
recursos naturales e infraestructura

Water management at the
river basin level: challenges in
Latin America

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Abstract

Water management is akin to conflict management among human beings and between human beings and their environment. Water and river basin management systems are created to avoid, prevent or resolve such conflicts. Humankind needs to learn to live with these conflicts and deal with them adequately. All the more so since the relative scarcity of water will become ever more pressing as time goes on, as a result of economic growth, social demands and climate change. Competition between users will become ever more intense and ruthless, so that legislation and institutions to manage the system satisfactorily will become an absolute necessity. To implement processes of integrated water and river basin management it is necessary to form alliances or agreements with many actors who normally act independently by sector, and in areas defined according to administrative and political criteria which do not coincide with the limits of the river basins. It is often difficult to co-ordinate these actors in Latin American and Caribbean countries due to the existence of a vast informal sector of the population which neither complies with the legal norms nor responds to the economic instruments that are used in the countries more advanced in their organizations for water resources management and use.

River basin management and the creation and operation of organizations for water resources management at the river basin level is one of the central areas of work, both in terms of policy-oriented research and technical advisory activities, of the Natural Resources and Infrastructure Division. These technical advisory activities and policy-oriented research have resulted in many studies on various aspects of river basin management and the creation and operation of river basin organizations (see Annex 1), but most of them are available only in Spanish. The objective of this publication is to make a summary of this research available in English.

I. River basin management as a way to sustainable development

The sustainability of development remains an academic concept unless it is linked to clear objectives that must be attained in given territories and to the management processes needed to achieve this. Management of the natural resources located within the area of a river basin is a valuable option for guiding and co-ordinating processes of management for development in the light of environmental variables. In order to turn environmental policies into concrete actions it is necessary to have suitable management bodies, which are normally very complex. The establishment of such bodies means generating a mixed public and private system which should not only be financially independent, socially oriented and sensitive to environmental aspects, but must also act in a democratic and participative manner. In the past, the idea of establishing bodies to guide the management of the natural resources of a river basin (especially water, of course) has aroused the interest of the countries of Latin America and the Caribbean, with varying results. This interest has now become an urgent necessity, in view of the greater competition for multiple water use and the need to control water pollution and manage the environment correctly.

A. Sustainable development and river basins

“Sustainable development does not refer to a tangible and quantifiable goal to be achieved in a given period of time, but rather to the possibility of maintaining a balance between factors that explain a certain level of development among human beings, a level that is always transitory, evolving and, at least in theory, should always lead to an

improvement in the quality of human life” (Dourojeanni, 1996). Sustainable development is thus the result of a set of decisions and processes which have to be carried out by generations of human beings, under ever-changing conditions and usually insufficient information, subject to uncertainties and with goals which are not shared by a population that is showing a growing trend to individualism.

One of the biggest concerns at present, at least to judge from policy statements, is to find viable development options based on equitable and lasting economic growth. The latter consideration has gained in importance in recent years because of the realisation that many alleged advances, especially in terms of changing production patterns, have been outweighed by the damage they cause to the environment. The greater awareness and understanding that now exists of mankind's interaction with the environment, and the vulnerability of forms of development which do not take this into account, have been made more explicit by the addition to the word “development” of the qualifying adjective “sustainable”. Since sustainability should be implicit in the very concept of development, this adjective should be only a transitory addition that will be needed only until the vital importance that development should be of a lasting nature is definitively incorporated in the concept.

On the other hand, the sustainability of development remains only an academic idea or abstract aspiration unless the concept is linked both with clear objectives that must be attained within a given area that contains the natural elements and resources needed for the subsistence of the human race and with the management processes needed to achieve those objectives. Political intentions must be transformed into concrete policies for implementation, and it is here that the greatest challenges arise.

In the Latin American and Caribbean region, there has been widespread reference to environmental problems, theories have been put forward on environmental issues, laws have been enacted, and even some ministries of the environment have been set up. What has not been done, however, is to lay the necessary bases for the management of each of the natural resources –water, soil, forests, fauna, minerals and energy– or of certain key natural areas such as coastal zones, river basins and deserts.

This means that very broad goals have been set without deciding on the necessary steps for reaching them. Territorial organization for the management of each resource and later of the environment in general; organization and training of the population; research on ecosystems; the establishment of systems of management for given areas; the strengthening of public institutions (especially local governments) to provide support for environmental management; awareness and heightening of the economic value of natural resources; the keeping of natural heritage accounts, and the preparation of operating manuals and rules are essential aspects for making real progress in the management of natural resources and the environment in general.

The management of natural resources in the context of the dynamic evolution of a river basin, more generally known as river basin management, is one of the possible options for organising the participation of users of natural resources within the process of environmental management. A river basin is uniquely fitted to serve as the basis for the co-ordination of the actions of all those involved in the use of a shared resource –water– and for the evaluation of the effects of environmental management measures on that resource. Water quality largely reflects the environmental management capacity within the basin in question.

A first step towards river basin management is to limit action to the management of the water resources existing within the area of the basin. Water management is a complex process designed to control the cycle of a natural resource whose availability is erratic and irregular over time and space. Furthermore, water is vulnerable to the treatment it receives, since it can easily be polluted, thus affecting all its actual or potential subsequent uses. The aim of this process is to solve conflicts among multiple users who, whether they like it or not, depend on a shared resource. Consequently, even though they may have water use permits or rights, they nevertheless affect and depend on each other. The supply usually comes from a common system, to which surpluses and wastewater are returned. Surface,

ground and atmospheric water resources, together with the areas where water is diverted and returned, thus form a single unit.

The actions taken have enormous repercussions on human health, the environment and production, so that they must be approached in an outstandingly technical manner. The high cost of the works involved, together with the long lead times of water projects, make it all the more necessary that management should be in the hands of experts whose tenure does not depend on political changes.

Finally, the water management process requires that many different agents should act in a co-ordinated manner in spite of their differences of approach and the fact that some of them are not aware of the effects of their decisions on the hydrological cycle. This is why it is so important to have stable co-ordination mechanisms and, at the very least, a permanent river basin centre or authority.

B. Characteristics of water and river basins

A river basin is an area which is defined by nature itself, essentially by the limits of the run-off areas of surface water converging towards a single watercourse. The river basin, its natural resources and its inhabitants have physical, biological, economic, social and cultural qualities which endow them with their own special characteristics.

Physically, a river basin represents a natural area of collection and concentration of surface and ground water and therefore has an essentially volumetric and hydrological connotation. At the same time, both the river basin and, above all, the water collected in it represent a source of life for mankind, though it can also be a source of danger when extreme natural phenomena take place or it is affected by pollution.

In mountainous areas, watersheds are natural arteries for communications and trade integration, either along the rivers that run through them or along the ridges that separate them. In other words, there are close-knit mechanisms of interaction among their inhabitants which endow them with special economic and social conditions. In river basins with a big flow of water and wide, relatively flat valleys, the line of the river also becomes an area of interrelation of the inhabitants, especially through the use of the river for navigation, transport and communications.

The territory of the river basins facilitates relations among those who live in them, even though they may be grouped together in different communes or other politico-administrative subdivisions, because of their common dependence on a shared water system and road network, and because they face common dangers. When there are no systems for reconciling the interests of the various actors who depend on a river basin, there are bound to be conflicts among them. All this is particularly true in inhabited mountain watersheds, but it is also true in broad river basins where there are water use projects that benefit the inhabitants as a whole and thus create a sense of interdependence among them.

In river basins, it is all too easy to see the negative effects of human actions on the environment, especially in the form of water pollution. This is recognised, for example, in the explanation of the reasons for the establishment of river basin agencies in many countries: it is noted that water is an element which serves as the home and sustenance of the animal and vegetable kingdoms, and that watercourses or bodies of water and their banks form a very special biological whole. Thoughtless human actions affecting any one of their component elements upset this precarious balance, and the entire natural environment suffers as a result. Consequently, harmonious management of water resources requires:

- above all, recognition of the fact that a watershed or hydro-geological basin forms a single unit;
- awareness that recognising and preserving this unity is an essential condition for satisfying in the best possible manner the water demands of the different users;

- definition of specific objectives appropriate to each area or territory, and execution of the works and actions needed to attain such objectives; and
- acceptance of the idea that all users have a legitimate right to water and that, consequently, each of them is also subject to corresponding even-handed limitations on their own water use.

A river basin is a natural unit which lends itself well as an administrative area for the co-ordination of management processes designed to ensure sustainable development. Water management processes, however, involve their own forms of complexity.

C. The river basin as a territorial option for directing environmental management processes

The territory covered by a river basin is not, of course, the only area within which development actions can be directed and co-ordinated in order to take account of environmental considerations. The limits of the surface waters which form the river basin do not necessarily coincide with those of the ground water, obviously do not cover the areas of the seas and oceans where much of the hydrological cycle is generated, and are not so relevant in relatively flat areas or extremely arid regions.

The use of the territory of a river basin for environmental management purposes is therefore merely one option, whose validity will depend on the geographical characteristics of the environment. It is an important option from the environmental standpoint because, as already noted, it furthers co-ordination among the users of a single shared resource, such as water, and above all facilitates monitoring of progress in water pollution control, through its effects on water quality. This does not mean, however, that the territory of a river basin is the only space needed for management of natural resources or the environment in general.

This observation is important for doing away with the mistaken belief held by some persons that the entire development of a region or its environmental management can be carried out solely on the basis of limits corresponding with those of river basins. It could be said that taking account of the limits of river basins is a necessary condition for incorporating environmental aspects, especially those relating to water and its “associated” resources, but it is not sufficient as an area of jurisdiction for managing human development.

In this sense, it is vital that all management projects at the river basin level should be carried out with due regard to their relations with management systems that operate on the basis of other limits, especially political and administrative ones, among which local governments are of prime importance. It must be clearly understood that in order to carry out river basin management processes successfully it is essential to co-ordinate the actions of the various public and private authorities operating in the area of the basin. Thus, river basin management projects which take account of local governments, have a much greater chance of success if the local government authorities are responsible for the execution of some actions in the project. Likewise, a local government programme to improve the environment or prevent negative effects on it must also take into account the influence of river basins partly or wholly corresponding to its area of jurisdiction.

