

PART ONE
THE GUIDELINES

I. THE RELATIONSHIPS BETWEEN LAND-USE PLANNING, DISASTER MITIGATION AND WATERSHED MANAGEMENT

A. The role of land-use planning in environmental management and natural disaster reduction

To a greater or lesser extent, all countries in the ESCAP region are vulnerable to water-related natural disasters. Such disasters may be caused by cyclones, floods, land instability and drought. From time to time they cause widespread death and injury, extensive property loss, substantial environmental damage and serious disruption of the economies of the stricken countries. Despite significant efforts to reduce the effects of these disasters, their frequent occurrence continues to affect an increasing number of people, to result in the diversion of scarce capital for relief and rehabilitation services and activities, and to contribute to falling living standards.

Burgeoning population growth, along with intensified agricultural development and the accelerating expansion of urban centres, contribute to a steady increase in the magnitude of actual and potential disaster losses. An ever-increasing proportion of national populations live in areas which are susceptible to water-related disasters. These additional numbers of people put escalating demands on limited natural resources, leading to over-exploitation of resources and increasing degradation of the natural environment.

When basic natural resources such as land, forest and water are utilized to provide employment, yield sustenance to rural communities and contribute to export earnings, they may not be developed and managed in an environmentally sustainable manner. As most of the available good quality arable land is already densely populated and fully utilized, agricultural expansion is being forced into marginal and fragile lands which are susceptible to significant degradation. Unsound development in such areas has the potential to cause serious disturbance of natural ecosystems and produce major impairment of the natural environment.

A frequent consequence of poor land use, aggravated by the occurrence of such water-based natural disaster events as tropical cyclones and floods, is soil erosion. On upland watersheds, such developmental land-use practices as deforestation, cultivation and the destruction of native vegetation can lead to accelerated soil erosion. Steeply-sloping forested land, when cleared of the protective cover of vegetation, is highly susceptible to soil erosion and landslide. In areas where the soil structure is fragile, the extent of soil erosion can be so serious that the potential agricultural productivity is irreversibly impaired. Eroded material may be transported downslope into rivers and streams, leading to the choking of channels with gravel, sand and sediments. This in turn may influence the frequency and severity of flooding, increasing downstream damage.

The adverse effects of land degradation are both insidious and cumulative. Not only can urban and rural populations be directly affected, but these effects can also impact on overall national prosperity and welfare. Even in areas subject to more gradual and less obvious erosion, there will be an inevitable and progressive reduction in soil fertility and productivity unless the land is developed and managed within its capability.

In recent years there has been an increasing recognition of the need for new approaches to the management of land and water resources, aimed at the control of degradation, the long-term, sustainable utilization of natural resources and the maintenance of the quality of the natural environment. Efforts to understand the interaction between natural hazards and the environment, the choices societies may make to increase or reduce the risk of disasters, and the community's ability to predict, control and limit the impacts of disaster events, are all part of rational environmental management.

The periodical occurrence of water-based natural disasters cannot be avoided. It is far more rewarding and effective to direct government and community effort towards the mitigation of damage than towards disaster response, relief and recovery. Damage minimization approaches, such as the elevation and relocation of buildings, or the construction of flood protection works and other structural measures, can be integrated with a range of non-structural measures. By way of example, in urban areas with existing concentrated development where removal to another location is impracticable, a combination of structural and non-structural measures can be employed to protect existing development.

For such measures to be fully effective, an integrated, river-basin wide approach is needed. Such an approach, called integrated watershed management, involves the adoption of a coherent management system for land, water and vegetation which can ameliorate the adverse impacts of natural disasters and help to achieve the sustainable use of the natural resources within a watershed. This approach recognizes that such factors as urban and agricultural development, the loss of wetlands, land drainage schemes, forest clearance and other activities carried out in the watershed, even though well away from river channels, can increase the volume and rate of run-off and worsen flood conditions. Accordingly, integrated watershed management involves the coordinated use and management of land, water, vegetation and other bio-physical resources within the entire watershed with the object of ensuring minimal land degradation and erosion and causing minimal impact to water yield and quality and other features of the environment.

