before attempting any action, and will allow researchers to select priority groups. Criteria for the disaggregation and for the selection of priority groups should be previously defined, and made explicit.

For example, a project introducing an additional activity for generating income may choose, as a target group, the women in the small families because they are more likely to be able to commit time for the additional activity; on the contrary, the project designer may choose as a target group the poor women in the largest families, because their need for an income is likely to be more acute.

Desertification is producing an important emigration of male rural labour force. In the absence of preventive project inputs, the modernization of the traditional agriculture sub-sector is also likely to produce a loss of male labour force for the smallest farms by eliminating a number of small farmers, as it did in most developing countries, and by reinforcing the position of better-off farmers who will need additional (and maybe seasonal) labour force. Similarly, the expansion of large modern schemes creates opportunities for wage labourers, and will attract men away from the traditional agriculture sub-sector.

What will be the reaction of the women left behind? Will the husbands' absence enlarge or reduce women's decision-making scope? The answer is far from self-evident. In Lesotho, although two-thirds of the male rural population are working in South Africa, the men decide which crops are to be cultivated.

Extension can prove to be difficult to design if decisions concerning innovations have to wait for the absent men's approval.

Amongst many nomadic people, men traditionally were responsible for cattle and all animals, except poultry and possibly goats. Emigration had the effect of increasing the work women dedicate to animal husbandry, but generally the decision-making power remains with the men.

On the other hand, desertification caused another consequence all over the Sahel: when the Long Drought caused the loss of many herds, women's workload for watering the animals and making clarified butter was reduced, as well as their income from the sale of it.

Efforts at the modernization of traditional agriculture - although not addressed to women - had important consequences for their activities and responsibilities. For example, the integration of animal husbandry with agriculture, the use of fertilizers, or the adoption of some other element of the Green Revolution, generally mean for the women an increase of the cultivated and harvested surfaces, heavier work of weeding, additional mounding operations, occasional transport of manure. If then these efforts are rewarded by a better harvest, she will certainly be happy to carry this heavier load.

On the other hand, modern agriculture is more ambitious, but also generally more risky than traditional agriculture, especially in areas of frequent climatic hazards. In case of crop failure, there will be strong pressure on women, who are responsible for the distribution of food within the family (and she may accept for herself a smaller share of food in case of shortage) and for storage.

In the long run, the first four priorities for the agricultural development of Sudan have been defined by the Government as follows:

- to bring more acreage under irrigation and maximum use of irrigated land by using modern farm machinery;
- to promote horizontal expansion by increasing the supply of surface and ground water resources by land reclamation programmes;
- to modernize traditional agriculture through provision of agricultural services and by establishing modern agricultural complexes in remote areas;
- to improve livestock production through the introduction of livestock on all rain-fed and irrigated schemes.

Research concerning the reaction of the rural women to this development policy should, therefore, relate to these trends of development.

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SUGGESTIONS FOR IMPROVING NUTRITION
IN RURAL AREAS

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Many social customs and environmental restrictions in the Sudan have contributed to poor nourishment in rural areas. Some common erroneous beliefs include not drinking milk while eating fish as it is believed to cause skin rash. Eggs are said to inhibit speech in toddlers, while coffee promotes it. It is not uncommon for women to sell eggs from their poultry to buy sweets and biscuits for the children instead.

In addition, there is often uneven distribution of food within the family: men are given the best food first, the women and children eating the remains. The Sudanese custom of communal dishes means that some family members may get less than their share and using fingers helps spread disease.

A recent study indicates the extent to which imbalanced meals still prevail in many areas of the country, reflecting food distribution problems, ignorance of sound nutrition and traditional food habits. Table 1 below shows that among the surveyed families, 31 per cent of the food budget went on non-nutritious items, such as, sugar, tea and coffee, while only 11 per cent went on vegetables.

Table 1: Average food expenditure for ten families in the Gezira Musvan area.

<u>Item</u>	<u>Amount paid</u> (LS)
Bread	90.00
Meat	6.00
Vegetables	17.50
Milk	--
Fruit	.50
Sugar, tea, coffee	<u>51.00</u>
TOTAL	165.00

Source: Survey conducted by Department of Rural Economy, Faculty of Agriculture, University of Khartoum, 1979. (Taken by the editor, from the paper submitted to the workshop by Kamil Ibrahim Hassan.)

Some relatively simple alterations in habits and consumption patterns could do much to improve the situation. For instance, using more of the available local foods, including foods that grow wild in the area, would expand the diet without adding costs. Using discarded foods - bones, vegetable tops, etc. - to make soups. Even when the same food must be eaten several days in a row, changing the method of preparation could make it more palatable to children; that is, frying one day, boiling the next, adding a sauce the next.