At the level of larger river basins, the same relationship should exist between the authorities of areas with political and administrative limits and those of areas with natural limits. Thus, for example, those in charge of a project for the development or integrated management of a major river basin should co-ordinate their activities with the authorities responsible for the development of the broader region in which the river basin is located. There have been many cases in which the lack of such co-ordination has resulted in one of the two authorities (i.e., the river basin or regional authority) absorbing the other, or else there has been a situation of permanent conflict between the two.

II. Definitions and scope of management processes at the river basin level

A. Classification of approaches to river basin management

Management at the river basin level has made a great deal of progress in the region, but despite these advances there is still no consensus on definitions that spell out the objectives of that management. The lack of conceptual clarity on the subject impairs the exchange of ideas and experiences, particularly between professionals of different countries, causes overlapping of functions and hinders the formulation of policies and laws on the subject.

Inconsistencies in the use and meaning of many of the terms relating to river basin management suggest the convenience of defining and classifying such concepts. Table 1 summarises and classifies concepts related to river basin management in Latin America and the Caribbean. A matrix format is used to set out the stages of the management process as they relate to the objectives defined by the elements and resources covered by the management. This lay-out was chosen to enhance understanding of the actions that may be co-ordinated in a river basin, and the purpose of such co-ordination. Moreover, it was considered useful to clarify other complexities arising from differences in terminology between English and Spanish; hence the decision to include entries in both languages; it is hoped that understanding of the Spanish term may be enhanced by a comparison with the original concept.

The table sets out two groups of factors, indicating the terminology used for each case:

- The stages in a river basin management process (1, 2 and 3):
 - **Preliminary stage (1):** studies, formulation of plans and projects.
 - **Intermediate (2):** the investment stage for river basin development with a view to the use and management of its natural resources for purposes of economic and social development. This stage corresponds to the notion of “development” as in “river basin development”, “water resources development” (the corresponding term in Spanish being “desarrollo de cuencas” or “desarrollo de recursos hídricos” or “desarrollos de recursos hidráulicos”).

Table 1

MANAGEMENT AT THE RIVER BASIN LEVEL: STAGES AND OBJECTIVES

Management stages	River basin management objectives		
	Integrated use and management	Use and management of all natural resources	Water resources management (integrated or sectoral)
	(a)	(b)	(c)
(1) Preliminary stage	Studies, plans and projects (“ordenamiento de cuencas”)		
(2) Intermediate stage (investment)	River Basin Development (“desarrollo integrado de cuencas” or “desarrollo regional”)	Natural Resources Development (“desarrollo” or “aprovechamiento de recursos naturales”)	Water Resources Development (“desarrollo” or “aprovechamiento de recursos hídricos”)
(3) Permanent stage (operation, maintenance, management and conservation)	Environmental Management (“gestión ambiental”)	Natural Resources Management (“gestión” or “manejo de recursos naturales”)	Water Resources Management (“gestión” or “administración del agua”)
		“Watershed Management” (“manejo” or “ordenación de cuencas”)	

Source: Axel Dourojeanni (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, Economic Commission for Latin America and the Caribbean (ECLAC) and Centro Interamericano de Desarrollo e Investigación Ambiental y Territorial (CIDIAT) and ECLAC (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, LC/R.1399, 21 June 1994, Santiago, Chile.

- **Permanent (3):** the operation and maintenance stage of structures and management and conservation of natural resources and elements. This phase corresponds to the notion of “management” (a term, which, has as many as four meanings in Spanish: “gestión”, “administración”, “ordenamiento” and “manejo”). In general, “water resources management” is translated as “administración de recursos hídricos”, and “watershed management” as “manejo de cuencas”). It should be noted that Spanish does not normally make a distinction between the concepts “watershed” and “river basin”, both of these being translated as “cuencas hidrográficas”, although some effort has been made to differentiate between the two by using terms such as “cuenca fluvial” and “hoya hidrográfica” to refer to “river basin”, and “cuenca de alta montaña” or “cuenca de captación” to render the idea of “watershed”.
- Natural resources and elements that are considered in the process of river basin management (letters a, b and c):

- **First group (a):** all the elements, resources and infrastructure for development of a river basin.
- **Second group (b):** all the natural elements and resources to be found in a river basin.
- **Third group (c):** only water resources.

This form of terminological analysis is unusual and it is hoped that it may be helpful in classifying concepts of the objectives of river basin management. The table shows clearly that the most complete type of management at the river basin level is indicated in column (a), under the heading “*river basin development*” at the intermediate stage and “*environmental management*” in the permanent phase. This approach amounts to applying regional development and environmental management techniques at the river basin level. It is an approach that gained currency in Latin America following the success of the Tennessee Valley Authority (TVA) in the United States, an approach that attracted followers in Mexico, Colombia, Brazil and Peru. Agencies responsible for this type of management are usually referred to as water corporations or commissions. Most originated and developed out of major investment projects.

The intermediate river basin management level is shown under column (b) and includes activities aimed at the co-ordination of the development (“*natural resources development*”) and management of all the natural resources to be found in a river basin (“*natural resources management*”). This level of systematic management of all natural resources in a river basin (management of the use of a river basin according to its capacity and purpose) has not been applied comprehensively in the region.

There are no systems or entities that facilitate co-ordination of the activities of use and management of the natural resources in a river basin. However, there are many watershed management programmes and projects (“*manejo de cuencas*”). Watershed management has become a sub-item or part of this integrated approach to natural elements and natural resource management.

The traditional approach to watershed management aimed at regulating the run-off of water (a concept that originated and was first applied in the United States) is part of the approach to natural resource management. Watershed management is therefore a mixed activity, linked to management and conservation of all natural elements and resources as well as water management itself.

The third level of management, which is shown in column (c) is geared towards co-ordination of investments in water resources development and subsequent management thereof. It can be oriented towards integrated water resources management or towards sectoral water management. Sectoral management is the only known level of river basin management in the countries of the region and it is at this level that most of the studies and investments in hydroelectricity, irrigation and drainage, drinking water supply and flood control are conducted. Some steps towards integrated water resources management have been taken but more in theory than in practice.

In Latin America and the Caribbean, it is normal for the intermediate phase (“*development*”) geared towards planning and execution of investment projects, in particular hydroelectric projects, to be governed by strong systems of sectoral management. This is largely due to the fact that it is a phase that normally benefits from substantial financial backing, political support and interest on the part of multilateral financial institutions.

Conversely, the permanent phase, (“*management*”), involving the day-to-day management or administration (for example, of water, use of flood-prone areas, water pollution control or use of hillsides and operation and maintenance of waterworks except in the hydroelectricity sector and some drinking water services) was and still is generally very poor. This is the phase oriented towards integrated water resources management that needs to be improved on all fronts.

B. The meaning of “integrated” management at the river basin level

In all river basins people are daily performing thousands of actions. The fact that they perform these actions does not imply that they are automatically part of a process of river basin management, let alone that they are integrated. *In order to form part of a process of river basin management, such actions must first be co-ordinated with one another with due regard for their joint effect on the dynamics of the river basin and its inhabitants.*

It is not necessary, however, to co-ordinate all the actions executed in a river basin. Only certain actions have to undergo this process, such as decisions regarding flood control or the multiple use of a basin’s water. At least, some of these actions yield better results if they are co-ordinated among the various actors involved and if the dynamics and characteristics of a wider territory are taken into account than is normally the case. For the process of river basin management to be “integrated”, actions have to be performed which yield benefits in both the productive and the environmental senses in the light of the basin’s behaviour. In addition, the management system has to be such as to allow users to take part in decision-making in the interests of equity.

The management of a river basin relies on the conjunction of two groups of complementary actions. One group of actions directed towards developing the natural resources (using, converting and consuming them) present in the river basin in order to boost economic growth, and a second group of actions directed towards managing them (conserving, reclaiming and protecting them) with the aim of ultimately ensuring environmental sustainability. It might be added that these two groups of actions must be performed with the participation of the actors, whether inhabitants or other parties having an interest in the river basin, with a view to seeking equity. This is considered to be implicit in the process of integrated management: *integrated management of (the natural resources of) river basins for the purposes of human development = development of (the natural resources of) river basins for the purposes of economic growth + management of (the natural resources of) river basins for the purposes of environmental sustainability.*

Actions involved in both the development and management of a river basin can also be divided into two groups:

- group of technical or direct actions, also known as structural actions or measures (studies, projects, works, operation, management); and
- group of management or indirect actions, also known as non-structural measures (financing, standard-setting, organization).

C. Advances towards integrated river basin management

The subject of river basin management has been associated historically with the main cultures and civilisations which have evolved –and sometimes disappeared– thanks to the availability or otherwise of water. City dwellers, who make up most of the population in many countries, have gradually been losing sight of this dependence on water and watercourses, to such a point that they have come to ignore it completely because they always have ample water at their disposal all the time. They have also fallen into the habit of demanding that the supply of water be increased, instead of seeking to reduce water consumption through more rational use. Nor do they really understand that water is a scarce resource whose availability fluctuates over time and whose control demands great investments that must be planned years ahead. Every so often, however, a flood, a prolonged drought or some flagrant instance of water pollution remind them of this dependence, but the effect does not always last long enough to cause them to organise themselves and take action to balance water supply and demand in the long term, and above all to establish stable management systems with guaranteed financing.

Due partly to these fluctuating perceptions of the value of water, advances towards integrated river basin management in the countries of the region have been neither uniform nor stable. Management systems have been changing erratically giving rise to many cases where in the past, management, at least of water resources tended to be “more integrated” than at present. Even some sectors and public utilities, such as those related to drinking water supply and energy, had had more control over an entire river basin than at present after having been privatised and fragmented.