B. Mitigation of water-related disasters through integrated land-use planning and management

Although it is not possible to avoid the occurrence of natural disasters, their physical impacts can be reduced through appropriate mitigation strategies. In many circumstances, wise land-use planning and management can be effective in reducing the adverse consequences of water-related natural disasters. On the other hand, the vulnerability of land to such hazards as flooding or landslip can be increased as a consequence of environmental degradation resulting from unwise land use and the uncontrolled exploitation of natural resources.

By way of example, the indiscriminate clearing and cultivation of virgin lands and the extension of traditional farming practices may lead to extensive soil erosion, landslip and sedimentation. These forms of land degradation across a watershed may result in the rapid concentration of surface run-off and increased susceptibility to flood hazards and landslides. Alternatively, other kinds of land-use change can alter run-off behaviour by reducing the amount of long-term flow in rivers and streams and so increasing the severity of droughts.

Just as there may be adverse consequences of poor rural land use, intensive urban development may also contribute to increased disaster hazard. Such development can, for example, influence the hydrologic behaviour of small urbanized watersheds by concentrating run-off and increasing the peak rate of discharge. On the floodplains of large rivers, badly located urban development can expose lives and property to the increased risk of damage from inundation by floodwater.

One approach to the mitigation of the severity of floods is to retard the rate of run-off from natural watersheds. In rural areas, this can be accomplished by adopting conservation practices directed towards the increased infiltration of storm rainfall and the surface detention of flood run-off. In small urban watersheds, run-off can be retarded by providing onsite detention storage facilities, using such techniques as the provision of lot storage and the use of parking areas and sporting fields to detain storm run-off.

Land-use regulations can be used as an effective means of reducing the damage associated with natural disasters. In the context of floodplain occupation, land-use regulations attempt to minimize the effect of flood disasters by balancing land uses with flood risk. Restrictions are placed on the nature

and location of urban and industrial development and the type and extent of agricultural activity. To be fully effective, such land-use control measures should be introduced in combination with other forms of disaster reduction drawn from the range of available structural and non-structural measures.

The most efficient way to deal with water-related natural disasters is to plan for their control or mitigation on a whole-of-catchment basis, taking a broad, catchment-wide view of the causes and effects of disaster occurrence. This approach is an aspect of what is termed integrated watershed management.

C. Requirements of a comprehensive watershed management system

The terms watershed, catchment, drainage area and river basin are all used to describe a land surface from which water flows downhill to a specified point on a watercourse. It is determined by topographical features which include a surrounding boundary or perimeter which is known as a drainage divide, beyond which water flows away into another catchment or catchments.

In North America, the term “watershed” is restricted sometimes to mean a comparatively small catchment, or sometimes to mean the upland, water-yielding portion of a larger river basin. In British Commonwealth countries it is sometimes restricted to mean “drainage divide”. In this document we will use it to be synonymous with catchment or river basin, particularly in the context of “integrated catchment management”, which clearly implies a whole-of-catchment approach to natural resources management.

Integrated watershed management can be defined as the coordinated, planned and sustainable management of the natural resources within a river basin. This approach to the management of land, water, vegetation and other natural resources seeks to maintain or enhance the quality of the catchment environment and, by adopting a variety of physical, social and economic policies and techniques, all aimed at minimizing the adverse consequences of natural disaster events, to improve and enhance the quality of life of the catchment community.

Watersheds are naturally occurring units of the landscape, which contain a complex array of inter-linked and inter-dependent resources and activities, irrespective of political boundaries. A watershed can be perceived as an integrated ecological system, and its effective management requires the adoption of a systems approach in which the complex interrelationships between the development of natural resources, the integrity of the ecosystem, and the quality of the watershed environment have to be understood and accounted for.

By way of illustration, the amount of watershed run-off is affected by precipitation rates and amounts, evaporation, transpiration and infiltration, as well as the nature and density of vegetation and the water-holding capacities of the soil. Activities such as logging, grazing, agricultural development and road building result in the removal of vegetation, which can result in increased run-off. This may produce soil erosion and salinity problems, which in turn affect water supply and quality. Chemical pollutants and effluent from agriculture and industry are transported by water run-off, often attached to eroded soil particles. Thus there is a clear association between land-use decision-making, natural resources utilization and the quality of the watershed environment – with a systems approach, the likely adverse consequences of mismanagement can be anticipated and appropriate precautions taken to minimize or avoid their effects.