We still have not adequately tapped all the available ways of presenting these ideas to rural women: radio and television can be very effective in reaching thousands of people who could not be easily reached otherwise. A number of agencies already exist in the community at various levels who could easily incorporate (as many of them already have) nutrition information into their contacts with rural women - maternal and child health centres, doctors, health visitors and midwives, and other workers involved in community development (social workers, village leaders and school teachers). We can also encourage families to introduce animal husbandry on a small scale, such as, having goats for milk and poultry for eggs and meat.

There is considerable reason to suggest, then, that promoting awareness among rural people, especially women, will do much to enhance family nutrition in the Sudan.

FACTORS CONTRIBUTING TO MALNUTRITION
IN THE SOCIAL AND PHYSICAL ENVIRONMENT

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The Sudan is a vast country comprising a variety of climatic and geographical conditions that have major effects on food production and availability. This is illustrated in the table below. It should be noted that with the great difficulties of transportation in the country, regional food shortages cannot be easily solved by importing foods, as they can be in other countries with more developed infrastructures.

Table 1: Regional variations affecting food availability.

Region	Geography	Staple foods	Problems affecting nutritional levels
Southern	tropical, heavy rains, forested	porridge fresh vegetables fish, termites, nuts, cassava.	long floods slow down planting; food stores run low - 'hungry season'
Central and Northern	fertile along Nile, dry inland	sorghum (dura) beans, peas, oil, seeds, meat.	families tend to sell food produced rather than eat it.
Western	desert mainly	dukhun porridge sour milk, dry vegetables & fish.	nomadism makes cultivation difficult, resulting in dietary deficiencies.
Eastern	arid up to Red Sea coast	dura, fish, camel milk	rainfed crops unpredictable - occasional famines.

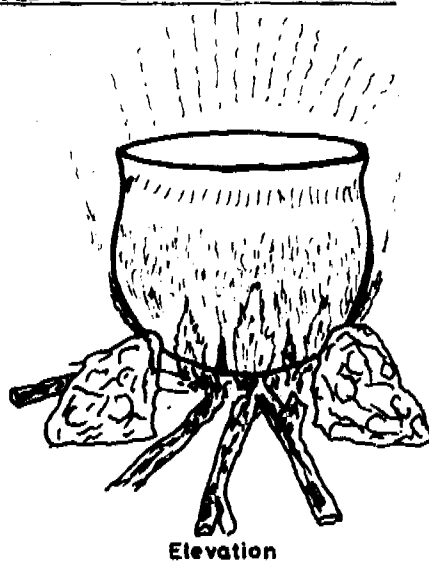
In addition to the above geographical determinants of food availability, social customs have major effects on eating habits. For example, in many areas men and women eat separately, with the males being given the choicest morsels first, with the

result that women and children may not get all their daily requirements. With the common eating patterns of everyone sharing the same dish, it is difficult to monitor individual consumption. Infant feeding it not known to many villagers and sick and convalescent individuals do not get special meals.

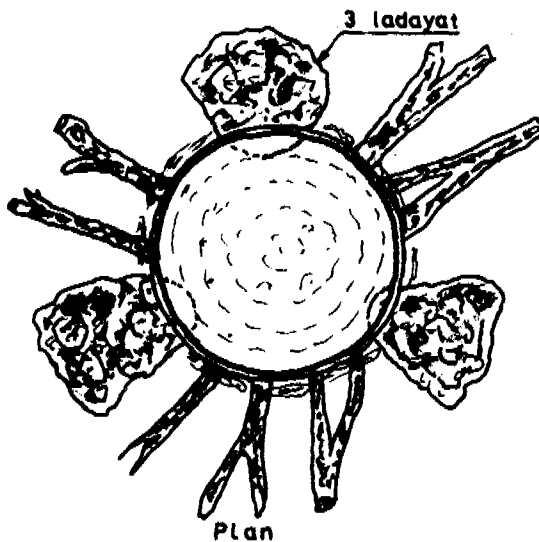
Nutrition education for women could assist them in making better use of local available foods, preservation techniques and ways of cooking to retain vitamins. The available national media should be used as much as possible as many people have access to radio and television. Public lectures and house-to-house visits can also be effective.