In its initial stages, co-ordination of activities at the river basin level was limited. Work was done at this level in order to solve problems as they arose and satisfy specific or sectoral demands for water, supplying water for population centres or irrigation, controlling flooding and building hydroelectric power stations.

The next step was to operate and maintain the structures thus constructed. This management was limited to the existing structures without any particular interest in multiple use of water resources or in managing the river basin area except for their own purposes. Thus a series of water management systems were implemented in the region, many of which were developed solely for sectoral water use.

In the late 1940s, corporations and commissions, as in Mexico, were set up for the integrated development of river basins, that is, for regional development at the river basin level. These corporations set out from the construction of water projects to embrace extensive areas under their jurisdiction and to invest in a number of sectors. They were mainly created under the influence and image of the TVA.

Around the 1970s, emerges the concept of “watershed management” mainly with the aim to reduce silting up in dams and to control land slides or flooding. There are very few instances in which all the natural resources of the river basin are managed. Integrated agricultural, forestry and livestock projects have helped to improve this aspect but do not compensate for the lack of a well co-ordinated system for the management of the natural resources of river basins or watersheds.

The environmental dimension began to be taken into account in Latin America and the Caribbean only at the end of the 1970s, that is, five to seven years after the United Nations Conference on the Human Environment (Stockholm, Sweden, 5–16 June 1972). First came environmental impact studies, and later environmental quality analyses. To a large extent, environmental management at the river basin level did not go beyond the phase of studies, planning and proposals for forming organizations.

A look at Table 1 is necessary to understand this development and to identify the different steps in management that cover the entire river basin depending on the phase of execution and the resources to be managed. The table shows a total of seven steps (intermediate and permanent phases) for river basin management: three geared to river basin development and four to the control, administration or management of the environment, natural resources or water resources. The chronological order followed in the region in co-ordinating actions at the river basin level is as follows:

- the question of water control and use in river basins is approached through the construction of water projects (“*water resources development*”);
- the question of the management of water in river basins is tackled (“*water resources management*”);
- there is then a direct transition to “*river basin development*”;
- the question of “*watershed management*” is taken up, especially with a view to controlling the erosion that affects existing dams and preventing landslides and mudslides;
- there is then an attempt of a direct transition, more in theory than in practice, to consideration of the question of “*environmental management*”; and
- there is a tendency towards creating capacity for integrated water resources management as a more practical approach.

What stands out in this evolution is that there has been an abrupt decision to co-ordinate, at least on paper, environmental management at the river basin and regional level, without yet having fully co-ordinated the measures for the development and management of all natural resources of a river basin or at least integrated water resources management. It will be remembered, however, that if natural resources are not managed in a co-ordinated manner, not even water, then it will be impossible to undertake environmental management. The first step should then be to manage the water resources in an integrated manner and then the other natural resources associated with them.

In the 1990s, the combination of greater concern with the environment, the increasingly serious effects of natural disasters and the appearance of epidemics such as cholera seem to have shaken up people's ideas to some extent, not only for social or environmental reasons but also, and above all, for economic reasons. It would appear that it will be economic considerations, rather than environmental ones, which will finally induce politicians and governments to progress from ideas to action.

These concerns, however, have not yet been reflected in Latin America and the Caribbean in the establishment of adequate water management organizations. Generally speaking, the question of water management (at both the national and the river basin level) is favourably viewed by many persons and institutions but has not yet been reflected in the actual creation of solid, stable systems (be they public, private or of a joint nature), except in a few cases and in respect of some river basins, particularly where big investments in water projects have already been made for some reason.

D. Relation between watershed management and river basin management

A classic definition of watershed management is that it is “the art and science of managing the natural resources of a watershed in order to control the discharge of the water in terms of quality, quantity, location and time of occurrence” (see Annex 5). This definition, formulated by Dr. Robert E. Dils of Colorado State University in 1964, is well-suited for the Rocky Mountains in the United States, where relatively small sparsely inhabited watersheds are mainly used for the catchment of water for urban and agricultural purposes. It derives from the forestry schools owing to the fact that these watersheds are mainly used for the purposes of forestry and pastureland. Originally, therefore, the term was used in the realm of hydrology and forestry, and some very well-known experimental watershed management programmes were established in the Appalachian Mountains (Coweeta) and in Colorado (Fraser experimental station) in the United States

This original definition of watershed management applied then, first and foremost, to sparsely inhabited watersheds whose main purpose was to capture water for urban use (municipal watersheds) or for other uses. It is also appropriate when applied to some watersheds located in the Andes, especially in their high-mountain areas in Chile and Argentina. On the other hand, in more densely inhabited watersheds where there is extensive use of land for agricultural and forestry production, as in the high Andes region of Bolivia, Peru, Ecuador, Colombia and Venezuela and almost the whole of Central America and Mexico, this definition does not suffice. Moreover, there has been a long tradition of the management of such inhabited watersheds, dating back to pre-Inca times, as in the River Colca, Arequipa, Peru.

For South America and most of Central America, a better definition of watershed management could be that formulated by the College of Engineers of Peru, whereby watershed management is defined as “the application of principles and methods for the rational and integrated use of the natural resources of the watershed –essentially water, soil, vegetation and wildlife– aimed at achieving optimal and sustained production of those resources with minimum damage to the environment for the benefit of the inhabitants of the watershed and the communities linked to it”. In other words, this new approach to watershed management pursues social, economic and environmental objectives for the benefit of all who have a stake in the watershed, in addition to managing it as a catchment area of water for multiple uses.

A tentative list of technical actions normally considered in watershed management programmes in Latin America is provided in Box 1.

It is important to note that the definition of watershed management is also being re-evaluated in the United States, where in the past decade, the number of watershed-based groups and initiatives has increased dramatically, along with the use of a watershed framework for addressing natural resources and environmental management problems (Institute for Agriculture and Trade Policy, 1997). Key to these developments is the emergence of the “new watershed approach.” Distinguishing features of this new approach are decentralised and shared decision-making, collaboration, engagement of a wide array of stakeholders (including non-governmental interests), and goals evidencing concern for ecosystems protection (Born and Genskow, 2001). This new approach differs from the traditional one that is more fragmented and reliant upon centralised agency decision-making and command-and-control strategies.

Box 1

TECHNICAL ACTIONS UNDER A WATERSHED MANAGEMENT PROGRAMME

For anyone wishing to tackle the subject of watershed management it may be helpful to have a list of possible technical actions belonging to a watershed management programme in order to gauge their scope. These actions may be classified according to various criteria, the most common system being according to their objectives:

- land planning and preservation actions;
- reclamation or rehabilitation actions;
- protection or mitigation actions; and
- conservation actions.

Technical or direct actions aimed at land planning or preservation

- The establishment and management of parks, sanctuaries, reserves and other systems designed to preserve biodiversity, natural landscapes, wildlife and other natural resources.
- The declaration of protected forest areas or protected areas in general in order to maintain optimum conditions for the catchment of both surface water and groundwater in a river basin.
- Zoning and the declaration of limits on the use of resources in certain river basin zones. For example, the declaration of municipal watersheds enables land and water use to be restricted for the purpose of eliminating drinking-water treatment needs.
- The declaration in general of limits on the use of or access to potential water pollutants deriving from industry, urban areas, mining operations, agricultural farms and aquaculture.
- The declaration and control of the physical occupation of watercourses, floodable terraces and mountain streams, and the licensing of activities aimed at extracting materials from river beds.
- The declaration and control of the use of land for the construction of housing, roads and any structures liable to be affected by waters or to cause problems in their flow.
- Restriction on the recreational use of land and waters in general with a view to avoiding potential damage to natural resources.

Technical or direct actions aimed at reclamation or rehabilitation

- The reclamation of lands which have suffered degradation as a result of over-utilisation by population, normally in the form of overgrazing or the use of unsatisfactory cultivation practices.
- Reforestation, generally after forest fires, indiscriminate tree felling, gully erosion or other situations responsible for destruction of the vegetation cover.
- The stabilisation of hill slopes which have undergone changes in gradient and a process of undercutting at their base through mechanical action of people or water.
- The recovery of groundwater levels and restoration of their quality after over-utilisation, the elimination of recharge zones and sources and other situations caused by people or nature.

Box 1 (concluded)

- The reclamation for agriculture of zones flooded for different reasons, bearing in mind that careful thought should be given to the necessity of draining natural or man-made marshland because of the extremely negative potential effects of doing so.
- The reclamation through drainage of areas salinised as a result of irrigation, the application of corrective measures and soil washing.
- The stabilisation of river beds in general which have been subject to the extraction of aggregate, changes in sediment load and changes in their banks as a result of river training works.
- The restoration of water-quality levels in water courses, lakes and marshland, and the reestablishment of the wildlife and plant life inhabiting such ecosystem.
- The reclamation of landscapes in general after mining, use of the land for dumping refuse and other uses affecting the natural environmental conditions.

Technical or direct actions aimed at protection or mitigation

- Actions designed to protect man and man-made constructions against the effects of extreme events induced by nature or by man himself, for example, measures aimed at controlling floods, avalanches, landslides and mudslides, torrents, deposits of washings and life-threatening situations in general.
- Actions aimed at protecting natural resources against the negative consequences of natural events or human actions. For example, measures to control water and wind erosion, forest-fire control, pest control, etc.

Protective actions normally have the following objectives: (i) to increase the resistance of natural resources and man-made constructions to extreme events; (ii) to reduce or dissipate the violent force of potentially damaging events and thus mitigate their effects; (iii) to avoid placing natural resources and human settlements in situations of risk; (iv) to alert the population to potential risks, giving sufficient advance warning; and (v) to have in place security and safety systems permitting rapid recovery in the event of the occurrence of undesired situations.

Technical or direct actions aimed at conservation comprise all measures directly associated with productive transformation systems

In contrast to the aforementioned actions, which may be carried out either in isolation or accompanied by development measures, conservation measures must be implemented in co-ordination with development measures. Every use or form of processing resources (agricultural, livestock, forestry, industrial, mining, etc.) must have its own conservation systems. The ideal situation is that these should form part of the production system in such a way that production and conservation are ensured by the same process. There is no point in providing a list of actions in this case since such a list would be as long as the list of production systems and uses of the natural resources. It should be pointed out, nevertheless, that the more conservation measures deployed, the less need there will be for investment in the reclamation or rehabilitation of the resources.