A watershed is a dynamic and integrated social, economic and bio-physical system which may contain people, urban and rural communities, agriculture and forestry, primary and secondary industry, communications, services and recreational facilities. The land resources of soil, water and vegetation cannot be managed for quality and sustained availability in isolation from each other or from the watershed environment. The natural balance of these resources can be easily disrupted by changes in land use, by mismanagement or simply through bad planning.

The watershed is the logical unit for coordinated land-use planning and management and effective and sustainable resource and environmental management. Integrated watershed management should aim:

1. To encourage effective coordination of policies and activities of relevant agencies, authorities, industries and individuals which impinge on conservation and the sustainable use and management of the country's watersheds including soil, water and vegetation;
2. To ensure the continuing stability and productivity of soils, a satisfactory yield of water of high quality and the maintenance of an appropriate protective and productive vegetative cover; and
3. To ensure that land within watersheds is used within its capability in a manner which retains, as far as possible, options for future use.

If the preceding principles are adopted and implemented, the following benefits can be anticipated:

- reduction in the rate of sedimentation in major dams, rivers and harbours
- reduction of run-off and damaging floods
- conservation of soil fertility and the maintenance and improvement of agricultural productivity
- maintenance and improvement of water quality
- reduction in soil salinity and acidity
- protection of wildlife habitat
- increased public awareness of the inter-relationships within watersheds and identification of land capability
- maintenance and improvement of tree and vegetation cover.

D. Land-use planning principles

Land use constitutes a fundamental mechanism for development and land-use planning can therefore serve as a guiding tool to direct development efforts towards prosperity and sustainability. Over past centuries, interactions between man and nature have greatly influenced land-use planning philosophies, concepts, principles and methodologies. Land-use planning concepts have evolved from a single-purpose approach to a more complex orientation, first directed increasingly towards sectoral needs, resource management goals and ecosystem values, and then more recently incorporating integrated and holistic development approaches (see figure 1). This evolution in land-use planning has developed from the recognition that land-use planning provides a forum within which land-use management options can be identified and developed, on the basis of a coupling of the management needs of resources and watershed ecosystems with development objectives.

As the development objectives become more and more complex, land-use planning has to deal with complex and multi-dimensional interactions. In the spatial dimension, three scales are generally recognized as requiring the formulation of different but related sets of goals for land-use planning, viz., (a) the national or international scale, (b) the basin or regional scale, and (c) the local or micro-watershed scale. Although these scales are only relative, they are set apart on the basis of the priority issues which require to be dealt with at each level. For example, at the national scale, the priority issues might include economic and social expectations, environmental aspirations and regional development patterns. At the basin scale, watershed management might be oriented towards ecosystem stability and biodiversity objectives. And finally, at the local level, issues may be more related to specific management options. Land-use planning is a process, and interaction between planning activities at all three levels is essential

