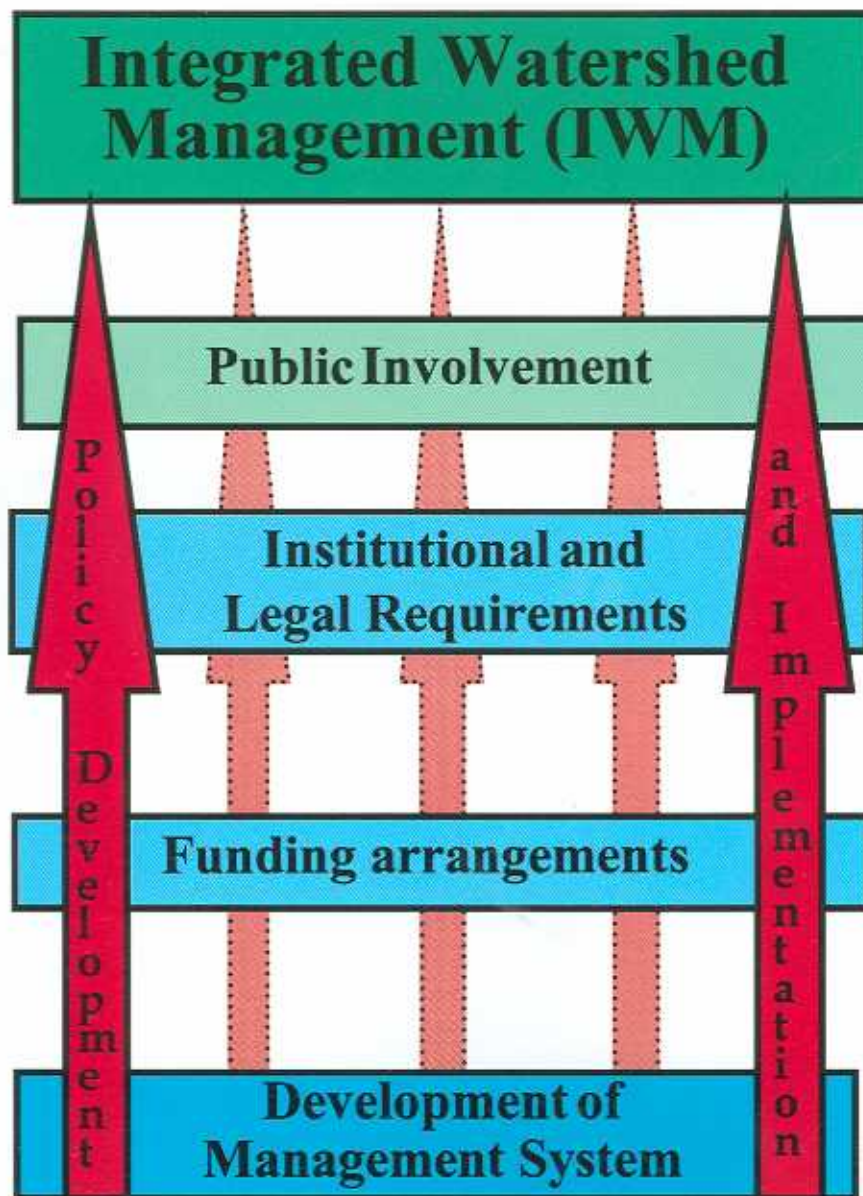


FIGURE 3. A STRATEGIC APPROACH TO INTEGRATED WATERSHED MANAGEMENT



- ensure that native flora and fauna are protected
- promote appropriate planning and management
- preserve items and places having cultural heritage values

Integrated watershed management can be the most effective approach in mitigating the effects of natural disasters by adopting the best management practices to balance the competing and compatible uses of a watershed's natural resources to meet social, economic, environmental and other community goals. It should be stressed that when the risk of natural resources disasters is not fully appreciated the loss of life and damage to property can be dramatically increased

B. A strategic approach

Land-use planning and management are important government functions. When governments fail to exercise effective controls in this and related fields, the natural environment, the community and

the national economy may all become casualties. On the other hand, when good planning and management practices are adopted, many existing or potential problems are automatically overcome or avoided. A strategic approach, including effective governmental arrangements which address resource management and environmental protection issues and utilize enlightened watershed management principles, is considered to be the key to achieving an efficient and acceptable administrative system (see figure 3).

Appropriate legislative and institutional arrangements are also necessary to ensure a satisfactory level of environmental protection, social well-being and sustainable resource development.

In some countries, governmental approaches to land-use planning, environmental protection and natural resource management are under ongoing development. In the past, resource management, planning and environmental law has tended to evolve in a somewhat *ad hoc* and reactive fashion. Throughout the ESCAP region, however, much of the existing legislation is currently being redrafted or refined, with the objectives of reducing complexity, overcoming delays and eliminating conflicts and confusion in relation to resource and environmental management. Some of the existing deficiencies, expected to be remedied through recent and current legislative and institutional developments, include:

- (a) Adverse trends in natural resource degradation and depletion;
- (b) A low level of strategic and policy commitment to natural resource management, with inadequate financial, legislative or operational support;
- (c) Uncoordinated and conflicting approaches from various government agencies,
- (d) Lack of uniformity or consistency in policies, legislation and strategies amongst different tiers of government;
- (e) Inappropriate and inconsistent administrative structures and boundaries;
- (f) Low levels of policing and enforcement of controls, conditions and regulations;
- (g) Low levels of community involvement in resource management activities.

