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TOPIC PAPER

APPROACHES TO LAND MANAGEMENT IN THE ESCAP REGION

BY

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ABSTRACT

The over-all theme of this paper is that poverty and growing food needs make it imperative that the developing countries of the ESCAP region adopt and comprehensive approach to the management of their land.

The total land area of the developing countries of the region is some 2,200 million hectares, of which 19 per cent is agricultural, 26 per cent under forest and woodlands, 18 per cent permanent pasture, and the remainder in other uses (urban, water-covered, barren etc.). The agricultural land may be subdivided into that which is canal-irrigated that which is served by ground water irrigation, and the rain-fed areas. Canal-irrigated land is in many countries subject to poor management and low efficiency, and problems such as water-logging and salinization and taking large amounts of irrigated land out of production. There is still great promise provided by ground-water irrigation, but proper management is required to ensure that sources are constantly being recharged and the water kept sweet. Unirrigated land still constitutes about two-thirds of the cultivated are in the developing countries of the region and there is much wastage of water and loss of top soil due to imperfect control of water run-off.

Deforestation is occurring at alarming rates in many developing countries of the region due to logging practices and shifting cultivation. Greater control is needed over the use of forest resources and vegetative over to prevent very serious losses of top soil with regard to pasture and other lands, effective inventories should be taken to help ensure that the best use is made of them.

The most important policy implication arising from a review of these problems is the need to integrate land and water management more closely, and consider soil as a valuable and non-renewable resource. The paper agrues for the creation of land and water commissions in each country to plan and implement project in catchment areas and river basins. At the multicountry level, the setting up of a regional centre is advocated and more co-operation among countries in the management of major river-basins.

Contents

I. INTRODUCTION

The ESCAP region contains some of the poorest and the most densely populated countries of the world. The number of people in this region who exist below the line of absolute poverty may be as high as 500 million.[1/] It is quite clear that high among the priorities of these countries must be programmes for the control of their populations and for achieving certain minimum levels of food, clothing and shelter for them. Since the populations of these developing countries may, in spite of all efforts, increase by 50 per cent between now and the year 2000[2/] and since their *per capita* consumption of food already stands at unacceptably low levels, they will, by and large, need to substantially increase their food production during the next two decades if they are to make any dent on the problems they are faced with.[3/]

The achievement of such a target will not be an easy task. Since almost all the available arable land in most of these countries has been already brought under the plough, increases in food production will have to be attained mainly by bringing more agricultural areas under irrigation, so that more intensive agriculture and multiple cropping may become possible. The task is however not impossible of achievement as the countries are situated in the tropical and sub-tropical zones and are generally well-endowed with good land and water resources. The success achieved by China in producing more than twice as much food as India from a substantially smaller cultivated area shows what a great deal can be done to make better use of under-utilized resources of land, water and manpower in this region.

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1/ This is an estimate based on a global figure of the number of people living in "absolute poverty" of around 800 million (of which a third are in India alone). See Eric Eckholm, Planning for the Future: Forestry for Human Needs, Worldwatch Paper 26 (Washington, 1979) and "Handbook on Cereal and Fertilizer Statistics for Asia and the Pacific" (Bangkok ESCAP, 1977).

2/ World population, which stood at 4 billion in 1975 is expected to rise to 6.3 billion by 2000. See United Nations, Population by Sex and Age for Regions and Countries, 1950-2000 (New York United Nations Secretariat, 1973).

3/ According to projections by Food and Agriculture Organization and the International Food Policy Research Institute, world demand for food will roughly double between 1975 and 2000. See United Nations, "Assessment of the World Food Corporation in Present and Future", United Nations World Food Conference, Rome, 1974, International Food Policy Research Institute, "Food Needs of Developing Countries - Projections of Production and Consumption to 1900" (1977), quoted by Lester Brown in The Worldwide Loss of Cropland, Worldwatch Paper 24 (Washington, 1978).

It would, however, be a serious mistake to imagine that the job ahead can be performed by merely providing more irrigation and drainage facilities and paying greater attention to other essential inputs into agricultural lands alone. The fact of the matter is that the productivity of good agricultural lands depends not only on how they are managed, but also in the long term, on a number of factors which are determined by what takes place on non-agricultural lands in the same river basin. A proper strategy for increased food production must accordingly pay adequate attention to the care of such non-agricultural lands also.

To illustrate, it would make hardly any sense to incur heavy costs to provide irrigation facilities to an area of high potential while ignoring the threat that it faces in the shape of recurring floods caused by the continued neglect of denuded water-sheds in the upper reaches of the basin. It would again be unpardonably myopic to continue merrily to pour large sums of money into the development of a canal irrigated area while ignoring the threat to the very life of the reservoir which is posed by unchecked soil erosion in its catchment area.[4/] Yet again, the process of desertification[5/] through the smothering of vegetation and choking of irrigation channels and drains on good agricultural lands through windblown sands, must be checked.

None of the above examples are imaginary: they are all drawn from real life and are typical of the rather chaotic land and water management situation in most developing countries of the region, with the possible exception of China and the Republic of Korea. The situation is indeed extremely serious in the context of the race against time in which these countries are engaged. It is all the more serious because it is not being adequately debated or talked about on account of a general lack of consciousness about these matters. Devastating floods and droughts - which are two sides of the same coin of poor land and water management - make big news for a while but are forgotten soon afterwards. "Resource-illiterate" governments, blissfully

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4/ "Studies of 17 major reservoirs in India reveal them to be silting up at three times the expected rate, apparently because of the deforestation of upstream areas". See Eric Eckholm, op. cit. See also B.B. Vohra, "Land and Water Management Problems in India", 1975.