FIGURE 1. TYPICAL LAND-USE PLANNING PROCESS

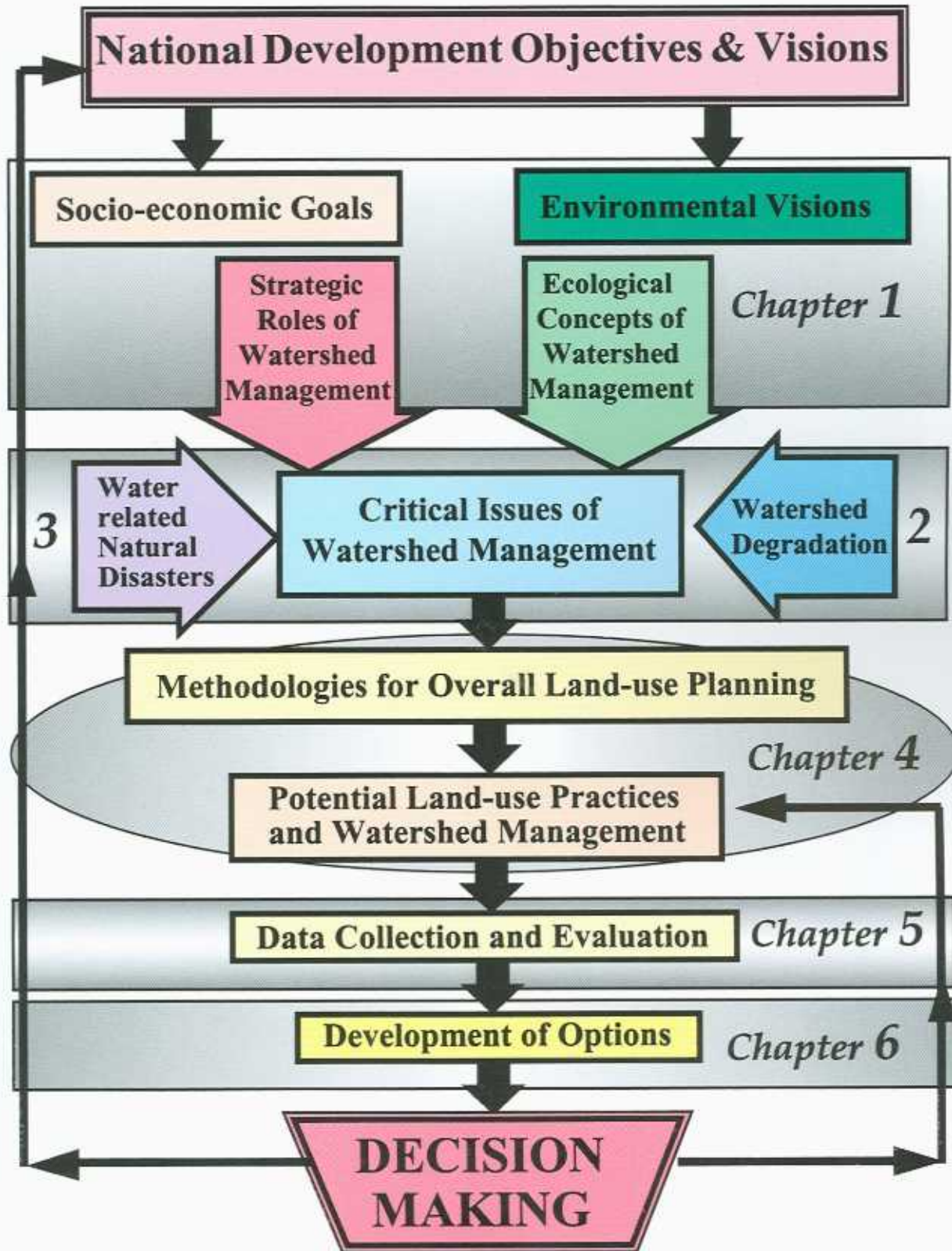




Photo 1: A typical model of integrated watershed development in the Republic of Korea



Photo 2: A recent flood in Cambodia

to ensure the effective achievement of development objectives and improved knowledge of the inter-related ecosystems. In essence, land-use planning should adopt both a proactive and a preventive approach towards integrated development objectives at all levels.

1. Land-use planning principles at the national scale

Past experience demonstrates that physical and socio-economic planning can no longer be undertaken independently, and attempts have been made to develop appropriate approaches for the integration of planning and resource management systems. Such approaches emphasize the introduction of spatial components into national strategies and policies, the integration of resource and environmental management activities, the inclusion of human/spiritual development, and ready access to decision-support information. These components are all in the processes of development planning at all levels of government administration.

Such approaches to land-use planning at the national level need to be based upon the following sets of principles:

- (a) Principles for the planning process;
- (b) Principles for the planning role;
- (c) Principles for planning integration.

The planning process needs to observe the following principles:

- (a) Adopt a holistic approach;
- (b) Recognize man as the focus of development;
- (c) Plan for multi-dimensional activities;
- (d) Seek qualitative and quantitative changes;
- (e) Ensure equitable distribution and utilization of resources.