TRADITIONAL COOK FIRE
(LADAYAT)

USED MAINLY IN WEST AND SOUTH



Elevation



Plan

A PROPOSAL TO OVERCOME MALNUTRITION IN RURAL AREAS

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One of the questions that plagues planners and policymakers alike is how to involve women in development programmes while the majority of those in the rural areas are ignorant, busy, poor and desperate? The Sudan's experience with literacy training has taught us a hard lesson in the difficulties of trying to apply modern approaches in a traditional society. Millions of pounds have been poured into literacy programmes in the expectation that uneducated adults would welcome the opportunity to learn to read and write. But there was little interest shown so the literacy rate remains at 20 per cent overall and much lower for women. Perhaps we can learn from this experience that we must introduce such changes in a way that is in tune with the rural people's own priorities, not those of the government officials or educators.

Raising people's standard of living is not simply a question of boosting incomes: one study in Sudan in 1974 found that even when the cash income of farmers increased, no changes were evident in local services and amenities. Similarly, a recent UNICEF study concluded that "Minimum improvement in the quality of rural life is often a pre-condition for economic development - not simply a consequence." Development programmes should integrate all aspects of both social and economic growth. Bearing these points in mind, I would like to suggest a project that I feel would do much to improve the nutritional level in villages and rural areas in this country.

Such a project would include the following aspects: introduction of vegetable gardening inside the housing compound; home units for poultry production and nutrition and health education incorporated at every stage; a minimum of two years would be needed to put the project in place and begin to see results. Supervision could be undertaken by students in Home Science and Community Care at Ahfad College at the initial stages.

Experiments such as this one can be excellent vehicles for achieving many of the goals of development, especially for women, while, at the same time, giving those involved a concrete reward to demonstrate the benefits of being involved in such programmes.

DISCUSSANT'S COMMENTS ON "FOOD AND ENVIRONMENT"
SESSION

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The papers concerned with women's role in agriculture pointed out many important areas for future work, particularly, improvement of technology and better training as well as the development of special bodies to help women with marketing. But it is not enough for well-meaning officials to come into a village and initiate such activities and then leave; follow-up and well-trained local staff must be incorporated into all projects.

In looking at nutritional problems, it is important to differentiate between urban and rural women as their social milieu and activities vary. Also, the acceptance of solutions will differ depending on their standards of living.

I would like to point out that food habits are changing in response to immigration, increased cost of living and greater availability of imported foods; nonetheless, even educated women still are not adept at preparing nutritious meals. An even more disadvantaged group, nutritionally, are the villagers who have moved to the city and are faced with a new environment and are unsure how best to spend their money or find affordable food.

Future research is needed in the areas of agriculture and nutrition; specifically, food tables showing the type of food eaten and nutritional values for the different regions of the country; food laws governing the use of food additives; surveys of food patterns throughout the country. Women need to be taught nutrition education to remove detrimental taboos and beliefs, and budgeting, to avoid the problem of inadequate diets at the end of the month when money has run out.

APPENDIX I

RESEARCH PROJECTS ON WOMEN AND
THE ENVIRONMENT
IDENTIFIED BY THE WORKSHOP

MAIN AREAS OF RESEARCH

The following areas have been chosen because they lend themselves to action-oriented research that will bring rapid benefit to women. Emphasis in each of the subject areas is placed on six types of approach:

- i) assessment of existing programmes or technologies in Sudan
- ii) development of new intermediate technologies
- iii) dissemination of new technologies/behaviours to the public
- iv) community acceptance and participation
- v) cost-effectiveness
- vi) environmental benefits.

FUEL AND ENERGY

1. Improved charcoal and wood stoves

Since these are the most commonly used type of cookers in the Sudan, improvements in their efficiency would greatly benefit people in terms of fuel costs, time spent and the environment in terms of soil and forest conservation. Effectiveness of any new design would, therefore, be measured, in part, on the basis of the above factors as well as appropriateness of the design for the locality where it will be used, willingness of the populace to adopt it, its fit with local methods of food preparation and the feasibility of its being locally and/or inexpensively produced.

The study could also include a survey of stove designs in other countries with a view to their appropriateness for the Sudan. Women should be involved in the design, evaluation, building and dissemination of new stove technology.

2. Introduction of tree plantations

It is recognized that in certain areas of the Sudan - in particular, the West and North - wood resources are becoming

scarcer and more remote from habitations, causing women to spend more time in fuel collection, to walk farther distances and to reduce consumption with possible family health and nutrition risks. Research into the use of multipurpose, quick maturing trees would help alleviate these problems as well as the environmental hazards of desertification in these areas.

The study would examine the following aspects:

- a) selection of suitable species - fast-growing on rainfall alone or with only minimal supplementary irrigation;
- b) how plantations could be designed to meet the needs of selected villages/households for fuel wood;
- c) other uses for the trees - i.e. gum production, tannin, fibre, fodder, etc.;
- d) use of waste water and run-off (from pumps) for woodlots.