The requirements of an improved administrative system capable of meeting the challenges of protecting the environment, integrating economic and land-use planning and management and encouraging sustainable resource management include the following needs:

- (a) A comprehensive and strongly coordinated legal and administrative system which addresses planning, environmental protection and resource management in an integrated fashion;
- (b) Consolidated legislation based on the principles of sustainable resource management, protection of the environment and the maintenance of vital ecosystem processes;
- (c) A land and resource management system based on watershed or river basin units and utilizing standardized regional planning policies and processes;
- (d) Clearly defined responsibilities for each tier of government;
- (e) Consolidation of existing legislation into a manageable number of concise but comprehensive Acts.

In some countries, recent developments in this respect have led to the consolidation of several government agencies into a single, comprehensive agency and the consolidation of existing legislation into a single omnibus Act. Within the ESCAP region, New Zealand provides an outstanding example of this approach, which is worthy of investigation. In larger and more diverse countries, particularly

in large Federations where several states have resource and environmental management responsibilities, this might not be an appropriate solution. The important emphasis should be on coordination and cooperation between agencies, integration of management activity and responsibility, and the taking of a holistic view of resource and environmental management issues, rather than upon amalgamation and unification

If the needs listed above can all be met, a basic framework is provided for the planning and implementation of new and existing plans, policies and strategies for the efficient and effective management of land and water resources. Such a management system focuses upon the effects and consequences of development, rather than upon development itself. To be effective, this management system must provide for the meaningful involvement of the watershed community, as well as, and in strong coordination with, all tiers of government.

C. Development of a management system

Watersheds are naturally occurring units of the landscape, containing a complex array of inter-linked and inter-dependent resources and activities which are not determined by political boundaries. They form a dynamic and integrated bio-physical, economic, social, environmental and political system containing people, agriculture, industry, communications, services and recreational facilities. The land resources of soil, water and vegetation cannot be managed in isolation from each other. The natural balance of resources in a watershed can be easily disrupted by changes in land use, by mismanagement or through bad planning.

Integrated watershed management recognizes that the natural resources and the environment of a watershed can only be successfully preserved and protected by integrating and managing the available natural resources. The broad objective is to develop policies which promote the sustainable use of natural resources and take into consideration the economic, social and environmental issues of the watershed.

Successful implementation of the integrated watershed management (IWM) concept requires coordinated action by the various government authorities that are involved in land and water management. This is because no single authority can have the experience, expertise and legislative powers to be solely responsible for the overall management of natural resources. In addition, it is essential that the community and individual landholders play a major role in IWM because their actions and farming practices will, to a large extent, influence the outcome of the approach.

IWM strategies should address the use and management of land within the watershed so that degradation of the land, and of the environment in general, is avoided. This form of planning is directed towards coordinating and controlling land-use change and development in order to minimize impacts which may be harmful to the environment. At the same time, it should aim to maximize the benefits of development to individuals and the community. The desirable objectives of this management system (see figure 4) can be summed up as follows:

- (a) Encouraging proper management of the country's resources, which include natural areas, forests, minerals, agricultural and urban lands, water and other resources;
- (b) Promoting the social and economic welfare of the community;
- (c) Sharing the responsibility for environmental planning between all levels of government; and
- (d) Providing opportunities for community involvement in planning.

If adverse environmental effects are to be minimized, the system should allow for:

- (a) Environmental factors to be considered before a decision on development is made;

FIGURE 4. OBJECTIVES OF AN INTEGRATED WATERSHED MANAGEMENT SYSTEM

- ❖ Encourage proper management of the country's resources, which include natural areas, forests, minerals, agricultural and urban lands, water and other resources
- ❖ Promote the social and economic welfare of the community
- ❖ Share the responsibility for environmental planning between all levels of government
- ❖ Provide opportunities for community involvement in planning

- (b) Public participation in the planning process, so that members of the community can have an input to planning decisions.

The management system is concerned with providing conditions or guidelines in those areas where there are potential impacts on the land resources, in order to minimize these impacts and maintain the long-term integrity and productivity of the resources. The concept of IWM may be incorporated into a series of land-use plans. These plans should detail the physical resources of a catchment and the environmental impacts, such as loss of productivity, degradation of land, reduction of water quality, etc. should uncontrolled development proceed. These plans may contain conditions on policies to be applied to developments to ensure that adverse impacts are minimized.

The preparation of IWM strategies may involve two principal elements: an inventory of physical resources and a series of interpretive maps of combinations of resources. These strategies will provide a basis for planning purposes and environmental evaluations. In particular, the IWM strategies will provide (see figure 5):

- (a) Land resource data;
- (b) Conditions to be attached to the use of land;
- (c) Proposed strategies and priorities for development;
- (d) Coordination between organizations which have responsibilities for land management in a particular area.

FIGURE 5. CORE FUNCTIONS OF AN INTEGRATED WATERSHED MANAGEMENT SYSTEM

- Inventory of land resource data
- Determination of specification for the establishment of conditions attached to the use of the land
- Development of strategies and priorities
- Coordination between organizations

These strategies should incorporate the basic components detailed below.

1. Land resource data

The resource inventory and interpretive maps should identify

- (a) Locations and descriptions of land features, e.g. topography, soils etc;
- (b) Specific constraints to land use e.g. flooding, unstable land etc;
- (c) Specific resource features e.g. water supply catchments, prime agricultural lands, open-cut mines, etc;
- (d) Areas of land degradation, e.g. erosion, mass movement, salinity, soil acidity etc;
- (e) Land-use capability and/or suitability classifications;
- (f) Cumulative impacts of development on land and water characteristics;
- (g) Recommended levels of optimum use of land to maintain long-term productivity and stability;
- (h) Areas requiring special land rehabilitation land management techniques to minimize damage to the environment and maintain productivity within the watershed.