Source: Axel Dourojeanni (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, Economic Commission for Latin America and the Caribbean (ECLAC) and Centro Interamericano de Desarrollo e Investigación Ambiental y Territorial (CIDIAT) and ECLAC (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, LC/R.1399, 21 June 1994, Santiago, Chile.

Watershed management programmes are rarely confined to aspects of protection, conservation, reclamation and preservation because they are normally implemented in association with actions of a productive nature relating to the use, processing or extraction of natural resources. For this reason, in practice there is no such thing as a single watershed management programme, but rather “packages” or “clusters” of projects which, in combination, succeed in developing the natural resources of a relatively small river basin or watershed without destroying them. An indispensable element of watershed management is the active participation of the local population in duly organised form, with the co-ordinated support of the relevant public and private institutions.

Technical actions falling within the scope of watershed management are directed towards the preservation, reclamation, control, protection and conservation of both the natural resources and the human population of a watershed or dependent on its resources (see Table 2). These actions must be performed on a continuing basis in order to contribute to environmental sustainability and to the steady development of natural resources, as well as to protection of the watershed’s human population against

extreme natural events. The sequence of actions needed for the elaboration of a master plan for small watersheds is presented in Box 2. The same sequence can also be used for river basin planning.

TABLE 2
DIRECT ACTIONS LINKED TO THE MANAGEMENT OF THE NATURAL RESOURCES AND ELEMENTS IN A RIVER BASIN

Examples of direct actions	Environmental sustainability ... ← ← ← ← ← → → → → → ...			Economic growth				
	Integrated management of natural resources in river basins							
	Water and river basin management			Water and river basin development				
	Preservation and reserves	Reclamation and rehabilitation	Protection and monitoring	Conservation	Utilisation	Production and processing	Operation and extraction	Degradation and destruction
Management of parks								
Protection of endangered species								
Erosion control								
Flood control								
Land reclamation								
Soil conservation								
Management of forest wildlife								
Water resources development								
Recreational fishing								
Irrigation and drainage								
Aquaculture								
Hydroelectric power generation								
Mining								
Toxic waste disposal								
<i>Integrated river basin development</i>								

Source: Axel Dourojeanni (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, Economic Commission for Latin America and the Caribbean (ECLAC) and Centro Interamericano de Desarrollo e Investigación Ambiental y Territorial (CIDIAT) and ECLAC (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, LC/R.1399, 21 June 1994, Santiago, Chile.

Watershed management forms part of river basin management. Watershed management programmes in most Latin American countries have been usually implemented by organizations specifically created, at the national, regional or local level, for this purpose, as for example the National Watershed Management and Soil Conservation Project (Proyecto Nacional de Manejo de Cuencas Hidrográficas y Conservación de Suelos - PRONAMACHCS) in Peru, and not by river basin management organizations of more general nature. A similar situation exists in the United States where the soil conservation and forestry authorities were and still are in some way in charge of watershed management programmes. In Latin America there are some exceptions to this general rule, as for example Colombia where some Regional Autonomous Corporations (see Annex 6) perform watershed management activities (see Box 3). In most other countries, watershed management programmes are the responsibility of forestry and agricultural sectors.

SYSTEMATISATION OF WATERSHED MANAGEMENT ACTIONS: TENTATIVE SEQUENCE

1. **Gather information on the watershed to be managed and its basic characteristics.** Prepare a bibliography, physically visit the watershed and collect existing maps, photographs and reports. The purpose of this first stage is to form as precise a picture as possible of the conditions of the locality, its history, the individuals involved in the activities being undertaken there, the state of the communication routes, and other factors.
2. **Identify the stakeholders concerned with the management and development of the watershed, whether they be local to the area or outsiders, who have some influence in the relevant fields.** In order to be able to input shareholders' data in an orderly fashion and to ensure easy access later, it is helpful to use an information system for this task. In the subsequent stages one should not lose sight of the connection between the stakeholders and the problems, objectives, obstacles, solutions and strategies to be applied in order to achieve those solutions.
3. **Enumerate and classify the direct or technical and indirect or management actions —past, present and planned— in the watershed known to and described by the different stakeholders interviewed.** Situate the technical or direct actions geographically on maps of the watershed and on lists indicating whether the actions concerned involve studies, projects, the execution of works, maintenance of structures or resource management and conservation. Also record the indirect or management actions in a systematic fashion. Prepare tables showing the relationships between each action and the others, the agencies involved, the credit lines in use, the investments made, the training provided to users and other data which, taken together, will provide a complete picture of what is being done in the watershed in terms of resource management and development.
4. **Collect each stakeholder's opinions on the execution of watershed management actions and on his own activities in developing the watershed's resources.** This will reveal whether the individuals concerned are in favour of such actions, neutral towards them or opposed to them, together with their personal or institutional interests in relation to the areas possibly to be promoted. It is also helpful to obtain information on the official functions of the various agencies concerned with the watershed and any arrangements already in place for co-ordinating their activities. It should be mentioned that the criteria employed by the stakeholders condition their view of the problems, hence the ideal model with which they compare real situations.
5. **List and catalogue all the watershed management problems perceived by the stakeholders.** Determine their frequency, location and the conditions in which they occur. In this phase it should be borne in mind that what might constitute a problem for one stakeholder (such as the farmers whose only irrigation canal is polluted by pathogenic germs or chemical products) is not necessarily a problem for the others (such as the hospital or industry which is responsible for polluting the canal with its refuse or waste). Classify the problems, separating those relating to technical and physical factors from those related to management issues.
6. **Once a list has been drawn up of problems indicated by the stakeholders, describe each problem in detail and the relationship between the problems and between each problem and the stakeholders.** It is advisable to collect the information together on forms designed to take account of the specific types of problems identified during interviews. The direct or technical problems must be marked on one or more maps of the watershed, problems common to all the users (generally those relating to the watercourses or channels) being distinguished from those affecting each landowner or tenant individually (usually problems relating to plots of land on hillsides, terraces or level ground). In the case of problems of an indirect nature or concerning management, the institutions responsible for creating or resolving them should be noted.
7. **The next step is to convert the list of problems (situations regarding which the stakeholders have expressed differences of position) into objectives clearly established by the stakeholders themselves.** There are two complementary ways of achieving this: either to infer the objectives on the basis of the list of problems or else to do so on the basis of quality-of-life models. Once the list of objectives has been established, a further one is prepared on the basis of the points made by the stakeholders themselves. The two lists are then compared with one another by the advisers and users together. The users are normally more inclined to express what they do not want without necessarily having a clear idea of what they do want. The final list of objectives has to be ordered according to priorities, particular importance being assigned to collective targets. A prioritised list of objectives is the basis for performing targeted studies and analyses on the watershed in an effective manner, saving time and resources.

Box 2 (concluded)

8. ***Then comes preparation of inventories, evaluations and diagnosis aimed at determining the feasibility of the objectives established in the previous stage.*** In the field detailed checks are made of the problems and the scope for resolving them. It is understood that achieving the objectives entails both, direct or technical actions and indirect or management actions. The purpose of the targeted evaluations and diagnosis is to identify the obstacles which will need to be overcome in order to achieve the objectives and the scope for doing so. This task may be carried out by applying the techniques already outlined. The concept of "evaluation", which means comparing a situation with a reference standard, should not be confused, however, with that of "analysis", which explains why the observed situation departs from the standard or model. The analysis is the basis for deciding what measures (better known as solutions) should be taken in the watershed.
9. ***All the obstacles (or constraints) must be codified and described on forms similar to those used for describing the problem.*** The difference between a problem and an obstacle (or restriction) is that the latter is defined in relation to a known objective. Once identified, each obstacle must be related to any stakeholder or stakeholders who caused it, to the persons or agencies responsible for overcoming it, to those who will have to assume the costs of the corrective measures and to those who will have to execute them. Systematic work to identify obstacles is the basis for generating solutions to overcome them.
10. ***The next step is to formulate proposals or alternative solutions for each of the obstacles identified, to classify them and to rank them hierarchically.*** Regarding the technical actions, the following procedure should be followed:
- a) ***Compile a manual setting out all the relevant practices in duly codified form.*** In order to do so, it will be necessary to have a codified list of land treatment measures, which for the most part comprise measures relating to vegetation and cultivation techniques and to the management of watercourses (watershed structural measures), which are predominantly mechanical and structural in character.
 - b) ***Prepare a list of planned watershed structural measures, each one being marked on a map showing its geographical location.*** In view of the complexity of the problem, it will be necessary to make a separate calculation of the cost of each structural measure and its effect on discharge control, water quality and sediment retention. Such measures will include torrent regulation, flood control, water treatment, bank stabilisation, control of landslides and gullies, and the like.
 - c) ***Draw up a table identifying the practices recommended for each type of land use, its reference code in the descriptive manual, the frequency of its application, the area of land covered in hectares and its unit cost.*** This table is essential for calculating the cost of executing the recommended technical solutions and gaining familiarity with the site where they are to be applied, the users of the land and other data.
 - d) ***Draw up a list of indirect or management activities necessary for implementation of the recommended measures.*** It should be borne in mind that each of these activities presupposes a set of previous actions, such as training of the users, awarding of credits, organization of support services, co-ordination of institutions, and so forth, and that this represents a major budgetary item for the watershed management programme or project.
11. ***The next step is to evaluate the benefits yielded both as a result of the combined effect of the envisaged management actions (medium- or long-term target, since at least 10 years are required to achieve any tangible results in terms of the quality or quantity of water discharge) and through each of the recommended practices, most particularly the land treatment measures.*** In order to evaluate the investments, it is necessary to calculate the unit costs of each structural measure. The calculation of benefits must take account of two factors:
- a) Benefits yielded in the specific site of application, for example, when pastureland is improved, terraces constructed or reforestation carried out, the resulting increase in output or soil conservation takes place on that same site.
 - b) The benefits yielded for waters downstream from the site of application of the structural measure, essentially as a result of lower sediment yield, increased basic flow, improved water quality, and so forth.