5/ "The evergrowing Sahara is expanding westward into Senegal and eastward into the Sudan. Readings taken of the Sudan in 1958 and 1975 indicate the desert expanded south-eastward by some 90 to 100 kilometres during the 17 year period". See Lester Brown, op. cit. See also Ronald Schiller, "Deserts on the March", Reader's Digest, May 1979.

unaware of the issues at stake, continue to draw satisfaction from the magnitude of the funds that are being poured into major irrigation and flood control projects, little realizing that in the absence of balanced and co-ordinated activities in the entire field of land and water management, they are getting very little value indeed from their spending.

Most of the developing countries of the region are so precariously placed in relation to their growing and impoverished populations on the one hand and their near-static *per capita* food production and endangered food production base on the other, that they just cannot afford to aim at anything less than the fullest possible utilization of their total land and water resources.

A total and integrated approach towards the problems of land and water management is also indicated by other considerations. Man does not live by bread alone: his requirements include not only cereals from agricultural lands but fuel-wood and timber as well as meat, milk, fruit, fish and a host of other products which owe their origin to lands under many uses. If the developing countries of the region are to lift themselves out of the depressing and degrading poverty in which some of them find themselves today, it will be inescapably necessary for them to ensure that such lands, which constitute around three-fourths of their total land area,[6/] are given adequate attention and are made to yield the best that they can, whether by way of trees or grasses or inland fisheries. The neglect of these lands in the past has resulted not only in their going out of production through deforestation and denudation, but also in the crippling of national economies by floods, droughts, and much loss of surface storage capacity as well as ground water. Obviously, such neglect cannot be permitted to be perpetuated.

The developing countries of the region must also take stock of the lands which have gone out of production and consider carefully whether they can be reclaimed; and if so, at what cost. Generally, good agricultural lands go out of production as a result of water-logging and salinization caused by canal irrigation in the absence of adequate drainage. Such lands can be reclaimed in most cases by drainage followed by appropriate soil amendments and cultural practices, but at heavy cost. It would, therefore, be necessary to prevent such damage by providing drainage in time to newly

/irrigated

6/ For the developing countries of ESCAP, the total land area is 2224 million hectares of which only 428 million hectares is classified as arable land (including land under permanent crops). See ESCAP, *op. cit.*

irrigated areas. It is also important to involve farmers closely in the formulation and implementation of such soil restoration projects to ensure their practical success and to make them economically feasible as well.

Non-agricultural lands on the other hand, usually go out of production as a result of over-felling and over-grazing; in other words, of over-exploitation. Nothing can be done for such lands if there has been a complete loss of top soil, but wherever the damage is not irreversible, a period of non-use will usually restore vegetal cover. Here again, a policy of prevention will pay better than attempting a cure after the damage has been done.

Most developing countries are, however, not yet in a position to do very much about improving the management of their total land and water resources. This is mainly because they are still not sufficiently conscious of the part played by the soil in the productive process and the inextricable manner in which the management of this resource is linked with the management of water. In such a situation of unawareness of the basic factors of resource management it is not surprising that in most of these countries, there is as yet no focal point where an over-all view of such problems can be taken. These countries have usually nothing more in the field of resource management than engineering organizations for designing and implementing irrigation projects and flood control works and forestry organizations for looking after forest lands alone. The record of both types of organizations has generally left much to be desired, thanks to the exceedingly narrow and compartmentalized view they have taken of their responsibilities. Thus, irrigation departments have traditionally not bothered too much about what happens above the dam or beyond the outlet while forest departments have, by and large, failed to even keep so-called forest lands under adequate tree cover, let alone save other lands from denudation.

In the sections which follow, an effort has been made to examine in some detail the policies which need to be followed in respect of each type of land use situation and to suggest the kind of organizational arrangements which need to be created at the national and regional levels to make it possible to implement such policies energetically, so that the ecological foundations of agricultural productive processes may be saved from further damage and enabled to play their proper role in the war against dehumanizing poverty.

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II. MANAGEMENT OF LANDS BY TYPE

A. MANAGEMENT OF AGRICULTURAL LANDS

Agricultural lands account for 428 million hectares out of a total surface area of 2224[7/] million hectares of the developing countries of the region - a percentage of little over 19 per cent. These lands can be broadly divided into two categories, irrigated and non-irrigated. Irrigated lands can be further considered under two heads: those which are served by canals and those which depend upon ground water for irrigation. Each of these three categories needs to be considered separately in view of their widely varying circumstances.

1. Canal-irrigated agricultural lands

Very large investments have been made in storage and distribution systems to increase the productive capacity of such lands (the figure for India stands at over $US 6,000 million) but the return from such investments has been, by and large, disappointingly poor. Not only are most irrigation projects not paying for themselves in financial terms but they have also failed to contribute to increased agricultural production to anything like the extent expected of them.

One of the important criteria for the efficiency of an irrigation system is the degree of multiple cropping that it succeeds in bringing about in the area commanded by it. In the climatic conditions which exist in most parts of the region, irrigated areas should normally enable at least two if not actually three crops to be harvested every year. However, only a limited number of irrigation projects in this region, outside China, have succeeded in achieving any significant level of double cropping. (In India, the figure for all (including tubewell) irrigated lands is still only around 25 per cent). This shows the extent to which installed irrigation capacities are still poorly utilized owing to inadequate knowledge and resources to ensure sustained production including the appropriate use of complementary inputs such as fertilizer, pesticides and high-yielding varieties.