2. Conditions attached to the use of the land

IWM strategies can be used to determine conditions for the use of land. These conditions may be in one of two forms:

- specifications for the maximum intensity of the use of land
- specifications for development standards should land be used for different purposes

The first set of conditions is designed to ensure that the intensity of land use does not exceed specified levels because of harmful effects on the environment. For example, tree-clearing densities may be recommended for lands with potential instability to prevent mass movement by slump or earthflow failure. Agricultural industries such as piggeries, which may cause pollution by effluent disposal, may need to be regulated in number to ensure that water quality levels do not fall below acceptable standards.

Under the second set of conditions, development standards would be recommended for land-use proposals to ensure that environmental standards were maintained. This might include the development of standards for the control of soil erosion or polluted run-off.

3. Development of strategies and priorities

IWM strategies provide an overview of the watershed. This overview, in the form of a land resource inventory and a series of interpretive maps, is a basis for land-use planning. These strategies take an holistic view of the natural environment. Their use to assess the quantity and availability of a particular resource, or to determine the cumulative impacts of different types of development, or to identify the extent of some problem, enables strategies and priorities to be set by land users as part of their planning. They can be used to develop preferred strategies for the allocation or use of a resource or the resolution of a problem. Options can be developed from the available information to achieve an acceptable mix of land uses, while achieving social and economic objectives.

4. Coordination between organizations

The formulation of any strategies is a time-consuming task which involves the coordination of Government agencies to ensure that their activities and advice are complementary and work towards the achievement of the aims of the strategy. Individual agencies are usually responsible only for a single aspect of a resource in a watershed. When decisions are made in an *ad hoc* manner, what may be beneficial to the areas of responsibility of the agency can sometimes conflict with the interests of another agency.

IWM strategies can be an effective means of reducing the impact of some natural disasters. In this regard land-use planning and management form some of the non-structural measures to mitigate such disasters.

Land which is prone to such hazards as flooding, landslide, landslip etc. can be withdrawn from use or limited to those purposes which are least threatening. For example, floodplains can be used for flood-compatible purposes or slopes which are prone to landslide can be left undeveloped.

Land-use planning and the adoption and employment of building codes are among the most effective measures for minimizing damages when natural disasters occur.

One strategy for mitigating small floods is to retard run-off in upland areas. This can be accomplished in a number of ways. In rural areas, the measures usually adopted are associated with such conservation practices as terracing, contouring, strip cropping, planting cover crops or using farm ponds. In urban areas, run-off can be retarded by on-site detention facilities. The implementation of such strategies requires the cooperative involvement of land management agencies, departments of agriculture, and rural or urban local government authorities.

In many parts of the ESCAP region land degradation can be attributed, at least indirectly, to the inadequacy of various forms of land ownership and land tenure. In particular, insecurity of land tenure often leads to over-exploitation of the land, encouraging its use at an intensity beyond its physical capacity and leading to productivity decline, soil erosion or various other forms of soil degradation.

In many of the member countries of the region, the average size of land holdings can be as small as two hectares. Rapidly growing populations, increasing demands for food production and the scarcity of additional virgin lands all combine to exert increasing pressure upon these small farming plots.

Forms of land tenure which can lead to the encouragement of land exploitation and degradation include communal ownership, short-term cultivation rights, share-cropping, shifting cultivation and absentee ownership.

The existence of such forms of ownership or tenure may pose serious problems for the successful implementation of watershed management strategies aimed at controlling land degradation and promoting sustainable land use. Unless landholders are provided with permanent land ownership rights, and perceive the long-term stability and productivity of the land they utilize to be in their own long-term interest, they will find it difficult to accept a commitment to watershed management or restoration programmes.

Careful evaluation of existing land tenure provisions, and the development where appropriate of more effective land ownership arrangements, must therefore be recognized as an important component of any new approaches to land-use policy and practice, particularly where this is to be implemented in an integrated watershed management context.

D. Funding arrangements

Under the concept of integrated watershed management, the different tiers of government can formulate national and regional policies in relation to the control of land and water use, the destruction of natural vegetation, environmental degradation, and similar aspects of land resource management activity. Appropriate legislation can be enacted to delineate the powers and responsibilities through which governments can promote the sustainable management of natural resources. This involvement may include direct management, management oversight, monitoring, the setting of standards, the setting of policy, the imposition of penalties, the prohibition of adverse management practices, and the enforcement of powers of intervention. It also empowers governments to take action to mitigate, prevent or require the rehabilitation of land and water resource degradation.

In addition to the regulatory devices outlined above, there are many ways in which governments can utilize economic tools to achieve their resource and environmental management objectives. These tools work by providing economic assistance and economic incentives for improved resource management activity, rather than by imposing regulatory controls and penalties. The instruments available for this purpose include:

- (a) Tax policies which allow the deductibility of expenses incurred in the rehabilitation of land degradation, such as soil erosion, decline of soil fertility and structure, loss of natural vegetation, salinization or silt and debris accumulation;
- (b) Low-interest loans offered to encourage the restoration of degraded land and the protection of production potential through the implementation of soil conservation measures, salinity control measures, tree planting etc.;
- (c) Direct government grants to organizations involved in the restoration of degraded land and water resources, which might include State, regional and local government agencies, landholder groups, conservation organizations etc. Different kinds of cost-sharing arrangement might be used, depending upon the nature of the project, which could range from full funding to cost supplementation and equivalent in-kind contributions.