The economic calculations can only be made on the basis of systematic and well-classified information concerning each structural measure. Given that a whole array of factors are involved in watershed management, it is not possible to prepare budgets for large areas without working on the basis of unit and combined costs and effects. This means, for example, that a bank that provides loans for watershed management must encourage the preparation of practical manuals as well as the estimation of the unit and combined costs and effects of the structural measures.

Source: Axel Dourojeanni (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, Economic Commission for Latin America and the Caribbean (ECLAC) and Centro Interamericano de Desarrollo e Investigación Ambiental y Territorial (CIDIAT) and ECLAC (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, LC/R.1399, 21 June 1994, Santiago, Chile.

THE WORKING METHODOLOGY ELABORATED BY THE CAUCA REGIONAL AUTONOMOUS CORPORATION (CVC) FOR WATERSHED MANAGEMENT

The working methodology elaborated by the Cauca Regional Autonomous Corporation (CVC) for watershed management may be summarised in the following phases:

- **Phase 1 or the approach to the community.** During this phase mechanisms are established for the control and monitoring of the natural resources with a view to organising their use and publicising standards to ensure their conservation. In addition, mechanisms are established to bring about closer ties with the community, to publicise the activities to be undertaken jointly with the community and to gain a better knowledge of the region.
- **Phase 2 or formulation of the plan.** The main objective to be attained in this phase is to devise a management plan aimed at conserving the renewable natural resources and developing the community. The first stage in formulating the plan is to obtain a detailed analysis of the biophysical, social and economic factors, for which specialised technical studies are required together with intensified soil and climatology programmes and agricultural, livestock and forestry trials. Contracts also have to be assigned in order to obtain basic information in geology and socio-economic areas.
- **Phase 3 or execution of the plan and self-management.** Analysis of this phase shows that the process of execution is in line with the conditions prevailing at this time, reflecting the broad scope of its formulation and the indicative objectives proposed in the plans. On the other hand, the plans executed were directed towards several objectives with fragmented activities planned over a very wide area, with scant involvement of the community and water users.

Factors which accelerated the shift towards the current approach

The economic and financial crisis which CVC underwent in 1985 and 1986, the promulgation of Law N° 79 of 1986, which in its short period of operation left CVC without any functions with respect to regulation of the use of natural resources, and various other factors dictated the adoption of different principles for the future management of natural resources and forced a change in the working strategy employed in watersheds.

Current approach to watershed management

In the light of the analysis performed, the methodological development of natural resources administration and national, regional and institutional conditions, a change in approach is called for requiring a reformulation of the methodology applied in watershed management, together with modification of the administrative structure and working systems with a view to:

- planning the administration of renewable natural resources in watersheds;
- analysing the problems of a multidisciplinary nature to be resolved, while maintaining a systemic approach;
- formulating plans aimed at concentrating efforts and resources where the greatest impact can be produced on the system of the major Cauca river basin;
- seeking the co-ordination of public and private bodies in the co-funding of watershed management projects; and
- securing the active involvement of the community, aware of its own development, from the formulation right through to the execution of watershed management projects.

Objectives of the current approach

- To achieve rational use of the available resources through the planning of activities with the aim of enhancing effectiveness and efficiency.
- To establish a hierarchy of areas for the administration of natural resources in watersheds, permitting investments to be made in order of importance and of impact on the system of the major Cauca river basin.
- To formulate plans for the integrated management of natural resources and production projects, in a participatory form, and to create facilities allowing the users of the resources to be involved in co-funding the projects defined.

Source: Fernando Alvarez (1993), "Modelo de manejo de cuencas en la CVC", *Memorias. Primer Congreso Internacional del Agua. Septiembre 21 al 25 de 1993. Centro de Exposiciones y Convenciones de Medellín, Corporación del Agua.*

III. Operational aspects of river basin management

A. Processes involved in river basin management

Setting up any kind of river basin organization, with a view to river basin management under any of its modalities (see Table 1), entails a series of ongoing processes that can be implemented in parallel. The processes that are particularly worthy of further analysis are: (i) communication and awareness-raising; (ii) formation of alliances and agreements; (iii) legalisation of operations; (iv) scenario development, evaluation and diagnosis; (v) operational consolidation of each water user; (vi) administrative organization; (vii) economic valuation and preparation of strategies; (viii) operation of the shared hydraulic system; (ix) conservation of bodies of water, natural habitats and biodiversity; and (x) water pollution control, stream corridor restoration and recovery of rural and urban drainage capacity. These processes can be divided into three groups: a central co-ordination process, a group of socio-economic processes, and a group of physical and technical processes.

- **Communication and awareness-raising.** Awareness-raising campaigns through whatever media are available are to be recommended before proposing the establishment of any river basin organization. It is a good idea to explain to the actors involved in managing the water resources of a river basin why an agency to co-ordinate their efforts is useful and necessary. This stage also serves to gather information, identify conflicts and compile bibliography. It is worthwhile to establish which

bodies or organizations are operating in the basin, which of them distribute the water, how they measure distribution, if they keep water-quality records, if they have emergency programmes and, in general, how they operate the existing water systems and with what resources.

- **Formation of alliances and agreements.** The actors involved should set up a preliminary alliance to take action that will gradually progress toward the establishment of an overall system of river basin management. The scope of the alliance can be widened as time goes on but, initially, it is usually easier if the actors set a specific objective for their action (clean-up of a lake or river, reforesting a river bank, administering the water of a river or canal used by several users, managing the banks and course of a river or any other subject that is of interest to more than one actor). The actors may include public or private, non-governmental organizations, local governments, universities and professional organizations. Alliances must be formally established and set concrete goals for their work. Ultimately, this activity is expected to give rise to round tables for co-ordination and dialogue. The list of actors who are invited to take part must be flexible, since it will vary from one situation to another.
- **Legalisation of operations.** The legal framework for a river basin organization can be consolidated gradually. If there is no specific legislation under which to create a river basin management system, the parties could start with a simple agreement to carry out a project. The final objective of the process, however, is to give the river basin management system legal personality and clearly identifiable competencies to manage the water in the basin (collection of charges, monitoring, etc.), either directly or by co-ordinating the actions of responsible organizations. There are several ways of affording legal status to actions relating to river basin management, including ministerial resolutions establishing special programmes and projects and responsibilities which are assigned by law to local governments, ministries or institutes, which then give their actions legal status through the modalities of ordinances, regulations and other directives.
- **Scenario development, evaluation and diagnosis.** Once a minimum of commitment and agreement has been obtained among the actors in the alliance about what they want to achieve in the river basin through their co-ordinated action, the existing situation must be evaluated in order to arrive at a diagnosis. This will require the participation of an interdisciplinary team and can be defined as **management procedures for sustainable development** (see Annex 2). The actors must be encouraged to participate in a public debate about the issues to be addressed. It is also important to promote the use of geographical information systems and, in general, of all available techniques for describing what is happening in the basin, who the affected and responsible parties are, and the costs and benefits involved in the programme of action.
- **Operational consolidation of each water user.** The aim of this process is to help each actor involved in managing the water and the river basin to ensure that they are complying fully with their responsibilities. For example, support should be given to organizations of agricultural users, drinking water supply and sanitation services, mining, fisheries and recreational users and, in general, all those actors who in some way alter the flow of water in the basin, to ensure that their practices conform to the highest standards possible. This consolidation process includes providing support to local governments to help them comply with their environmental responsibilities and to ministries –such as health ministries– to help them discharge their role of environmental quality control, and to other entities including non-governmental organizations.

- **Administrative organization.** All the stages must be carried out within an adequate administrative framework, including the collection of charges, registering of actors, accounting, financial controls, monitoring and ensuring compliance, procurement of equipment and hiring of staff and consultants. The administrative system will become more complex as the process advances. If the organization is to survive, it must make itself indispensable, and that will only happen if it generates confidence in its financial management and the quality of its work. The professionals who make up the administrative system must be suitably qualified.
- **Economic valuation and preparation of strategies.** Plans are written strategies and strategies are presented in the form of programmes of work or projects which have due technical and financial backing. Once it has begun, the process of planning is never concluded. Planning should be seen as equivalent to building a system of information and rules, standards and criteria that facilitate decision-making among multiple actors. The factors which are used to calculate costs and benefits, design strategies and draw up a plan come from the stages of identifying the actors, their criteria, problems and objectives, building shared scenarios, evaluating the existing situation, making diagnoses and identifying obstacles and restrictions. The plan should serve to communicate intentions and co-ordinate where necessary.
- **Operation of the shared hydraulic system.** Qualified technicians are needed to operate and maintain the hydraulic system built in the river basin and to support water conservation and management, and the many users in the river basin must also participate in the process. The basin's rivers and hydraulic systems must also be equipped with a series of water monitoring stations and satellite information systems, or these must be reinforced if they already exist. In general, the organization needs to be sufficiently equipped to be able to keep track of situations and plan ahead. Modern communications systems are essential to enable the overall system to function correctly.
- **Conservation of bodies of water, natural habitats and biodiversity.** It is not enough to merely operate the hydraulic systems built. A huge amount of work is required to recover damaged areas along riverbanks and riversides and rehabilitate biological habitats. It is essential to mitigate the effects of conflicts related to water and river basin management by ensuring that plans for the use and occupation of the territory respect –as far as possible– the natural catchment and water-flow conditions in the river basin. This is necessary to maintain all the river basin's original functions, in particular to conserve biodiversity and the landscape. This process requires town-planners to take account of natural water courses, with normal and seasonal flows, in their decision-making.
- **Water pollution control, stream corridor restoration and recovery of rural and urban drainage capacity.** In most river basins, especially in urban areas, this process entails reversing situations that have already profoundly altered water courses and flows. This is a long task and likely to be the most challenging of all. It is not possible to conserve river basins or water courses if they have already deteriorated totally. While industrialised countries are in the process of rehabilitating stream corridors, most developing countries are in the process of destroying them.