Land-use planning forms an overall framework for physical planning towards the achievement of balanced development. The principles for the planning role include the following:

- (a) Translate socio-economic and other policies into spatial and physical forms – to attain this strategy, all socio-economic policies have to be evaluated according to their spatial and physical implications;
- (b) Emphasize the importance of environmental quality in physical planning;
- (c) Provide facilities to ensure an equitable and higher standard of living for all;
- (d) Planning policies should take into consideration the latest developments in science and technology, which in turn can help towards achieving a higher quality of living.

The principles for the integration of land-use planning need to focus on two integrating links:

- (a) Integration between socio-economic development policies and physical planning – the interpretation of sectoral socio-economic policies in spatial form. This is achieved primarily through the preparation and implementation of various types of development plans at different levels of administration;
- (b) Integration between environment and physical planning – undertaken in a holistic and systematic manner, and incorporating the necessary instruments to plan for sustainable development. At the local level, efforts will be made to minimise adverse environmental effects arising from development.

THE MALAYSIAN EXPERIENCE¹

In the Malaysian context, a sustainable community is the fundamental objective of the Malaysian Vision 2020. To achieve Vision 2020, which is based upon the underlying premise of attaining balanced communities, a comprehensive and universal planning doctrine has been formulated. This "Total Planning Doctrine" is a guiding principle for development planning processes. The doctrine calls for the sustenance of three relationships – between man and his Creator, man and man, and man and his environment – in order to achieve balanced development, a prerequisite to achieving a sustainable community. The doctrine postulates that man is the focal point for development. As part of the planning processes, accurate and timely indicators for key policy variables, particularly performance indicators which measure conditions and changes in human settlements, are required. As such, steps are taken to develop land-use performance tools which will provide better understanding of the relationship between performance of the individual sector and broadened social and economic development outcomes. Identification of indicators for measuring sustainability of development plan is carried out at two levels. The first involves the identification of *land-use planning criteria for sustainable development*. In this respect, the goals of sustainable development are used, i.e. resource conservation, built-environment in harmony with natural environment, environmental quality and social equity. The second involves the identification of *land-use planning criteria for sustainable community*. To this end, *the principles of sustainable community* have been chosen, i.e. respect and care for community of life and quality of human life, conserve Earth's vitality and diversity, minimize depletion of non-renewable resources, keep development within Earth's carrying capacity and change personal attitudes and practices. Malaysia has also adopted an Integrated Planning and Resource Management approach which manifests the global need for sustainable development and places emphasis upon the integration between environmental and physical planning. This is further strengthened by the need for spiritual development and the availability of easy access to physical planning information. To ensure wide acceptance and full support from the public, Malaysia has been exercising a consultative process at all levels in order to get opinion from the public, based on the moderation approach, on all aspects before any decision is made. The success of realizing sustainable community is largely dependent on the extent of commitment from the public and the local government. Thus, people empowerment and decentralization of power to the local government are the major agendas being addressed in Malaysia.

¹ Extracted from "Planning Practices in Malaysia" prepared by Puan Hajjah Norasiah Bte Hj. Yahya, representative of the Federal Department of Town and Country Planning, Peninsular Malaysia for discussion at the Workshop on Guidelines and Manual on Land-use Planning and Practices in Watershed Management and Disaster Reduction, Bangkok, Thailand, 18-21 March 1997.

2. Land-use planning principles at the basin scale

The basin scale of land-use planning offers the most logical and effective approach to integrated resource management and natural disaster reduction. One of the most commonly accepted principles of the river basin approach to development planning and management is that the integrated utilization of land and water resources provides an effective means for the concurrent achievement of development objectives and ecosystem integrity. It does so by recognizing and considering not only physical and biological processes, but also the social context, all at the basin scale. The principles of land-use planning at this scale are governed by the integrity of the basin ecosystem, characterized by various physical and biological processes; the social, economic and environmental context of development in the basin; regional and national level objectives; and advances in planning and management technology. These principles need to be elaborated into development methodologies, strategies and policies and supported by a coordinated programme of data and information collection. Land-use planning at this level is regarded as the central theme of these guidelines, and is elaborated in more detail in Chapter IV.