/Canal

7/ ESCAP, op. cit.

Canal irrigation is however not an unmixed blessing and can actually damage the productive capacity of the land if adequate arrangements are not made for the drainage of excess water. It has been estimated that in the world as a whole, as much irrigated land is going out of production every year as a result of water-logging and salinization as is being brought under new irrigation.[8/] India which has around 15 million hectares under canal irrigation has already lost over 6 million hectares to water-logging and salinization and is in the process of losing more.[9/] The damage to agricultural lands caused by water-logging and salinization in Pakistan has also been very substantial.[10/] Extremely large investments will need to be made to save newly irrigated areas from water-logging and reclaim those which have already gone out of production. The sooner policy makers in developing countries realize this fact, the better it will be for their long term prospects of food production.

Some of the measures which need to be taken to increase the productivity of canal irrigated lands and to make better use of the investments which have gone into them are the following:

(a) Very significant losses - sometimes as high as 40 per cent of the waters released from the head works - occur during the transmission of water to the field. Such losses can be saved by preventing seepage by the lining of canals and distributaries. The additional expenditure involved would be worthwhile not only because it would enable additional areas to be irrigated with the water saved from seepage losses but would also prevent damage by water-logging of good agricultural lands lying alongside canals and distributaries;

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8/ Matthij's de Vreede, "Deserts and Man", the Hague, 1977 (sponsored by UNCOD, UNEP and UNDP), p. 18. According to the noted Soviet soil scientist, N. Kovda, 60 to 80 per cent of all irrigated lands are, due to inadequate drainage or canal lining, becoming gradually more saline and hence infertile - see Eric Eckholm, Losing Ground: Environmental Stress and World Food Prospects (New York, W.W. Norton and Company, 1976).

9/ Ibid., p. 125.

10/ According to Food and Agriculture Organization Document FERC/78/3-Sup 1, May 1978, "The State of Natural Resources and Human Environment for Food and Agriculture", out of a total of 15 million hectares of irrigated land in Pakistan, about 11 million hectares suffer from salinity, water-logging or both, resulting in pronounced restrictions in crop yields. In Iraq, more than 50 per cent of the Lower Rafadian Plain suffers from salinity and water-logging. In Syria, about 50 per cent of the total irrigated area in the Euphrates Valley is seriously affected. In Egypt, some 0.8 million hectares or 30 per cent of the total are affected, and in Iran over 15 per cent of the irrigated lands.

(b) In order to save on costs, adequate provision is not often made for the construction of cross-drainage works when constructing canals, distributaries and roads in newly-irrigated areas. This also leads to the water-logging of good agricultural lands bordering canals, distributaries and roads and thus lowers the productive potential of the command area instead of adding to it;

(c) Many irrigation schemes do not contain provision for the construction of the field channels which should take water from the outlet in the distributary to each individual farm. This responsibility is left to be discharged by farmers acting in concert with each other in blocks which are sometimes as big as 200 hectares each. Experience has shown that the job is sometimes beyond the technical and administrative capacity of the farmers. As a result, areas which are presumed to be irrigated by project authorities do not sometimes actually enjoy this amenity;

(d) In many projects, the provision of water supplies leaves much to be desired. Water supplies have to be made in accordance with the requirements of the crops in time as well as in quantity. Many irrigation projects, however, respond poorly on account of their vast size and bureaucracy and the absence of farmers' organizations which could be associated with their day-to-day working;

(e) In order to make the best possible use of the water, fields must be properly levelled and shaped and must also be provided with drainage facilities to prevent water-logging. The provision of these services requires a great deal of technical competence as well as large financial investments and the willing co-operation of the farmers concerned. The ideal way would be to consolidate holdings and redraw field boundaries in accordance with the lie of the land and in a manner which would permit the construction of channels, drains and roads and the levelling and shaping of land to be carried out in a rational manner;

(f) Increased production from irrigated areas will also demand a great deal of support by way of provision on an adequate scale of inputs like credit, seeds, fertilizers, machinery and services (e.g., extension roads and markets) and continuing research on a site-specific basis.

Experience in India (where 50 command area development projects have been taken up) indicates that the provision of all these facilities is a matter of great complexity and will also involve at least as much additional investment (if not more) as was required by the original project.

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2. Agricultural lands served by ground-water irrigation

The importance of ground water as a source of irrigation supplies has begun to be appreciated only comparatively recently in the developing countries of the region. It is now being increasingly realized that ground water is available over much larger areas than was once imagined and that even hard-rock areas contain appreciable amounts of ground water, as for instance, in peninsular India. Ground water, therefore, holds great promise and in India has already surpassed canal irrigation even in terms of acreage served; its utility in terms of the quality of irrigation has of course always been incomparably greater. With the increased availability of pumping sets and with the spread of electricity to rural areas, more and more farmers are turning to ground water as a source of irrigation which is dependable, i.e., entirely at their own disposal and does not require, for its exploitation, any involvement with a big bureaucracy.