The availability of appropriate funding is usually the principal constraint to the achievement of a satisfactory level of watershed rehabilitation.

With few exceptions, the different tiers of government in the ESCAP countries provide funds for rehabilitation, made in the form of grants, to support the implementation of integrated watershed management programmes. These grants are made for such purposes as re-forestation, soil conservation, water conservation and pasture improvement.

Funds allocated for these activities may be obtained by central governments from a variety of sources. These include:

- (a) Income derived from normal budgetary functions, such as taxes, tariff, etc;
- (b) Grants from donor countries or international organizations, made for the support of specific integrated watershed management projects;
- (c) Loans from international funding institutions

Depending upon the area of responsibility each tier of government occupies with respect to natural resources management, such funds may be allocated directly to the central government agencies or channelled through the appropriate State or provincial government for allocation to its agencies. In some countries, rural communities participating in watershed management projects may also contribute funds towards the maintenance of works associated with these projects.

In some cases, limited funding has been forthcoming from the private sector for the support of individual projects, particularly where these have involved sustainable forest plantation activities.

Where funding is limited, as is usually the case, and alternative projects have to be considered for possible support, economic efficiency criteria based on conventional benefit/cost analysis procedures are generally applied to determine whether a given project is economically justifiable. Such analysis might also be used to establish the need for the project, to provide guidance for project formulation, to assess the relative economic merits of alternative measures for meeting the project objectives, or to choose between competing projects.

Where the rehabilitation of degraded land is involved, benefits can be assessed either by estimating the loss in agricultural production income incurred by the degradation, estimating the potential increase in such income if the project were to be undertaken, or estimating the improvement in property value to be expected once the restoration project has been undertaken. The net benefit can be assessed as the difference between the estimated benefit and the estimated cost of the rehabilitation project. Alternatively, the benefit/cost ratio might be calculated. Where alternative methods of rehabilitation are being examined, or where several alternative projects are to be funded from a limited total pool of funds, the alternatives or projects showing the highest net benefit or the highest benefit/cost ratio should be supported. It should be noted, however, that in cases of severe land degradation it might become government policy to provide financial assistance for projects which are not economically efficient, showing negative net benefits or a benefit/cost ratio less than unity.

E. Institutional and legal requirements

The effectiveness of land-use planning and management in the ESCAP countries depends, to some extent, on the system of government and the strength of existing legislation available to each country to control environmental degradation. Those countries which operate under a system of a strong national government usually are more efficient in controlling land-use planning and management than those which operate under a dual system of national and State/provincial governments. In the latter case where the State/provincial governments assume responsibility under the constitution, there is a tendency for the legislative and institutional arrangements for land-use planning and management to be disparate and fragmented among the various states/provinces. Such fragmentation can culminate in a diverse set of legislative provisions. This situation is unlikely to promote the most efficient system for land, water and vegetation conservation. Even in those countries where the constitutional power for land use is vested in the national government the existing legislation is often ineffective in controlling watershed degradation problems. To be fully effective it is necessary to invest the central government with the powers and responsibility for land management which are enshrined in comprehensive legislation. This legislation should encompass the following objectives:

- (a) The adoption of a single and comprehensive legal and administrative system which adequately addresses land-use planning and management from the viewpoint of sustainable development;
- (b) The empowerment of the central government to direct the development and management of land resources, formulate national policy, set standards, monitor progress, use economic instruments and intervene in land management matters to ensure that the land resources are being managed efficiently;
- (c) The promotion of a system of land management which is based on the principle of watershed boundaries.

In association with the enactment of suitable legislation, an integrated approach to institutional arrangements and administration needs to be adopted. The fragmentation and lack of clarity in responsibilities of the various government agencies involved in land management leads to ineffectual

land-use practices. In many cases there is uncertainty in the role of agencies, their responsibilities and ability to treat problems in a comprehensive manner. An integrated approach would best be achieved by conferring the responsibility for the overall coordination of legal, administrative and financial matters in one leading authority. This authority should review the operating philosophies, roles and functions of the agencies involved in land management and coordinate their activities into a system of effective watershed management.

Legislation in the form of land-use regulation and codes can control the disturbance of forest cover by prohibiting the erection of buildings, clearing, cultivation and burning. Land-use regulations have proved to be successful in preventing flood damages through land-use zoning which directs development away from hazardous areas.

F. Public involvement

The loss of agricultural productivity through land degradation is an issue of major concern in the ESCAP region. Because most of the highly productive arable land of the region is effectively utilized, agricultural expansion has moved into marginal lands. If this land resource is to be utilized in a sustainable fashion, agricultural practices must be accompanied by appropriate soil conservation measures. However, many of the current cultivation practices are unsustainable and are responsible for valuable agricultural land going out of production. Consequently, land owners need to be educated in the practice of sustainable management.

It needs to be stressed that land degradation is not solely an environmental issue and any measures which address it purely as an environmental issue are doomed to failure. This has been the cause of many expensive failures in erosion control and watershed management the world over.

Land degradation is often merely the symptom of underlying socio-political problems. The nature of land tenure, lack of services and agricultural extension all contribute to the land degradation problem.

The primary responsibility for soil degradation should be vested in a government agency which has defined management responsibility for soil conservation. This organization should be in a position to foster the implementation of the most technically appropriate methods to arrest land degradation.

It is the government structure which bears primary responsibility for addressing these concerns, either directly through policies and programmes or indirectly by guiding and facilitating the work of other agencies. Government will need to assume a positive role as a facilitator, coordinator and integrator of local initiative and involvement rather than acting as a prescriber and controller.