The effectiveness of the plantations would be measured in part by: their adequacy as a fuel source which is renewable and close to habitation; the ease with which the community can establish and maintain them; other benefits derived, such as, production of other materials, environmental conservation (wind reduction, less soil erosion), improvement of the surroundings (less dust, more shade etc.); acceptance of the community of this idea.

(This could be combined with No. 4 below.)

3. Use of renewable energy sources

In addition to wood and charcoal, four other renewable energy sources have been identified as being relevant to the Sudan, namely: solar energy, biomass energy, micro and mini-hydropower, wind power.

Research in this area would include:

- a) assessment of the potential of one or more of the above in different areas;
- b) introduction of alternative sources into an appropriate area and monitoring their acceptance by the community.
- c) feasibility of using this source to replace or reduce reliance on conventional energy sources.

Examples of such alternatives include: aquatic weeds, solar and wind for water pumping, micro and mini-hydroelectricity in the South and the Gezira, animal dung and other agricultural residues.

4. Training programmes for women

Since 96 per cent of energy used in the Sudan is consumed for domestic purposes, and since women are the prime collectors

and/or consumers within the home, greater emphasis should be placed on involving them in conservation schemes. Research in this area would look at designing training programmes for women in the production and use of renewable energy sources at the household level and the evaluation of these programmes. The use of female teachers should be investigated. One such scheme could involve training women to grow some or most of their fuel requirements by planting woodlots in their yard of a quick-growing variety to be irrigated with used household water. Another project could incorporate women into forestry projects - planting, harvesting and marketing. The effectiveness of the training programme would be measured in part by its community acceptance, its cost-effectiveness, the participant's assessment, etc. (This could be combined with No. 2 above.)

5. Renewable energy for household and community services

Renewable energy sources, which are adaptable to small-scale local production and use, are considered the most promising answer to domestic energy needs in rural and urban areas as well as community energy needs in remote and isolated areas. Research into household energy could include: solar refrigerators, solar water heating for sanitation, biogas generation for cooking, etc.

Community service projects might include: community water supply pumping using solar or wind power, improved communications systems for remote areas using microwaves and solar photovoltaics for closed circuit education programmes, solar powered refrigeration for community health centres.

The study would look at the feasibility of these sources in different areas, suitable designs, community acceptance, cost-effectiveness, its effect on women and the environment.

WATER AND ENVIRONMENTAL HEALTH

1. Water use technology

In order to facilitate and improve women's ability to provide safe water for their families, more research is needed into appropriate, low-cost technologies for handling and storing water in rural areas. These might include specifically, the following:

1. Improved equipment for drawing water from deep traditional wells, taking into consideration:
 - a) safety and health;
 - b) minimizing the physical efforts for drawing;
 - c) minimizing water pollution.
2. Improved water containers for women who are obliged to make long water trips. Main objective: to avoid

"occupational health hazards."

3. Products made from local materials to improve the quality of treatment of water from rivers, shallow wells, natural and artificial rain lakes (fulas and hafirs).
4. Equipment made from local materials to minimize the risks of secondary contamination of:
 - treated surface water
 - well water
 - piped chlorinated water

due to unhygienic conditions of storing and removal.

The research could look into the following aspects:

- further designs and models
- manufacture of substantial quantities for tests involving different groups of users
- additional designs for posters, printing of suitable visual aids
- printing and design of instruction pamphlets in vernacular Arabic or tribal languages
- improvement in community and/or household health status as a result of their use.

2. Cost-effectiveness of alternate supply services

Effectiveness is here defined as the reduction of labour and waiting time particularly for women, the minimization of water-borne diseases. Cost refers to the provision of those water supply services that would bring about the above.

Research in this area would look into the cost-effectiveness of various strategies for the provision of water to low-income rural and urban dwellers. The research would be concerned with the whole cycle of water use from the provision of water, through its transportation to the place of use and its subsequent use within the home. At each point in the cycle, the health and labour time aspects would be studied so that an overall assessment of cost-effectiveness of the system as a whole could be determined. The research would consider such systems as: water from wells, hafirs, bore holes, and other surface water sources and its distribution through human or animal agencies or through standpipes or house connections. Problems of waste-water disposal would also have to be taken account in the overall cost-effectiveness assessment of the system. The research could also look at specific technologies

for water transportation, handling and storage, as mentioned in No. 1 above, in terms of cost-effectiveness.