Unlike major irrigation projects, which take decades to plan and construct and to bring to full fruition, ground-water projects are small in size and have a very short gestation period. In sedimentary areas where ground water exists fairly near the surface (as for instance in practically the whole of the Ganga Valley), individual farmers can install a tubewell within a matter of days and at very small cost. Ground-water use does not result in water-logging problems because its application to the land can be controlled accurately and the farmer has no interest in using more of it than is absolutely necessary. The land shaping and levelling of fields served by ground water is also something which the farmer can do on his own without reference to surrounding areas, whereas similar operations in canal-served lands have necessarily to be undertaken on the basis of the entire area commanded by an outlet which is sometimes as much as 200 hectares.

From the point of view of the community also, the use of ground water needs to be encouraged because it does not require any huge governmental investments for development. It is also most important to remember that the exploitation of ground water does not involve, as the exploitation of surface water does, the permanent loss through submergence of large areas of land under reservoirs or the disturbance of the ecological balance such as occurred in the Nile Valley after the construction of the Aswan dam. The use of ground water also does not involve the loss of much valuable land for the transmission of water in canals and distributaries. Ground water is further not susceptible to losses by seepage during transmission or by evaporation in storage and transmission.

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In view of these advantages, it would be advisable for the developing countries of the region to pay greater attention to this resource. They should carry out scientific investigations aimed at determining the quality, quantity and the areal extent of their ground-water resources. In particular, the recharge characteristics of ground-water aquifers need to be studied carefully so that these may not be exploited beyond the limits indicated by their recharge capacities. Countries which do not have adequate technical institutions to carry out such studies must create them with all possible speed. (It may be mentioned in this connexion that a ground-water organization at the national level was created in India in 1970 and has already proved its utility in abundant measure.)

Ground-water organizations should be made responsible for providing technical advice to farmers on all questions relating to the construction of tubewells on their farms and for regulating withdrawals so that costly investments do not become infructuous as a result of the lowering of water tables. The need for statutory regulation of ground-water exploitation is particularly relevant in situations - such as coastal areas - where overdrawal of sweet water can result in saline infestation by sea water.

Experience in India has shown that one of the quickest ways of encouraging the utilization of ground water in areas where it exists plentifully is to undertake programmes for the consolidation of holdings. A farmer who has his land distributed in a number of tiny parcels finds that he can only afford to have a tubewell of his own when he is given all his land in one place. The extension of credit facilities and of rural electrification have also proved to be most helpful in encouraging ground-water utilization.

All necessary care must naturally be taken to ensure that the replenishment of such a valuable resource as ground water is facilitated in every possible way. The easiest way of achieving this objective is to make sure that the upper catchments of the basin in which the land is situated do not get denuded, as it is in these areas that most of the recharge takes place. It needs to be appreciated that denudation causes not only the loss of top soil but also excessive run-off which results in the loss to the sea of a great deal of sweet water which would otherwise have found its way into ground-water aquifers. This is why natural springs and artesian wells dry up as a result of deforestation and denudation of slopes. Here is another example of how closely land and water management problems are interlinked.

3. Rain-fed agricultural lands

While it must be the constant endeavour of developing countries to increase the area under irrigation so that multicropping and intensive agriculture may be practised and the elements of risk taken out of agriculture, a significant proportion of agricultural lands will continue to be rain-fed. In the developing countries of the region as a whole, the proportion of unirrigated land to the total cultivated area is still as high as 65 per cent.[11/]

Rain-fed agricultural lands fall broadly into two categories: those which are situated in an arid environment and those which have plenty of rainfall. In arid areas, the main problem is how best to conserve available moisture while in areas of heavy rainfall the main problem is how to drain away excess water without allowing the fertile top soil to be washed off. In both situations, the solution lies in the terracing and bunding of lands along contours and the construction of water ways in a scientific manner.

Experience shows that a great deal of soil and water conservation work undertaken on agricultural lands has proved to be more or less infructuous for a number of reasons. The construction of true contour bunds requires that existing ownership boundaries should be redrawn so that they may also follow the contour lines. However, since this has been found to be difficult to achieve in practice, soil conservation bunds have been generally built without due regard to actual contour lines and therefore in an unscientific manner. Another source of weakness lies in the fact that the work is usually taken up in a fragmentary manner only on patches of agricultural land and without the simultaneous treatment of the upper reaches of the subcatchments which are not under agriculture. This means that there is no protection to these works against uncontrolled run-off from the higher reaches of the subcatchment. Yet again engineering works like bunds and terraces are often designed and carried out in the absence of adequate resource and site-specific research data. Maintenance too is very often not adequate. If wasteful expenditure is to be avoided, it is necessary that the treatment of agricultural lands should not be taken up in isolation but as part of an over-all plan for soil and water conservation in the entire subcatchment in which these lands are situated. It is also necessary that while carrying out such works, the consolidation of scattered holdings and the redrawing of field boundaries should be undertaken simultaneously.

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11/ ESCAP, op. cit.

Mention needs to be made of the havoc which has been caused by the improvident extension of agriculture to rain-fed lands which were until recently under natural cover. The removal of natural vegetative cover without simultaneously terracing and bunding the lands - which are often situated on steep slopes and have shallow soils - has led to massive soil erosion in many developing countries. Increasing population pressures and a lack of appreciation of the importance of saving the top soil from displacement are mainly responsible for this development.