THE EXPERIENCE OF THE REPUBLIC OF KOREA¹

In the Republic of Korea, the prediction of future socio-economic changes within the country has been found to be of major importance for watershed management planning. The development of a river basin usually takes several years. In rapidly developing countries like this one, the economic and social structures can change very rapidly and various new demands for watershed development can emerge whilst development projects are being implemented. The Republic of Korea has experienced many such changes including industrial structural change, migration of population from country to urban areas, sky-rocketing increases in labour costs and land value, run-off increases due to urbanization, and water quality degradation, all in a relatively short period. Those changes were too large and too rapid to be predictable at the planning stage or at the commencement of watershed development projects. The socio-economic changes strongly altered the expected impacts of the development projects. New development projects have had to be initiated upon the completion of previously planned projects in order to meet rapidly increasing demands for water resources and land development. Environmental conservation has come to be a more and more important aspect for consideration in the context of watershed management and water resources development in this country. Water quality in the watersheds is becoming degraded through various natural and man-made causes, whilst efforts to protect the watersheds through the application of appropriate practices have lagged behind the pace of development. The effective development and management of watersheds clearly needs to be based upon reasonable expectations of forthcoming socio-economic issues, including changing environmental concerns.

¹ Extracted from "The Comprehensive Keum River Basin Projects as a Case Study for Watershed Management and Disaster Reduction in the Republic of Korea" prepared by Huh, Yoo Man for discussion at the Workshop on Guidelines and Manual on Land-use Planning and Practices in Watershed Management and Disaster Reduction, Bangkok, Thailand, 18-21 March 1997.

3. Land-use planning principles at the local scale

At the local scale, successful implementation of land-use management options provides the driving force for integrated watershed management and sustainable development. The principles adopted for land-use planning at this level may include the following components:

- (a) Integrated utilization of natural resources;
- (b) Sustainable farming systems;
- (c) Interactive and pro-active community farming systems;
- (d) Community participation;
- (e) Conservation measures;
- (f) Development of models for sustainable land-use systems.

A sustainable farming system needs to focus on the social conditions, especially poverty alleviation, and may include the following components:

- (a) Food component;
- (b) Fodder component;
- (c) Fuel component;
- (d) Income generation component (which is supported by house-hold production systems.)

The interrelationships and interlinkages among the components of the farming system need to be analysed and treated in a holistic manner. These components will be discussed in more detail in subsequent chapters as important elements of sound and integrated watershed management

THE INDIAN EXPERIENCE

Guidelines for watershed management developed by the Ministry of Rural Development of India stipulated the following purposes of watershed management:

- (a) To promote the economic development of the village community which is directly or indirectly dependent on the watershed through: (a) optimum utilization of the watershed's natural resource such as land, water, vegetation, etc. that will mitigate the adverse effects of drought and prevent further ecological degradation, and (b) employment generation and development of the human and other economic resources of the village in order to promote savings and other income-generation activities.
- (b) To encourage restoration of ecological balance in the village through (a) sustained community action for the operation and maintenance of assets created and further development of the potential of the natural resources in the watershed, and (b) simple, easy and affordable technological solutions and institutional arrangements that make use of, and build upon, local technical knowledge and available materials.
- (c) To place special emphasis on improving the economic and social condition of the resource-poor and disadvantaged sections of the Watershed Community, such as the assetless and the women, through (a) more equitable distribution of the benefits of land and water resources development, and the consequent biomass production, and (b) greater access to income generating opportunities and focus on human resource development.

It was also expected that each Watershed Development Project would achieve the following results by the end of the project period:

- (a) The completion, with the active participation and contribution of the user groups, of all the works/activities that are planned for the treatment and development of the drainage lines, arable and non-arable lands in the watershed area.
- (b) The taking over by the user groups of the operation and maintenance of the assets created, and the making of suitable administrative and financial arrangements for their maintenance and further development.
- (c) All the members of the Watershed Development Committee, and staff such as Watershed Secretary and Volunteers, to have been given orientation and training to improve their knowledge and upgrade technical/management and community organizational skills, to a level appropriate for the successful discharge of their responsibilities on withdrawal of the Watershed Development Team from the Project.
- (d) The village community to have been organized into several homogeneous groups for savings and other income generation activities which achieve sufficient commitment from their members and built up sufficient financial resources to be self-sustaining.