3. Education in water use

In order to ensure that improved technologies have an impact on family health, education of women and family members around water use is an important link. Research in this area could incorporate a survey of perceptions and attitudes about water as a basis for designing educational programmes; investigation of the role of women and other family members in decision-making about water (use, collection, etc.) to help determine to whom to direct the messages. Also, there should be an assessment of different types of educational approach to determine which would be most effective. Consideration could also be given to the introduction of specific programmes into the school curricula.

4. Socio-economic effects of water supply

When a change is made in the water source of a community, there may be a number of unintended effects on different groups in terms of changes in roles, income and costs related to water, access to the new water source, control over the water source and involvement in planning, and decision-making concerning water in the community. Research should be carried out in areas with traditional and new water sources to determine the political, economic and social effects of supplying potable water in different communities. In particular, what effects does "improved" water supply have on women's free time, income, work within and outside the home?

FOOD AND NUTRITION

1. Women's food-related activities

In order to plan innovations, it is necessary to ascertain precisely what women's food-related activities are as well as the social and economic context in which they are carried out. Research needs to be conducted into such areas as: the manner in which these activities are performed, the time and energy women expend, the customs and knowledge they base their activities on; time allocation of women for food preparation and production, and how this is affected by seasonality and her other responsibilities; the role women take in decision-making about crops and the allocation of food within the family.

2. Food consumption practices

In order to design appropriate nutrition programmes, food consumption patterns in different regions of the country should be determined. Information to be collected would include type and amount of food consumed by each family member in different seasons, customs of food handling and preparation, weaning and child-feeding practices, disposition of the family

food budget, amount and cost of 'imported' (i.e. not grown in the area) food, practices of feeding sick family members, especially children and any changes in eating habits due to social or environmental changes in the area - such as, increased desertification, migration, development projects, changes in crops grown and land use in general, including effects of family size and birth spacing; the presence of food rules and taboos and reasons for malnutrition among certain groups. The study could also look at population growth and family size related to food preparation activities, nutrition and income levels. The research could also ascertain what local indigenous plants are, or could be used to supplement the diet. Such a survey would also have to be combined with an assessment of the nutritional status of households in the area.

3. Improved technologies

In many areas of the Sudan foods are prepared using locally made and designed equipment which could, with relatively minor and simple modifications, become more energy- and time-saving and result in more nutritious meals. Research in this area could be directed to improving present cooking and food preparation practices through better technologies, i.e. mills for grinding flour, pressers for getting oil from local seeds, equipment for drying and preserving food and so on. The basic criteria on which the technology would be assessed would be: its use of local or inexpensive materials; whether it was labour-saving, especially for women; whether it improved or did not detract from the nutritional quality of the food produced; whether it was acceptable to the women or household using it and whether in trials it was actually adopted and used by the target population. Also, whether it reduced environmental deterioration and food wastage.

4. Food production

Sudanese women are involved at various stages of food production. Research is needed into the roles women play in each and how their knowledge and experience can be utilized in future projects utilizing:

a) home gardening

producing fruits and vegetables for home consumption and sale and the preservation of foods for use in the off-season.

b) livestock raising

what benefits do rural and urban families derive from domestic animals - goats, cows, sheep - in terms of health nutrition and income? What role do women play in their maintenance and use?

AGRICULTURE AND INCOME GENERATION

1. Vocational training

A number of projects have been undertaken in the Sudan to promote income-generating activities for women in the field of agriculture, gardening and livestock raising. Studies could be conducted to assess the outcomes of such projects in terms of the cost-effectiveness, the benefits for the target populations, the effects on women's earning power and future in the wage labour market. The effect of women's activities on family income, health and nutritional status should also be examined.

2. Improved technologies

Much of the farm labour that women engage in is seldom benefited by modern machinery or methods. What is needed is research into labour-saving devices, such as improved hand tools, animal-drawn equipment, storage cribs, milling machines and so on. The baseline data collection would look at the type of agricultural work done by women in different regions of the country, the devices that would be most useful to them, the design and implementation of such devices, and their acceptance by the target population. These would include improved technologies for harvesting, drying, threshing, winnowing, and pest control. Some assessment should also be made of the effects of such devices on women's time allocation for different tasks, income-earning potential, and on environmental improvement.

3. Women's agricultural activities

While it is recognized that women in many parts of the Sudan do play an important role in agriculture, much of their work is defined as 'unproductive' and the extent of their contribution is still unknown. Research needs to be undertaken into the precise role women play in agriculture: land ownership patterns, decision-making roles in crop planting and use. This study could include an investigation into co-operatives and how they might benefit women, women's role in marketing produce and the effect of their farming practices on the environment. This is necessary baseline data for planning of development projects and training programmes.