If the environment is to be protected, it will be necessary to prevent any more non-agricultural lands from being put to agricultural use without ensuring that such diversion will not result in any increase in soil erosion and that it is also not carried out at the expense of forestry or pasture development. The dangers of extending rain-fed agriculture at the cost of forest and pasture lands have been vividly brought out by studies conducted by the United States Department of Agriculture and quoted in Erik P. Eckholm's "Losing Ground":

> "The annual soil run-off from forested areas was only a few hundredths of a ton per hectare. Erosion from grassy pasture lands was much higher, though still not dangerous, averaging four tons per hectare. Lands cultivated for corn production, however, produced an average annual sediment yield of fifty-four tons per hectare. On the more skilfully managed fields, the erosion rate was eight tons per hectare, but on some farms it reached 106 tons. Where gullies had formed on abandoned farm lands, the average run-off of sediment was an astounding 450 tons per hectare. The numbers differ in every region but the basic relationships do not: as forests are cleared for agriculture, or are severely depleted by lumbering, grazing, or firewood gathering, the silt load of the rivers and streams below usually rises."12/

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12/ These findings relate to sixteen Mississippi watersheds in 1976. However, they would be even more true of countries in the ESCAP region which generally experience a greater intensity of rainfall.

B. MANAGEMENT OF FOREST LANDS

The area classified as forest and woodlands in the developing countries of the region amounts to 579 million hectares.[13/] This represents a percentage of 26 which, on the face of it, would appear to be quite substantial. However, in many of these countries the area which is actually under adequate tree cover is much less than appears in the statistics. For example in India, although 65 million hectares are reported as forest lands, in fact only a little over 30 million hectares have adequate tree cover. It is suspected that the forest statistics of many other countries may be equally misleading.

There is indeed irrefutable evidence that deforestation is proceeding in the ESCAP region at a much faster pace than official reports would suggest. Satellite photographs show that only 12 per cent of the once lush island of Java is left with tree cover and that in the Philippines, forest cover is less than 20 per cent of the country's land area, and not at least one-third as had been commonly assumed. In northern Thailand, forests are being reduced at a rate of 5 to 7 per cent a year.[14/] In Pakistan although 8.25 million hectares are classified as forest and range lands, only 2.6 million hectares are actually wooded.[15/] The destruction of forests in Nepal is taking place at such a rate that the country is "likely to be all but totally denuded by the end of the century".[16/]

The unchecked loss of forest cover over vast areas must be viewed as the biggest single threat to ecological balance in the region. The consequences of deforestation and denudation are indeed serious beyond all computation. The erosion of top soil - whether by wind or water - which follows in the wake of the loss of vegetative cover, particularly in the tropical conditions of the region, represents a loss which is not only disastrous in itself but also brings in its wake a host of other very serious consequences. It is perhaps easy enough to quantify the losses of top soil in terms of weight but it is impossible to estimate the loss which occurs in terms of productive capacity. Thus, it has been estimated that in India around 6,000 million tonnes of top soil are lost every year and that these contain major nutrients which it would cost around $US 1,200 million to replace. However, the top soil is not an inert substance but almost a living organism which teems with life, a teaspoonful of it may contain billions of living organisms, the micro-fauna and the micro-flora which are responsible for the fixation of the atmospheric nitrogen

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13/ ESCAP, op. cit.

14/ Lester Brown, The Twenty Ninth Day, (New York, W.W. Norton and Company 1978) pp. 25-26.

15/ Food and Agricultural Organization, "Forest News for Asia and the Pacific" (Bangkok), Volume II, No. 1, February, 1978.

16/ Lester Brone, op. cit.

and the breaking down of organic as well as inorganic substances into forms suitable for assimilation by plants. It is these minute organisms which perform the complex functions which are carried on simultaneously in the soil at various levels - physical, chemical, geological and biological so that life may continue to be sustained on this planet.

No country, let alone the impoverished developing countries of the region, can afford the loss of the top soil which is the medium - in conjunction with water and air - for the conversion of the inexhaustible energy of the sun into various forms of plants and therefore animal life. This loss is particularly serious in the context of the energy crisis which faces the world today, because the growth of vegetation is still the easiest way of fixing solar energy. The developing countries of the region, therefore, just cannot afford to lose the productive capacity represented by top soil.

The displacement of the top soil, however, also causes the siltation of storage capacity in tanks and reservoirs, and gives rise to disastrous floods. The havoc caused by floods is a familiar phenomenon, but the consequences of the premature siltation of reservoirs are not so well-known. It is all the more serious because in most cases once the existing reservoirs go out of operation, alternative sites are not available. Most reservoirs are designed for flood control and the generation of hydro-electric power also, and that ground-water development is increasingly dependent on adequate power supplies. The siltation of reservoirs will therefore affect not only surface-water supplies, and their role as moderators of floods, but also ground-water development.

Since denuded surfaces facilitate too rapid a run-off of rain water, soil erosion also involves the loss to the sea of a great deal of sweet water which could otherwise have percolated and got stored in the soil as ground water at no cost to the community. The role played by forests in maximizing the recharge of ground-water aquifers needs to be recognized as ground water is one of the most precious resources, and is indispensable not only as a direct source of irrigation, but also for the recharging of river flows in lean seasons and therefore the prevention of droughts.