It is widely appreciated that many subsistence farmers will overwork and exploit the soil resource for short-term gain. If land degradation is to be averted then it is necessary to establish an atmosphere of cooperation and requires the endorsement of government, community organizations and individual land users. To develop mechanisms to minimize adverse landscape impact it is necessary to develop sets of guidelines for the implementation of IWM strategies. This can be achieved through the establishment of a committee with representatives from the major land-use and planning arms of government and representatives from the community. The role of this committee should be to develop IWM strategies for the relevant watersheds. These strategies would form the basis of a comprehensive plan which would lay the foundation for solving watershed land degradation problems and minimizing adverse impacts on the watershed environment.

IWM has the capability to encourage cooperation and liaison between all tiers of government and the landholders of an individual catchment. It should reduce the threat of conflicts in land-use practice, pave the way for ensuring sustainable resource development and minimize environmental damage.

Community responsibility involves all those people, organizations and authorities who have an interest in using the resources of an area of land, including individual farmers. Improvement of the landscape in the long term must involve an integration of agricultural land use with other land uses. This in turn can only be achieved by detailed planning, based on an assessment of the land's capability to support various activities, including agriculture, and a cooperative approach to land management. Under this process, dialogue is encouraged between all the parties who have a stake in watershed management and who can contribute to gaining a common understanding of how the resource should best be managed within the bounds of the principles of sustainable resource management.

G. Human resource development

Because rural populations rely very heavily for their daily living needs upon the natural resources of the watersheds in which they live – such as water, soil, forests and pastures – it is necessary to manage both the natural resources and the human resources which depend upon them in a coordinated way, in order to ensure that the people utilize their land resources in a sustainable manner.

Land degradation occurs on many of the watersheds within the ESCAP region. This has largely been the consequence of mismanagement or exploitative utilization of the watershed resources, which has included such activities as deforestation of steep slopes, cultivation of land without taking appropriate measures for soil and water conservation, or the destruction of vegetative cover through overgrazing.

In many parts of the region this degradation is accelerating, a problem which is aggravated by the already degraded condition of many watersheds, the limited scope for expansion of the available areas of arable land, and the restricted opportunities for further development of irrigated agriculture. Because of this, there is a pressing need for the development and application of improved technology for the stabilization and improvement of the productivity of degraded watersheds. This requires that traditional farming practices be assessed and upgraded where necessary to ensure that watersheds are managed in a sustainable manner.

Scientific research is therefore necessary, particularly at the watershed scale, to develop ways and means for overcoming the many adverse effects associated with many traditional farming practices, which are aggravated by a lack of data about land capability, soil productivity, soil and water conservation techniques and sustainable farming practices. Such research should be directed particularly towards the enhancement of the sustainability and productivity of the land and water resources of the watershed. This will require the development of programmes to assess the best combinations of cropping patterns, crop varieties, soil conservation measures and fertilizer application needed to obtain optimal productivity on a sustained, long-term basis, in such a way as to maintain soil fertility and soil loss or degradation within acceptable limits. Related research topics might include techniques for re-forestation and techniques for increasing stock carrying capacities through such means as increased fodder production and improved methods of fodder storage. It is vitally important that the results of such research be easily communicable, socially acceptable and economically feasible to the watershed community. It is also important that the application of such research yields visible and measurable improvements in watershed productivity and rehabilitation within a reasonable time span.

The education and training of farmers and other resource users are essential components of the application of the integrated watershed management approach. If there is inadequate or incomplete participation by the watershed landholders in any management programme, the effectiveness of that programme will be significantly diminished. It is important that the entire watershed community be fully involved in the programme.

There are various ways in which the education and training of land users can be accomplished. Demonstration farms can be established within the watershed to show landholders how to accomplish rehabilitation and increase productivity and income without further degrading the land or damaging the

watershed environment. Specific training in watershed management and conservation farming techniques can be achieved through the provision of adequate extension services, which should be available as appropriate in relation to agriculture, soil and water conservation, forestry and revegetation, animal husbandry and ecosystem care. In addition, general education of the farming community with regard to soil and water conservation techniques and land care can be assisted through such means as the dissemination of information via pamphlets, handbooks, and audio-visual outlets such as radio and television.

H. Policy development and implementation

The broad objective of ecologically sustainable development recognizes the need for the improved management of natural resources, in order that they can support responsible development and economic and social uses on a sustained, long-term basis. To achieve this objective, it is necessary to devise and implement policies which are based on the underlying principle that the various tiers of government, landholders, resource users and the general community must all share the responsibility for resource management.

As has been explained in Section IV.A, the integrated watershed management framework has been specifically developed for this purpose. IWM forms the basis for the development of integrated natural resources management policies, particularly in relation to soils, vegetation, surface water and groundwater.

It is the primary responsibility of government to ensure that policies and policy instruments support the management of land and water resources in an ecologically sustainable manner. To fulfill this responsibility, governments should take the following actions:

- (a) Develop integrated goal-setting and policy formulation at the national, regional and local levels, taking proper account of environmental, social and economic issues;
- (b) Develop policies that encourage sustainable land use and sustainable management of soil, water, vegetation and fauna resources, having proper regard for the interests and requirements of the national, regional and local communities;
- (c) Review the regulatory framework, including laws, regulations and enforcement procedures, so that an efficient and effective system is available for the official management of natural resources;
- (d) Implement economic incentives to assist in the rehabilitation of degraded land and encourage the use of best practices for the sustainable development of natural resources;
- (e) Encourage the active participation of the local community in planning and implementing programmes of natural resource management.