This analysis is clearly not intended to be complete. Neither does it address how to combine all these processes in a flow diagram of work, incorporating the activities, staff and time for each action. The implementation of the processes described above will be greatly aided if theoretical and practical data is compiled to support the establishment of the river basin organization. This can be complemented with additional information such as an evaluation of the knowledge of water-users, the actors who will be involved in managing the water in the river basin, their criteria on multiple water-use management, the problems and conflicts involved in shared management and the objectives they are pursuing. It is also necessary to carry out a comparative analysis of past and present experiences and attempts to create

such organizations within the country –and if possible in more than one country– whether these have been successful or not.

A particularly important point for making the processes of creating and consolidating a river basin organization as smooth as possible is to begin while the hydraulic works are still being built, whether they are State- or privately operated. Commonly, the “master plan” for integral river basin management is not thought of until the works are finished. Still worse is that this often means that no resources are available for setting up the operative system –which amounts to much more than making a plan– including funding for complementary communication works and monitoring systems. At least 5–10% of the cost of the major hydraulic works should be allocated to establishing the management system, including the necessary infrastructure. No less than ten years should be allowed for consolidation, especially in river basins featuring a combination of formal and informal actors and low-income groups.

B. Functions of a river basin organization

The management of co-ordinated actions to achieve various types of goals at the river basin level is normally undertaken by river basin organizations known variously as authorities, agencies or committees (see Box 4). The scope of the organization depends on the objectives it is set: these may range from regional development, to natural resource management or multi-purpose water management (see Table 1). Irrespective of the organization’s level of coverage, ideally consideration should be given to environmental, social and economic aspects. Accordingly, the philosophy that determines these organizations' functions should be based, among other things, on:

- **Water/environmental criteria**, i.e., it should be designed on the scale of a hydrological unit and establish as a principle respect for the environment and its physical and environmental dynamics.
- **Social criteria**, any negotiations which take place between actors and users of the river basin should seek to foster equity and minimise conflict, as well as provide for the safety of the inhabitants.
- **Economic criteria**, to promote economic growth through the efficient use of the river basin's natural resources.

Box 4

CONCLUSIONS AND RECOMMENDATIONS OF THE II WORKSHOP FOR MANAGERS OF RIVER BASIN AUTHORITIES IN LATIN AMERICA AND THE CARIBBEAN ON INSTITUTIONAL ASPECTS OF RIVER BASIN AUTHORITIES

- The nature and role of a water management organization at the river basin level should be clear and oriented towards serving water users in such a way as to promote appropriate water use in qualitative and quantitative terms, minimising potential conflicts among users. Such organizations should not be given conflicting roles, and their tasks and functions should not replace the functions of already existing bodies.
- A few organizations already existing in the countries of the region tend to perform tasks corresponding to a river basin organization. The existing bodies should not be changed, but should be adjusted, strengthened and made financially sustainable in the long term. A water management body at the river basin level should avoid taking over the functions of existing bodies, public or private, which have functions connected with water management; rather, it should strengthen their operational capacity.
- Water management models cannot be transferred inflexibly from country to country; rather, they should be adapted to local needs. What can be done, however, is to adopt the underlying principles of a particular water management model, adapting it to needs and conditions in each country, region and river basin.

Box 4 (Concluded)

- Programmes should be designed, set up and implemented to promote and strengthen river basin management entities in the countries of the region
- For a system of multiple water-use management to function properly, each user sector should be capable of appropriate operation and maintenance of its own water systems.
- Measuring stations for obtaining information on water resources can and should be constructed and operated by each user sector to the extent necessary for operating their systems. However, it is essential that all the information should be concentrated in a “water information centre”.
- A State water department having technical and regulatory functions of a multisectorial nature should not be dependent upon a user sector; this would make it both judge and party in the same case, diminishing its authority.
- It is best not to separate the construction of waterworks by Government from the technical, regulatory and operational aspects of water systems. Also, during the phase of investment in major waterworks designed for multiple water use, the organization which will be in charge of managing multiple water use at the river basin level should be set up.
- Pilot projects should be set up in relation to the establishment and launching of water management bodies at the river basin level, and studies should be conducted into the systematisation of experience gained from such projects.

Source: ECLAC (1997), *Report on the Second Workshop for Managers of River Basin Authorities in Latin America and the Caribbean. Santiago, Chile, 11–13 December 1997*, LC/R.1802, 1 September 1999, Santiago, Chile

Before defining the functions of a future river basin organization, it is necessary to identify which organizations individually and collectively administer the river basin's water resources at present, and how efficiently they perform this task. Then it is necessary to ascertain how reassigning some or all of these functions to river basin organizations could enhance water management. Only a limited number of functions related to water management should be assigned directly to the river basin organizations. The important thing is that river basin organizations should neither replace nor duplicate the functions performed by other institutions; in addition, they need to show profitability from the social, economic and environmental standpoints.

The main functions that could be performed by river basin organizations:

- **Co-ordinating function:** the river basin organization should serve as a “*co-ordinating forum*” for water resources management using water/environmental criteria. ***The extent of the organization's executive power*** (i.e. its rights and responsibilities) ***should preferably be stipulated in the water law*** (Box 5). In carrying out its duties, the new organization should respect those organizational and functional multi-purpose water management structures already in existence that operate efficiently.
- **Administrative function:** in order for the river basin organization to accomplish its administrative functions, it is vital that the law require ***internal administrative regulations*** to be drawn up for each of them.
- **Allocative function:** if the river basin organization has the power to allocate functions and responsibilities to other bodies or users with a view to improving multi-purpose water use, the law should state exactly how this is to be done. In order to ensure the users' commitment, ***the legislation in force should provide for and facilitate their participation in water resources management***, since clearly not all actors will be willing to submit to rulings by a river basin organization and will thus oppose the creation of such an organization at least initially.

CONCLUSIONS AND RECOMMENDATIONS OF THE II WORKSHOP FOR MANAGERS OF RIVER BASIN AUTHORITIES IN LATIN AMERICA AND THE CARIBBEAN ON LEGAL ASPECTS OF RIVER BASIN AUTHORITIES

- The reformulation of water legislation should take into account the successes of previous legislation and embody its basic principles, as well as technological progress and the latest criteria and experiences in the sphere. New water legislation should include an explanatory introduction which clearly expresses the underlying motivations. The text of the laws should only cover substantive issues, leaving technical specifications to be incorporated in regulations.
- In the formulation of new legislation, the work should be oriented towards a conceptual technique of the “framework legislation” type, tying the text in with other laws, and setting out broad and flexible criteria to facilitate effective application in such a way as to make the new laws always adaptable to situations that may arise in different regions within a country.
- Where the law provides for the creation of “integrated master plans”, it should also specify their legal structure and adoption procedures, the minimum requirements for their implementation and their purposes and objectives. It should also define responsibilities for their application.
- The law should provide for the creation of an entity at the water system level having sufficient institutional and financial autonomy to be able to collect the funds needed for appropriate management of water resources
- The water management entity should be generally set up as an autonomous public body, but mixed or semi-public structures should not be excluded.
- The legal framework setting up a river basin organization should include a terminological glossary in order to avoid arguments over interpretation, and a list of powers and responsibilities which should be provisional and subject to change.
- In federal countries, where the states involved in water management structures are autonomous, the Federal Government should create a law establishing national water policy objectives and providing for river basin authorities to be set up as an excellent means for decentralised regional management of water resources.
- Mechanisms should be created for dispute prevention and settlement, conciliation, harmonisation and other similar negotiations, tending to avoid cumbersome and lengthy court proceedings. In the regulations, water legislation should place greater emphasis on preventive measures, rather than on detection and punishment.
- Each country should endeavour to elaborate a set of technical and administrative standards to provide guidance for water management at the river basin level.

Source: ECLAC (1997), *Report on the Second Workshop for Managers of River Basin Authorities in Latin America and the Caribbean. Santiago, Chile, 11–13 December 1997*, LC/R.1802, 1 September 1999, Santiago, Chile

- **Consultative function:** aside from its co-ordinating role, the river basin organization should be able to provide advice to other bodies involved in water management at the river basin level which so desire, as well as undertake specific studies. One essential aspect of this function consists in providing the agency responsible for **granting water rights** with information on the water balance in the river basin.
- **Monitoring** function: the river basin organization should be charged with monitoring water courses in the river basin from their source, over their entire length, and in respect of all their uses. This requires the existence of **standards in respect of water quality and quantity** which serve as the legal framework for the task of monitoring compliance. Standards and

regulations will only be observed if, in addition, *arrangements to penalise* non-compliance effectively have been put in place.

- **Arbitration function:** since the river basin organization is a co-ordinating body with participatory management, it is also considered to be the most appropriate entity for acting as arbitrator in disputes that arise between actors over water use, as well as for preventing disputes.

Public entities in charge of water management have at their disposal a simple method for initiating the organization of activities. All they need to do, in the case of each river basin, is set up a centre devoted solely to gathering all available information on studies made of the river basin, maps and other existing documents, to which the general public can then have access. In this manner, both users and the general public can significantly increase their participation in water management, without the need for substantial expenditure or a rearrangement of the functions performed by already existing organizations.

The initial task may simply consist of facilitating the co-ordination of water management initiatives in the river basin, without attempting to modify the duties of each organization currently responsible for managing the water resources of the basin. This co-ordination process should help identify: (i) the areas of activity for which no one has responsibility; and (ii) whether the authorities charged with performing a particular task are properly trained and equipped to do so.