It is necessary for each developing country to urgently consider how further deforestation can be stopped and lands which are not eroded beyond repair placed under tree cover. Forest departments in most of the developing countries of the region, need to take a fresh look at the policies they have been pursuing until now. It has been a tradition in these departments to look after forests as a source of timber and revenue without appreciating the role

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that they play in maintaining the ecological balance, and conserving both soil and water. Profit-oriented commercial interests which, often in collusion with forest officials and political interests, have been responsible for unauthorized fellings on a large scale must be brought under strict control. The notion that forest lands have no useful role to play and therefore can be easily converted into agricultural lands to satisfy the land hunger of burgeoning rural populations must also be dispelled. However, the genuine needs of impoverished populations who depend upon forest lands for fuel and grazing must be kept in mind and satisfied in a manner which does not result in deforestation.

Special mention must be made of the disastrous practice of shifting cultivation which is resorted to by tribal communities in almost all the developing countries of the region, especially in view of the considerably shortened cycles of felling. Ways and means must be found of putting an end to this practice and of inducing more communities to take to settled agriculture or alternative economic occupations. The need to contain deserts by means of extensive plantations and forest belts is also self-evident.

The task ahead requires the generation of a stern political and administrative will as well as the willing co-operation of people. That the task is not impossible of achievement is shown by the success achieved by China and the Republic of Korea in creating man-made forests on a large scale. Other developing countries of the region could gain from studying experience of these countries and devising their own policies and methodologies for providing tree cover for every acre of land which is not required for a more pressing use. The selection of the trees to be grown, whether for fuel and fodder, pulp and timber, recreation or watershed management, should depend upon the needs of each local situation and must be done with great care in order to obtain the support of local populations.

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C. MANAGEMENT OF PASTURE LANDS

According to land use statistics of the region, 408 million hectares or 18 per cent of the total area of the developing countries are under permanent pasture.[17] However, just as there are ambiguities surrounding the definition of forest lands discussed above, the proportion of the area classified as permanent pastures that is actually grassland may be quite small. The Indian experience shows that a great deal of the area which is classified as pasture land is in fact denuded.[18] In many cases, parts of village pastures which are supposed to be owned by the village community as a whole have been absorbed by the more influential members of the community for their own use.

There is a need for such lands to be clearly identified and demarcated and thereafter made to play a productive role whether by growing grasses or trees. Once these lands have acquired a permanent vegetative cover, they should not be allowed to be lost by overgrazing. The carrying capacity of pastures can be ascertained and ways should be found to ensure that it is not exceeded. Here again a powerful political will as well as the willing co-operation of the people are required to retrieve lost ground.

/D.

17/ ESCAP, op. cit.

18/ "Most of the land we are planting are called grazing grounds, but in reality they are nothing more than exercise grounds that have scarcely produced a blade of grass in years" - see B.K. Jhala, "Social Forestry in Gujarat" (1978), quoted in Eric Eckholm, Planning for the Future: Forestry for Human Needs, op. cit.

D. MANAGEMENT OF OTHER LANDS

Lands other than those under cultivation or under so-called forests and permanent pastures amount to 809 million hectares, or about 36 per cent of the total land surface of the developing countries of the region.[19/] The exact nature of these lands is not known: it is, however, obvious that they include lands under urban and industrial uses, lands which are barren on account of their inherent nature of location, lands under water bodies, and lands which have gone out of production on account of either the erosion of their top soil or on account of water-logging and salinization.

It would be desirable for each country to identify the location and extent of the lands which have gone out of production for one reason or another and to consider the possibility of reclaiming them. Long range plans for reclamation of degraded lands must be drawn up in an effort to make the best possible use of the total land and water resources in the country. It is indeed a sad commentary on the existing state of affairs that exact information regarding degraded lands is seldom available in the developing countries of the region and that no arrangements exist for collecting it regularly.

In certain areas productive coastal lands are threatened by sea erosion. Attention must be paid to the protection of such lands.

/III.

19/ ESCAP, op. cit.

III. SOME POLICY IMPLICATIONS

It will be clear from the above discussion that the problems of land and water management are inextricably interlinked and should not be handled in isolation if infructuous expenditure and disappointments are to be avoided. A great mistake has been made in the past by most developing countries in giving a disproportionate amount of attention to the so-called management of water resources without an adequate consideration of the interest of the soil. The time has come for this mistake to be rectified and to recognize that there is, and can be, no such thing as water management per se. The management of water which is a renewable resource can, in fact, have only one valid objective which is the optimization of production from the soil which is, for all purpose, a non-renewable and an irreplaceable resource.[20/] We must, therefore, learn to look on all land and water management problems only from the point of view of the productivity of the soil. The only rational policy to pursue in this field is therefore one which aims at maximizing the productivity of the land in any given situation. Thus, if the land is sick, it must be restored to, and thereafter kept in, good health which means in a condition of increasing productivity. Good lands must be saved from damage as well as diversion to other uses and treated in a manner which would enable them to improve their productivity constantly.

Our failure to recognize the soil as a basic resource in its own right has been largely responsible for the fragmentary and compartmentalized manner in which problems of land and water have been approached in the past. Endless debates have taken place regarding what our water policy or forest policy should be, but without any reference to the interest of the soil, as if such policies could have any meaning without reference to this basic resource. Water is, in fact, of relevance only so long as there is soil to be irrigated, and forests too can be grown only if there is enough soil cover to sustain them. Once however the top soil is lost, much more is lost. The ruins of several ancient civilizations in North Africa and the Middle East are silent but eloquent witnesses to this simple but still largely unappreciated fact.

The soil is in reality the most basic of all our natural resources and must be consciously recognized as such. It is our legacy from the past and must be bequeathed to posterity in as intact and healthy a state as possible.