Under the integrated watershed management framework, component national, state and/or regional policies should be developed for the integrated management of each of the major categories of natural resources. These should include a land-use policy, a soils policy, a vegetation policy, a surface water policy and a groundwater policy.

1. Objectives of land-use policies

The national/state land-use policy should have the following broad objectives:

- (a) To achieve greater coordination and integration in the management of land, through appropriate legislative, institutional and policy arrangements and the effective involvement and participation of the whole community;

- (b) To ensure that land is always used within its capability, and for its optimal suitability;
- (c) To ensure the continued stability and productivity of the land on a sustainable, long-term basis;
- (d) To manage land and land resources on an integrated, watershed system basis;
- (e) To identify land degradation and rectify this degradation through coordinated land use and management.

2. Objectives of surface-water management policies

The national/state surface water policy should have the following broad objectives:

- (a) To manage surface water resources in such a way as to sustain catchment yields and maintain the supply of appropriate and equitable quantities of water to all legitimate water users;
- (b) To manage surface water resources in such a way as to maintain and where appropriate improve water quality;
- (c) To ensure that river flows are of adequate quantity and quality to maintain aquatic and wetland habitats and ecosystems and ensure the quality of the riverine environment;
- (d) To manage surface water resources in conjunction with groundwater resources in a planned and coordinated fashion,
- (e) To manage surface water resources on a whole-watershed basis and to integrate water management with the management of related soil, vegetation and other land resources.

3. Objectives of groundwater management policies

The national/state groundwater policy should have the following broad objectives;

- (a) To maintain the productivity of groundwater resources and to ensure the long-term sustainability of both the quantity and the quality of these resources;
- (b) To ensure that the needs of environmental systems dependent upon groundwater resources are met;
- (c) To integrate the conjunctive management of surface and groundwater resources on a whole-catchment basis;
- (d) To integrate groundwater management with the wider environmental and resource management framework.

4. Objectives of soil-management policies

The state/national soils policy should have the following broad objectives:

- (a) To manage soils in such a way as to avoid their loss or degradation and ensure their continued utility, stability and productivity;
- (b) To prevent, mitigate and rectify soil erosion and degradation;
- (c) To undertake programmes of soil survey, land capability and land suitability evaluation in order to ensure that soils are used within their capability and for their optimal suitability;
- (d) To manage soils in an integrated fashion, in association with the management of vegetation, water and other land resources.

5. Objectives of vegetation-management policies

The state/national vegetation policy should have the following broad objectives;

- (a) To ensure that the national/regional coverage of trees and other vegetation is conserved, maintained and where appropriate enhanced in order to conserve soil and water resources and maintain environmental quality;
- (b) To maintain and improve silvicultural and agricultural productivity on a sustained, long-term basis,
- (c) To conserve native flora and fauna and their habitats;
- (d) To conserve the scenic and aesthetic qualities of the environment.

Under each of these broad resource management policy headings, a range of related and more detailed component policies might be developed. Under the umbrella of a surface water policy, for example, there might be more detailed component policies including a water quality policy, a wetlands policy, an estuarine management policy, a flood management policy, a drought management policy, a riparian zone policy and so on.

Implementation of the principles and strategies of integrated watershed management, in order both to maintain and improve the sustainability of watershed-based natural resources and to mitigate the severity of water-related natural disasters, requires close co-ordination between the government and the community and the active participation of landholders and other users of land resources. This requires the adoption of a management system which provides for representation of all the stakeholders in the cooperative management and rehabilitation of the catchment resource system.

There are several mechanisms by which this can be achieved. At the most basic level, it has been shown to be highly effective if governments encourage – and facilitate by financial incentives and the provision of technical aid and advisory services – the formation of locally-based community action groups.

Landcare groups, rivercare groups, and other kinds of watershed-based groups have been shown in some countries to be very effective in achieving direct landholder participation in rehabilitation and conservation activities and giving community members a sense of ownership of resource management problems and their solution. At the larger-scale, catchment or river basin level, various approaches to the involvement of the community and the coordination of community and government activity have been adopted.

In some countries, governments have established catchment or river basin management authorities of various kinds to plan and coordinate land and water resource management activity. To be effective, such organizations required to be adequately funded, either by government allocation or through an ability to levy rates or taxes on landholders and industry within their area of responsibility. They require a small number of their own professional staff and the ability to engage consultants and contractors or to utilize the assistance of state or local government agencies for investigation, design, planning, construction and maintenance activity. The management board of such an organization should have an adequate representation of locally-based community representatives and should preferably also be advised by a community advisory committee or council, widely representative of community interests within the watershed or catchment area. The board membership should also include appropriate representation from the various government resource management agencies responsible for land and water resource management in the area, as well as representatives of the local government agencies responsible for land management and development control in the area.

In other countries, governments have chosen to make land and water resources management at the watershed or river basin scale the responsibility of their own agencies. Under those circumstances, it is highly desirable to ensure community involvement and participation through the establishment of watershed-based coordinating committees or management committees. This approach has been adopted, for example, in some states of Australia. These committees, called catchment management committees, have the function of developing watershed or catchment management plans and coordinating the implementation of these plans. The membership of such a committee must include significant community, landholder and industry representation and representation of the relevant state and local government agencies responsible for land resource management. To be effective, they require strong financial and professional support from the responsible government agencies, including the secondment of appropriately qualified coordinating staff. It also is highly desirable that there be some statutory mechanism to ensure that the catchment management plans developed by such committees have legal standing and are capable of being imposed by the appropriate state or local government authority.