C. Institutional structures for river basin management

In order to analyse the institutional structures for river basin management, it is essential to attempt to distinguish between the many variations they adopt. There are three basic types of structure in river basin management organizations:

- **Management structure.** Management structures vary depending on the extent to which the different actors participate in the management process. The name given to the river basin organization does not necessarily reflect their degree of participation in the decision-making process but it does, at least, indicate the original intention. The most common formulas are “river basin commissions”, “river basin committees”, “river basin councils” and “river basin agencies”, which display a wide range of types of participation by the actors involved in the decision-making process. In other cases, the management structure consists of a board of directors, which may be composed of government officials only or may include users, non-governmental organizations, universities, etc. The board of directors must have the power to decide, resolve and enforce agreements (it should not be merely an advisory or co-ordinating body)
- **Operational structure.** An operational structure is the body which puts the decisions of the management group into practice. It executes actions and processes, either directly or through consultants and contractors. The operational structure of a river basin organization must have highly qualified personnel. They are the “agency” in the strict sense, although they may be known by other titles, such as executive office, technical group, technical office, corporation or even institute, for example. The operational structure is the one responsible for providing the studies and information that the management group needs to take decisions.
- **Financial structure** (see Box 6). The body responsible for raising financial resources is one of the most difficult to design. In the countries of the region it is common to find that financial resources for river basin management are only available at the phase of executing hydraulic works, which is obviously not the solution for a river basin organization that is intended to be permanent. Few “models” of financial structure are transferable from one country to another. The “polluter pays” principle and subsidies and incentives are a good

option but are clearly insufficient and even inapplicable to many of the region's river basins which are characterised by informal settlements and producers. Any financing proposal must take into account the situation of the country, region and river basin.

Box 6

CONCLUSIONS AND RECOMMENDATIONS OF THE II WORKSHOP FOR MANAGERS OF RIVER BASIN AUTHORITIES IN LATIN AMERICA AND THE CARIBBEAN ON FINANCIAL ASPECTS OF RIVER BASIN AUTHORITIES

- Modern legislation must specify the need to determine the value, price, and scales of charges for water, taking into account the fact that water is not only a resource and a socioenvironmental factor, but also an economic good.
- To determine the economic value of water it is useful to use the market as a mechanism for allocating rights and financial contributions. It should be borne in mind that this principle is not absolute and that the market for water rights must be regulated by the State.
- It is more efficient to meet the need for financial resources to support river basin authorities than to provide the same resources in order to alleviate the consequences of a negative impact caused by the lack of such management.
- In many of the countries of the region, major weaknesses in existing legislation make it difficult to establish sources of financing which are clear, transparent and sustainable in the long term. The main weaknesses in the system of financing of the water sector are not solely a matter of charging for water use as such, but also have to do with deficiencies in supervision and pollution control, water resources conservation, and monitoring the effects of extreme natural and other phenomena.
- In practically all countries of the region, water users are willing to pay for water-related commercial services. Furthermore, in some countries there is a growing belief that payment should be made for water use or for activities which cause externalities, and that the funds collected should be used to finance water management activities.
- Some countries of the region have already implemented or are implementing systems of charges for water use, there are similar proposals in other countries, and many countries already have the elements that would be needed for the possible implementation of such systems.
- The basic charge which is used for maintaining a water management entity at the river basin level should come from a fixed, permanent source, contributed by water users and by all the inhabitants of the river basin. Charging for contamination will only be feasible once systems are in place for direct or indirect measurement of contamination, which may take over 10 years; a simple system of charges should therefore be used initially.
- Multilateral financial assistance institutions should expand their activities to support the creation of water management organizations at the river basin level.

Source: ECLAC (1997), *Report on the Second Workshop for Managers of River Basin Authorities in Latin America and the Caribbean*. Santiago, Chile, 11—13 December 1997, LC/R.1802, 1 September 1999, Santiago, Chile.

IV. Creation of river basin organizations in Latin America

Establishing river basin organizations is the first step to achieve tangible goals in reducing the deterioration of water resources and their catchment areas. Even a brief study of the demography of river basin organizations in the countries of Latin America and the Caribbean shows, however, that creating and running such organizations is not easy. The countries of the region still face sizeable obstacles to the creation and operation of river basin organizations. Proposals along these lines still encounter stiff opposition, often due to rivalries between different agencies or because of conflicts with local governments. Even many of the organizations that have been in operation for quite some time face strong opposition. New organizations emerge and existing ones collapse in almost the same numbers.

Probably the most important factor that slows the creation of river basin organizations and hampers their operation is the lack of clarity about their roles (which generates sources of potential competition with other authorities), their economic viability and the methods which will be used to fund them. It appears that proposals sent to legislatures or debated in public are neither based on sound analysis nor sufficiently detailed.

In spite of the mentioned problems a large number of river basin organizations will be created in the region in the near future. This means there will be huge demand for training and co-operation activities to put them into operation. At present, there are little resources available to carry out these supporting actions. Today governments must rise to the task of advising a huge number of river basin organizations all at the same time, enabling them to equip themselves, mainly in a private-sector environment, with staff, communications, operations and control systems.

Although sizeable networks do now exist for issues relating to integrated water management, there are still very few regional studies available in this area and there is even less access to criteria, standards, procedures and working methods at the river basin level. It is therefore suggested, as part of the necessary task of improving multiple water use management, that funding be provided for an appropriate number of researchers to systematise and standardise the experiences available. This would be possible if a research or logistics centre was established for multiple water use management and integrated river basin management.

This centre could be set up with the support of interested organizations and could be attached to a university or some existing regional or international organization, in order to serve as an information centre both for regional water resources networks and for educational centres to support manager training for river basin organizations and multiple water use management, the centre should help move on from the present situation of dispersed information, confused ideas, a lack of follow-up on the progress made and the generally unstable procedures for training, consolidation and functioning of water management bodies at the river basin-level, and organizations for multiple water use management in some countries of the region.

A. History of the development of river basin organizations

A look back over the history of river basin organizations shows that many never become more than, at best, “co-ordination systems” which somehow manage to get some integrated river basin studies carried out. Historically, some river basin organizations were created for the specific purpose of sponsoring a study or plan, often carried out by groups of consultants hired temporarily for the purpose. In other words, many short-lived “river basin organizations” were only intended to direct the execution of inventories, studies, assessments or diagnoses, or draw up river basin development plans that were somewhat more complete than usual. Many of the studies on individual river basins that are currently available have been conducted by institutes of natural resources or by government ministries; these tend to produce the same results as the integrated river basin studies conducted by temporary river basin agencies.

In other cases, river basin organizations are, in practice, the management structures of investment projects corresponding to major hydraulics works in river basin. The names given to these organizations also tend to be varied, the most common being corporations, commissions or agencies, or simply “programmes” or “special projects” which have been responsible for executing hydraulic investment projects in one or more river basins. Likewise, there have also been many national-level projects devoted to a single type of activity, which have been responsible for simultaneous studies in many river basins. These are what have become known as “national programmes” such as those targeting flood control, watercourse stabilisation, soil conservation, drainage and land reclamation, watershed management or rural electrification, to mention a few examples. Some of these projects have been co-ordinated at river basin level, but most of the national programmes have been run independently.

With the increasing drive for local government participation in environmental management and the acknowledgement of the vital importance of broad public participation in river basin management programmes, a new focus has developed on the issue of managing rivers basins and water bodies that are shared by urban areas and several local governments. Local officials have become the most recent “clients” in need of working methodologies on river basin management and recovery of watercourses, with the participation of the inhabitants of their administrative areas.

A variety of historical circumstances have brought about substantial progress in establishing and operating river basin organizations, such as the River Basin Councils in Mexico (see Annex 3) and the River Basin Committees and the Water Agencies in Brazil (see Annex 4). There are also other river basin organizations that have been in operation for several decades. In general, in the course of their existence they have undergone several changes of name, responsibility or degree of autonomy. None of

them, however, are guaranteed to survive unless they adapt to the changing situations in politics, the economy and demands of the population. Although the efficient operation of a river basin organization does not ensure its continuity, it does give it a certain degree of security in the face of the institutional changes that may occur in any given country.

Prior to proposing the establishment of a new river basin organization in a country it is, therefore, useful to analyse the historical development of similar organizations. It is a worthwhile exercise to look for explanations of why some of these bodies continue to exist years after their creation, while others have disappeared.

B. The long process of creating the legal framework for river basin organizations

The creation of formal institutional conditions for river basin organizations is at varying stages of progress in the region. Without a doubt, the best scenario involves national legislation serving as a regulatory framework for the process of creating river basin organizations while also providing for the possibility to adopt alternative approaches at state, provincial and regional level, in line with the country's political and administrative structure.

In federal countries, and countries with regions which have greater or lesser degrees of autonomy, the legal framework for creating river basin organizations is usually established at the respective administrative level (state, province or region). In some cases, the framework is jointly created by mayors who share a river basin or by simple agreements between the main users of water in these areas. There are also situations in which the national-level legal provisions come under legislation on decentralisation, environmental laws which include provisions on territorial organization, investment promotion legislation, laws on national investment programmes or projects, or other variations arising from proposals by different ministries or regional governments.

Transboundary river basin development agreements can also provide a basis for formalising the framework of river basin management. These agreements tend to be lasting, indeed much more so than agreements concluded at the national level. Some of the river basin organizations which have survived longest –albeit with some changes of name and responsibilities– are precisely those which come under international treaties involving bilateral or multilateral commitments, which can not be so easily ignored.

Another major catalyst –and technical factor– in stabilising and conferring legal status on river basin organizations are bilateral technical assistance agreements. These agreements have the virtue of providing a legal framework for the creation and operation of river basin organizations through agreements with multilateral financial agencies or with partner countries. This arrangement puts the respective organization in a better position to withstand at least one direct attack, which can come in the form of a change in management, a change in attitude by some official or the sudden structural and operational transformation of the public agency responsible for controlling it.

The process of providing a legal framework for any type of river basin organization is slow and many fall along the wayside. The fact that a law is passed to establish such an organization represents no guarantee whatsoever that it will be implemented. The approval of legislation is only a preparatory step, which must be made in parallel with many other actions, particularly in relation to organising and implementing the formulas needed to create and operate these organizations. For river basin organizations to become consolidated, they must also be given the capacity to raise their own funding, a basic issue so many times ignored.