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20/ "It takes Nature from 300 to 1,000 years to bring back a single inch of top soil and we sometimes lose that much top soil as the result of a single rain, if it is an especially heavy torrential type of rain" - Dr. H.H. Bennet quoted in Vogt, Road to Survival (1949).

The present generation has only the right of usufruct in respect of the soil and must look upon itself as trustee of this resource on behalf of future generations, not permitting this resource to be damaged in any way.

Once this basic change in attitude takes place, everything else will follow. Developing countries of the region should make arrangements to make accurate inventories of their soil resources, including those areas which have gone out of production on account of erosion or water-logging. Hopefully, developing countries of the region will also designate authorities which are to be held responsible for looking after the interests of the soil - no such authorities exist today because the need for their existence has never been felt. Governments have an extremely important role to play in the protection and rational use of the increasingly scarce soil resources in the region.

A correct appreciation of the role of the soil in all life-sustaining productive processes will automatically result in the formulation of rational land and water policies in various types of situations. Thus, rich agricultural soils must be provided with irrigation as well as drainage in order to improve their productivity. If ground water is available, it should be tapped in preference to the use of surface water as it is a more efficient source of irrigation, and has no side-effects. If, however, surface water has to be held, this should be done with all due care, to prevent unnecessary losses in storage or during transmission, and the water should be used in a manner which does not cause damage to the land. Good agricultural lands must also be saved from being permanently diverted to urban use. Urban and industrial growth should therefore be permitted to take place only on second-grade lands. Top soil, whether in desert areas or in watersheds should not be permitted to be dislodged; in order to achieve this objective, suitable vegetative cover, whether in the form of trees or grass should be provided to non-agricultural lands, wherever possible. This will help control floods, save reservoirs from premature siltation, save ground water from being unnecessarily lost to the sea and prevent estuaries from getting choked. Concern for the health and productivity of the soil will also demand that water-logged areas be drained and reclaimed. Where low-lying areas are found to be beyond redemption, these can be deepened and converted into lakes and ponds so that they may support inland fisheries.

A policy for putting hitherto unproductive lands back to work will result in a dramatic transformation of the national economy. The enormous increase in the availability of grassland, fuel-wood and timber will revolutionize the animal husbandry, horticulture and forestry industries. Such lands will be able to maintain large numbers of range animals and at much higher levels of nutrition and therefore productivity than is possible today. All this will mean a very great increase in the availability of milk and milk products. The care of the soil and the resultant increase in its productivity will generate very substantial employment potential in rural areas where idle manpower represents one of the most intractable problems of our times. To illustrate, it has been estimated that a total programmes for the development of land and water resources in India over a period of 30 years or so will demand an investment of over $US 60 billion mostly in the form of wages to labour required to carry out land shaping, land levelling, drainage, afforestation and soil conservation works.[21/] Since such an investment will by its very nature be productive in character, it will revitalize the rural economy, and also yield several other pay-offs. The present drift to towns of the rural poor would be reduced; nutrition and health standards would improve dramatically and reduce the national medical bill. With greater prosperity and employment, social tensions born of poverty and glaring disparities in standards of living would lessen and therefore also problems of law and order. The planned development of our natural resources would also provide a truly firm foundation for integrated rural development programmes, and food for work projects.

The single-minded pursuit of the aim of enhancing the productivity of the soil in all circumstances should result in co-ordinated working among various agencies and disciplines which are today functioning in isolation of each other. The concept of correct land use will demand that soil capability surveys be carried out and that the unit of planning as well as implementation be an entire catchment area. The soil resources of each catchment area should be classified according to their different capabilities and land use regulated accordingly. Agriculture should be permitted only on

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21/ B.B. Vohra, op. cit., p. 15.

flat valley lands or properly terraced slopes while remaining areas should be placed under adequate tree or grass cover according to the needs of the community. Soil and water conservation works must be carried out in watersheds in order to ensure that only water which is really surplus to local requirements leaves the catchment area and that too in a silt-free condition. Planning and implementation must start from the highest catchments and move to lower catchments so as to control and discipline the river in convenient stages.

An integrated approach will make it impossible for big new irrigation projects to be taken up even while existing projects are languishing for lack of adequate care for their command as well as catchment areas. Concern for the health and productivity of the soil will demand that available funds be utilized on a priority basis for saving existing reservoirs from premature siltation and for improving drainage and land and water management in existing canal irrigated areas. It will also demand that an over-all view be taken of the country's most pressing needs in the entire field of land and water management so that these may be met on a priority basis. To illustrate, an over-all view of the subcontinent will indicate the overriding urgency of saving the lower Himalayan region from further deforestation and denudation so that the ecological environment in this part of the world is not damaged beyond repair.

If developing countries adopt a rational approach in this area of activity and treat the complete river basin as the natural unit for planning and implementation - of which the best example is provided by the Mekong project - the prospects of extended international co-operation in the management of international rivers will also become much brighter than it is today. It may be mentioned in this connexion that the possibility of international co-operation with regard to the management of certain rivers in the Himalayan system needs to be explored urgently in the interest of India, Nepal and Bangladesh. However, it is futile to hope for concerted action with regard to international rivers when a similar integrated approach is not yet being followed with regard to rivers which lie entirely within the boundaries of individual countries.