Whatever institutional arrangement is provided for achieving watershed management coordination, the following functions need to be fulfilled by the coordinating organization:

- (a) The provision of a coordinated approach to land and water resource management;
- (b) The establishment of effective coordination between government, land users, industry and the community at large;
- (c) The provision of a forum for the resolution of resource and environmental management conflicts;
- (d) The identification of watershed management issues and the development of strategies for addressing these issues;
- (e) The recognition of the relationships that exist between the components of the watershed system and identification of the impacts that resource development activities may have on all the components of the system;
- (f) The coordination and prioritization of appeals for government funding and the allocation of government funds to assist in the implementation of planned integrated watershed management strategies.

I. The regional experience

Because Bangladesh is a country consisting principally of alluvial floodplain lands, the management of water-related natural disasters has almost exclusively been directed towards the mitigation of floods and storm surges. Land degradation, soil erosion, loss of soil fertility and similar forms of environmental degradation are also matters of concern. The need for improved coordination of the activities of the agencies involved in the management of land, soil and water resources is currently being addressed. At the same time, active community participation in planning, development and management activities related to natural resources management is being encouraged. The preparation of a national water management plan, which incorporates a comprehensive land-use policy and is based on an integrated watershed management approach, is currently being addressed.

The Government of Cambodia has recently enacted legislation relating to environmental protection and the management of natural resources. The purposes of this legislation are to enhance environmental quality through the control and reduction of pollution and to ensure that the conservation, management, development and utilization of natural resources are undertaken on a sustainable basis. The new legislation also makes provision for public participation in the watershed management process. In addition, a Royal Decree on watershed demarcation and management was drafted, with objectives aimed at the management of soil erosion, landslides and sedimentation, the maintenance of biodiversity

and water quality and improved management of the natural environment. A national committee to supplement the Government's forest policy has been established under the chairmanship of the Prime Ministers and with membership including representation from the various ministries involved. The long-term objective of this committee is to manage forests effectively and efficiently and on a sustainable basis.

In 1986, the State Council of China established the State Bureau of Land Management as the principal authority responsible for the unification of land management throughout the country. Corresponding organizations were set up in the provinces, autonomous regions, municipalities, prefectures, cities and counties. The task of the Bureau is to guide and coordinate the protection, rehabilitation and development of land resources, activities which are undertaken by several agencies including the agriculture, forestry and water resources departments. The watershed has been adopted as the basic land-use planning unit. Also in 1986, the Government promulgated the Law of Land Management, which is the fundamental act governing the overall planning and management of land resources. In addition, a series of related laws pertaining to agriculture, forestry, grasslands, water and soil conservation and other natural resource management issues was enacted to unify the land management process. Public participation is also a fundamental requirement in China's approach to watershed management.

The prevention of land degradation and the regeneration of natural resources are major areas of concern for the Government of India. Based on the experience gained through the implementation of a number of model watershed development projects undertaken by various research organizations and universities, the development of the micro-watershed concept has become an integral component of the strategy for sustainable development in rural areas. Micro-watershed management practices involve the use of land treatment measures and farming systems which can be adapted by farmers to diversify their rainfed agricultural activities on small, intensively-farmed watersheds. This approach is employed to make the most effective use of rainfall and soil moisture and provide a measure of insurance against crop failure in low-rainfall districts. In addition, it seeks to reduce or control land degradation, being based on the premise that improvements in rainwater conservation will also yield improvements in soil conservation. This approach is employed on what are referred to as "micro-watersheds", which usually range in size from 500 to 5000 hectares. Watersheds as small as 50 hectares have however been also treated in this way.

Key features of the micro-watershed approach are that project preparation is undertaken in close consultation with the watershed community, is based on local farming experience, and is directed towards the solution of the basic problems faced by local farmers. Indeed, the success of such a project is gauged by the extent of participation by the local farmers involved in the scheme. Whilst schemes of this type rely largely upon improved rainwater conservation, achieved through means such as the improvement of drainage lines and the adoption of farming systems and cultivation techniques which increase rainfall interception and infiltration and are ecologically sustainable, other elements may be incorporated into the overall watershed management system. These might include, for example, improved animal husbandry, agro-forestry, horticulture, fish farming and sericulture. To ensure the successful implementation of such a scheme, it is essential that the participating farmers be adequately trained in techniques of low-cost, appropriate technology and the application of sustainable farming methods. This programme is implemented by the Ministry of Agriculture and Cooperation and the Ministry of Rural Areas and Employment. Guidelines have been separately formulated by both Ministries. They provide for public participation, a pattern of funding, institutional arrangements and the involvement of NGOs

In Indonesia, emphasis has been placed on the development of a watershed conservation programme. The objectives of this programme are to conserve natural resources and improve the productivity of the land. Four key activities have been identified, these involve soil and water conservation, land management, development of appropriate farming systems, and the development of

the necessary physical and social infrastructure. These activities have contributed significantly to the improved sustainability of natural resources and a reduction in the frequency and intensity of natural disasters. Many Government agencies and other institutions are involved in watershed management and disaster reduction in Indonesia. This fragmentation of responsibilities amongst sectoral and line agencies needs to be rationalized to improve the efficiency of integrated watershed management. Involvement of the people living in catchment areas is seen to be the key to the successful achievement of watershed protection. Public awareness campaigns and encouragement in the form of subsidies and rewards, as well as penalties, are used to motivate community participation in integrated watershed management.

The Lao People's Democratic Republic has formulated a range of laws, decrees and regulations, which have recently been proclaimed, in order to establish a new framework for the improved management of natural resources. These include new legislation for water, forest and land management. Ongoing efforts relating to natural resources management include the reformation of the land resources management system, the redistribution of land resources, and the strengthening of community participation in resource management, together with the zoning and demarcation of different land-use types according to national development goals and policies. A legal system and administrative framework has been established which provides for close coordination and awareness of responsibilities amongst the concerned agencies. This system will be supervised by a central coordinating council. In addition, it was proposed to create a national information centre for land and natural resources management.

Under the Federal Constitution of Malaysia, the management of land, water, soils and forests is a State responsibility. Federal legislation touching upon such matters cannot be enforced unless it is endorsed by State Governments. In order to achieve uniformity in such matters as land, water and forest management or environmental control, the Federal Government has established, or will be establishing, a series of national councils to deal with natural resources issues. Such a council would, with appropriate State participation, formulate and implement a National Master Action Plan in respect of each major natural resources management area, to be implemented in a comprehensive manner and on a watershed management basis. At the national level, Malaysia has adopted an integrated planning and resource management approach which recognizes the global need for sustainable development and recognizes the need to coordinate environmental and physical planning. To ensure wide acceptance and support from the public, Malaysia has developed a consultative programme which involves all levels of the community in the decision-making process.

Land-use objectives, policy measures, strategies and plans have been enunciated by the Government of Myanmar in its 1995 Forest Policy. The land-use management objectives have been designed to develop a system of balanced and complementary land uses. Under this system, land will only be used for purposes which optimize production and minimize degradation. It is proposed to phase out those practices which are incompatible with sound land-use management and cause environmental degradation. Shifting cultivation practices are to be discouraged and replaced by improved farming methods which improve productivity and increase the economic return to farmers. The Government intends to formulate a land-use plan, specifying permissible land uses, in order to guarantee catchment protection and nature conservation. This plan will ensure that appropriate land-use practices are employed and avoid irreparable environmental damage. To achieve these objectives and facilitate better coordination, a National Land-use Advisory Board will be established. Community participation is considered to be an essential element of the overall land-use management programme.

To ensure that the principles of sustainable development are put into effect, the Government of Nepal has placed emphasis on new policies, legislation and institutional arrangements. These are designed to avoid deterioration of the environment and degradation of watersheds, and seek to reduce the incidence of natural disasters. Although there are a number of existing laws and regulations relating

to land and environmental management, these are primarily oriented towards administrative formalities and procedures. The development of a comprehensive legal framework, and the coordination of the activities of the agencies concerned with environmental management, are issues yet to be addressed. It is the Government's objective to ensure the wise and effective use of available resources, to encourage community participation and to conduct a public education programme in order to achieve an efficient and effective land-use management system.

Although the Philippines has a comprehensive and well-prepared suite of legislation relating to watershed protection and preservation, the consequences of improper management, inadequate technical knowledge and other factors have been a failure to use the existing laws to full effect. The achievement of effective watershed management and rehabilitation has been a major thrust of the Government of the Philippines. The principal agencies involved in watershed rehabilitation are the Forest Management Bureau and the National Irrigation Administration. The activities of these agencies are supported by a number of NGOs. Community involvement in the management of watersheds is encouraged and coordinated through the Department of Environment and Natural Resources. The priority concerns of Government are the implementation of plans and programmes for the sustainable development of watersheds, with emphasis on the maintenance of biodiversity, the development of resources and the mitigation of water-related natural disasters.

In the Republic of Korea, national land development plans are prepared to comply with the National Economic Development plans. They are concerned with land resources development, water resources development and agricultural development. Development proposals put forward in these documents are planned and implemented by the relevant ministries and other levels of Government. Similar plans are also prepared by regional governments. The national regional development plans include targets for the reduction of natural disasters for river basins and water districts. In the Republic of Korea, integrated watershed management is an activity which is spread amongst a number of Ministries and their action agencies. The Central Civil Defence Committee has the responsibility at national level for the prevention of natural disasters, including water-related natural disasters. The Ministry of Agriculture is charged with the responsibility for organizing and coordinating the disaster management activities of the Government departments involved in disaster prevention in rural areas. This Ministry is also responsible for the development of agricultural land, whilst the Ministry of Construction and Traffic has the responsibility for urban land development.

The Government of the Republic of Korea has enacted a strong environmental law for the management of watersheds, including the control of water pollution. Community participation is given a strong role and receives considerable encouragement from Government in relation to integrated watershed development and management activities. Community involvement is particularly directed towards sound watershed development, improved production and cooperative activities in rural villages.

In Sri Lanka, at the present time there is no lead agency responsible for watershed management; the task is fragmented and management activities are spread amongst several agencies. The need for comprehensive planning of land use and development activities has been identified and is now being acted upon. A land-use Policy Planning Division has been established for the purpose of developing a national land-use policy and preparing sub-national level land-use plans. A national conservation strategy and forestry master plans are also being developed, along with a national water policy.

In Thailand, the responsibilities for land-use planning and watershed management are spread across several ministries. To achieve the goal of integrated watershed management, the Government has established the Office of the National Water Resources Committee. This organization will act as the central agency in policy making and the formulation of master plans for integrated natural resources management in each river basin.

The Government of Viet Nam has passed a number of laws relating to environmental protection, the development and protection of forests, and the development and management of land. A comprehensive law concerning water resources management is still in the drafting stages. The purpose of these laws is to achieve appropriate control and management of the natural resources of watersheds, in order to ensure that these resources are utilized on a sustainable basis. In this way, living standards can be upgraded and poverty can be alleviated. Community participation is encouraged in the protection and management of watersheds, as part of the process of ensuring that natural resources including land, water and vegetation are not degraded.