A. SUGGESTIONS FOR GOVERNMENTAL ACTION

In a situation where the neglect of land and water resources has already reached alarming if not catastrophic proportions, but where there is as yet little consciousness of the threat that this poses to the welfare and in fact the very survival of the community, a great responsibility rests on each government to break through the vicious circle created by lack of awareness, complacency and continued neglect. The task of the government is made more difficult because complacency regarding this matter extends not only to each individual but also to the politicians and elitist classes who are among them in charge of the country's destiny. In these circumstances only a very bold and unorthodox approach can have any hope of succeeding in fighting the backlog of neglect, unconcern and apathy and creating the attitudes and organizational managements, which would enable an integrated and energetic view to be taken of the country's land and water problems.

It is clear that the very first thing to do is to create a nodal point within each government where it would be possible for all land and water management matters to be considered in a synoptic manner, without being subject to either narrow departmental pulls and pressures or to the vicissitudes and vagaries of political changes. Such a purpose can perhaps only be achieved by setting up a prestigious statutory authority at the national level which should be responsible for advising the government on all matters relating to the management of the country's land and water resources and for the creation of an informed public opinion on the subject so that pressures may build up with each passing day for government to take energetic action in an area which has long suffered from the most serious neglect. Such an authority may most appropriately be called the National Land and Water Commission. The Commission should be a small and compact body composed of people with a deep concern for, and understanding of the issues involved, rather than of specialists with narrow visions and loyalties. The Commission should however have access to expert opinion in all relevant disciplines and the comparatively modest financial resources needed to get broad assessment surveys and studies carried out by appropriate agencies as well as to mount a sustained public relations campaign designed to make every thinking citizen aware of the overriding importance of conserving and enhancing the land resources which sustain all life.

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The Commission should not only have the right to make public recommendations to the government from time to time but also the obligation to submit annual reports to parliaments with regard to the status of the management of the country's land and water resources and its views as to how it could be improved.

Such an arrangement would permit areas of neglect to be identified and studied in a detached manner and ensure that politicians, bureaucrats and the public at large are constantly reminded of their responsibilities in a field of vital importance. In brief, the Commission would act as a trustee for the care of the natural resources of land and water and therefore of the immediate as well as long-term interests of the millions sustained by these resources.

The Commission will naturally set about to obtain, as quickly and as reliably as possible, an over-all picture of the most pressing problem faced by the country in saving lands from further degradation, in reclaiming lands which are not beyond help already and in making increasingly better use of all productive lands. Based on such a picture, the Commission would be able to suggest to the government the manner in which existing priorities should be changed and how the redeployment of financial and human resources should be carried out in the over-all interests of the community. It will also be in a position to assess the working of all the existing organizations in the field of land and water management and to suggest the setting up of new organizations and agencies wherever necessary. The Commission would be able to recommend to the government as to how all these agencies should relate to one another and work as a team rather than in watertight compartments.

Since the natural unit for all land and water management planning and implementation is the complete river basin, it will be obviously necessary for the Commission to recommend the manner in which interdisciplinary river basin boards should be set up and made responsible for the planning and implementation of integrated projects within each basin, and for similar bodies to be created for individual catchments and subcatchments. The vesting of river basin boards and other governmental agencies with the legal authority required by them for the regulation of land use will also be a fit subject for study by the Commission. Among the other matters which the Commission may study will be the ways and means of obtaining the large financial resources needed for the execution of

land and water conservation and afforestation projects on an appropriate scale and the manner in which popular support for such efforts should be mobilized.

The Commission might also address itself to some of the following tasks:

(a) The strengthening of the resource data base which for historical reasons may have big gaps in it. Such gaps are particularly serious in the case of soil and group water resources. Recourse might be had for this purpose to aerial and remote sensing techniques;

(b) The strengthening of site-specific research with regard to the various problems of land and water management in different situations;

(c) The training of skilled manpower for inter-disciplinary projects to be planned and implemented on a complete subcatchment basis;

(d) The preparation of a draft perspective plan, extending over a period of 30 years or so, for the care and development of the country's total land and water resources. Such a plan would be of great use in educating the public with regard to the scope and size of the tasks ahead and in mobilizing support for increased activities in a hitherto neglected area. Such a plan would naturally be indicative in nature to begin with but could be refined and improved upon as data improve;

(e) The reorientation of rural employment and integrated rural development schemes so as to base them firmly on properly planned projects for the development of land and water resources on a complete subcatchment basis.

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B. SUGGESTIONS FOR INTERNATIONAL AND REGIONAL INITIATIVES

International and regional organizations such as ESCAP, FAO, UNDP and IBRD, can play a most valuable role by helping developing countries of the region to organize themselves as rapidly as possible for the formidable tasks which lie ahead. For this purpose, it may be useful for them to pool their resources and co-operate in setting up a properly staffed and equipped regional centre for land and water management which could act as a catalyst in this field as well as a focal point for contact with national governments and national commissions.

Such a centre could serve the cause of optimum utilization of natural resources in a variety of ways. It could help in the inter-disciplinary training and reorientation of personnel, in the carrying out of specific studies of national as well as international river basins, in the collection and dissemination of relevant information and data, and in constantly raising the level of awareness among top officials and policy makers regarding the nature and extent of the problems faced by their countries. This last would be done by means of seminars, discussions, and observation tours of successful projects both within as well as outside the region. The centre could also become a useful agency for the appraisal of integrated river basin projects on behalf of financing institutions and thus help to increase the flow of funds into this sector.