C. Difficulties in establishing and operating river basin organizations

The establishment of river basin organizations very often faces strong opposition from some of the main users, sometimes from interinstitutional rivals and sometimes because they have to confront or compete openly with regional authorities. Many organizations which have been in operation for years continue to face the same set of conflicts and opposition. Not a few river basin organizations have succumbed to this problem, as the statistics of some countries show. The organizations which last longest are those which can rely on their own stable and secure sources of financing and, at the same time, are able to adapt to changing circumstances.

To establish a river basin organization it is therefore necessary to run several processes in parallel. It is strategically advisable to start by acknowledging any type of water administration that already exists in the river basin –whether this is a single sector user, such as irrigation, hydroelectricity or drinking water supply and sanitation, or various sectors– and involve them in the process right from the beginning. Many past failures or delays in creating river basin organizations are attributable to neglect of something as fundamental as this.

It is obviously essential to have agreements in place among the public institutions which are involved in water management. Conflicts between State agencies are very injurious to the process and often occur between ministries and agencies, even from the same sector, to the extent that one party may even boycott the initiative. Conflicts sometimes arise between local authorities or provinces and the central government for political reasons, especially if the mayor or governor belongs to the ruling party's opposition.

In general, most of the financial agents of major hydraulic works are guilty of a glaring lack of provision for financing the establishment of river basin organizations to operate and maintain the hydraulic works once they are built. This is usually considered to be allocable to current expenditure of the fiscal budget and not to project expenditure.

Conflicts over the creation of river basin organizations also arise because of the effects of existing legislation, or the lack of it. Sometimes an existing law that provides for the creation of a river basin organization is not flexible enough to allow it to achieve its purpose, for example: (it may establish conditions for the participation of actors, composition of boards or charges which are impracticable). In other cases, there is no legislation on which to base the creation of a river basin organization, afford it a legal framework or provide financial support.

The likelihood of finding positive solutions is even further complicated by the lack of economic data on the value of water use or of historical records on water management in each country, the dearth of information on the growth of conflicts over water development and the lack of clarity with respect to the roles of the different actors involved in water use, including government river basin management agencies, and inadequate knowledge of their true ability to adequately perform their responsibilities.

It is possible to conclude that only limited tangible results have been achieved in the field of integrated river basin management and in the administration of the river basin or at least its water resources. The gradual deterioration of water quality, the degradation of soil and vegetation in river basins, the overexploitation and pollution of groundwater and the general lack of control over water supply in river basins all provide evidence that integrated river basin management is not practised.

Initiatives in the management area aimed at improving the supply and quality of water are more often due to individual groups of users than to any authority. Spontaneous co-ordination efforts are also undertaken in the face of catastrophes such as floods or droughts but there is generally no traditional approach or school of thought with respect to the issue despite all the progress achieved.

D. Procedures for creating a river basin organization: a way forward

All river basin authorities should be established at once by a general water law, as in Brazil and Mexico and implemented on a step wise approach. They should cover the whole territory of the country. Their functions and responsibilities should be modest at the initial stage and gradually expand, as their capacity improves and as water users become convinced of the need to have such organizations. Experience of Mexico suggests that, although they can be created in a relatively short time, their consolidation usually requires a much longer period of time as well as a continuous support from the central government.

Thus, a start can be made by setting up authorities to manage the water of a river basin rather than river basin authorities proper, since fully-fledged river basin authorities have broader functions which are harder to reconcile with those of the regional development authorities and local governments. Water authorities should be only concerned with the management of the water and associated natural resources of the basin, and so will have fewer conflicts of authority with national or local government bodies. Obviously, it is essential to determine the exact nature of the relationship between the water management organization and the regional and local authorities. The role of local governments in water management should be clearly established, and functions and resources assigned to them.

The water authorities of a river basin should therefore be responsible, at least, for the co-ordination of multiple water uses and for the execution of actions of common interest, in order to protect and conserve water quality and forestall and control extreme phenomena. In practice, they should manage the supply of water resources in the basin. The actual establishment of each river basin water authority should be carried out gradually, under the terms of a general law, so that efforts and scarce resources can be concentrated to assist the organization of users in some river basins of priority importance, while experience is being gained in the matter.

Water users must participate from the beginning in the formation of the water authority of the basin to which they belong. This authority must be made up of users themselves and representatives of the local and State governments, and it must be backed up by a permanent technical team that will serve as its secretariat. The State can begin its activities by organising relatively small water management bodies for priority river basins. Already at the beginning of their operations these bodies should have a steady source of income, based perhaps on a landed property tax (for example, 50 U.S. cents per year for every US\$ 1 000 that a property is worth).

Such a body, which might be called an agency or corporation, should call upon the users to organise themselves by watercourses and canals in order to be registered as users and potential members of the water board or committee of the basin and to become eligible for technical support and loans (watershed initiatives). The formal registration of users, with details of the volumes of water involved, quantity, quality, location, flow regime, etc., could be carried out by private consultants, technicians and lawyers, suitably trained and recognised by the State. The formal registration of current uses of water and the establishment of water balances should be prior requirements for the granting of water rights.

Decisions on special charges and investments should be taken by the user representatives in conjunction with the other members of the water board of the basin. As the measurements of water quantity and quality become more complete, it will be easier to determine the best ways of levying charges, exacting payment for pollution, and allocating the costs and benefits of each project. With the funds collected in this way, the water authority of the river basin, in co-ordination with the public and private sectors, should gradually equip the basin with systems for measuring water quantity and quality, as well as carrying out studies and helping users in technical and financial matters.

E. How can the failure of river basin management processes be prevented?

Many attempts to establish water resources and river basin management systems fail because proposals for the creation of the pertinent organizations, whether in the form of authorities, agencies or any other body, are presented in a relatively superficial manner. Most proposals to legislatures fail to specify sources of revenue, ways in which the actors should participate, the costs and benefits involved, the role of the public and private sectors, adjustments that may be introduced for a particular category of river basins, feasible investment programmes and the form that relations with national and local authorities should take. All this casts doubts on the viability of the proposals.

Generally the aim is to give systems a “holistic” focus¹. Hence they should: (i) be economically efficient, self-sustaining and competitive; (ii) have a social orientation, promote social equity and be environmentally responsible; and (iii) involve both public and private sectors, provide for civic participation and take a conciliatory rather than an authoritarian approach. In essence, the objective is to create a superior body responsible for fostering sustainable development. Today, in Latin America and the Caribbean, the water issue is immersed in a series of plans relating to integrated environmental management goals, an aim which assumes that the capacity to manage multiple water use will be achieved as a by-product. For the sake of this idea, in more than one case the existing capacity for water management has been reduced in the process of adapting it to “integrated environmental management”.

Experience shows that the creation of any organization that performs at least some of the basic functions, such as preventing, reducing or solving disputes among water users, should be a gradual process. The initial step should be to gather information on: public policies in regard to water resources and the economy; the features of water resources and river basin management; the characteristics of water management systems and the actors involved; and the most appropriate methods of operation for public and private organizations responsible for managing water and natural resources in a river basin.

Viewed from this perspective, it may be very useful to analyse policy declarations in terms of a methodological sequence which seeks to direct management procedures towards sustainable development (see Annex 2). It is suggested that in order to execute actions, it is necessary to: (i) identify the actors involved in the management process; (ii) analyse the actors' criteria (policies, principles, etc.); (iii) identify any problems relating to these criteria; (iv) identify what the actors' objectives are; (v) define the spheres within which it is hoped to attain these objectives; (vi) identify constraints on the attainment of these objectives; (vii) propose solutions for overcoming these constraints; (viii) decide on the strategies to be applied in order to achieve solutions; (ix) design programmes and projects for carrying out the selected strategies and evaluate them; and (x) execute both one-off and ongoing programmes and projects.

In accordance with this sequence, policy formulation takes place mainly at the stage when criteria for action and the actors' objectives need to be specified. These criteria are for the most part declarations of intent. By contrast, policies for executing actions can only be formulated once the solutions and strategies have been designed. Thus, water policy formulation needs to be undertaken step by step, in a systematic way, so as not to overlook aspects critical to successful implementation.

Water policy formulation in the countries of the region has seldom been carried out in a rigorous way. Generally speaking, policy formulation is ad hoc, and does not follow any established procedure. Water policies in the region have at various times emphasised the preparation of plans, the formulation of laws, the creation of new entities, and so on. However, it is a matter of concern that the vast majority of these proposals are not properly harmonised. The measures taken in this context are piecemeal, their

¹ There is a tendency to adopt new terms such as “sustainable”, “holistic”, “integrated”, “interdisciplinary” and so on, believing that such goals will be accomplished by “miracle”, without having to transit all the necessary steps and time needed to reach them.

objectives limited to, for example, avoiding inconsistency with an economic system, reinforcing other laws, mitigating specific conflicts that arise from time to time among users, satisfying the demands of certain groups of voters or facilitating a particular decentralisation project. In such circumstances, the water policies formulated are normally incomplete. For example, decentralisation in some countries has led to profound contradictions between development policies and water policies, with the result that river basin organizations attached to the central government sometimes find themselves subordinate to two or even three authorities, because the river basin under their control has been divided by regional boundaries.

Water policies should fit neatly with national development policies, usually not available or changing every time but it should also be pointed out that both water resources and processes to develop them have certain features which, if neglected, give rise to huge contradictions (see Annex 7). The unique features of water as an economic resource demand, if not a dominant role for the State, at least joint management by the State and users of supply at the river basin or interconnected system level. This is the only way to resolve any conflicts that may arise, to make resources available to deal with shared problems and to control externalities, natural monopolies and other aspects that require regulation.

Because the consequences of water management policies in force are often unknown, it is difficult to come up with way to improve them. In other words, if there is a lack of information about how water development policies are currently working (causes and effects), it is hard to decide what to do to make them more effective. Many countries do not maintain an up-to-date register of laws dealing with water resources and river basin management. Countries also sometimes lack a register of users of river basin or water systems, as well as an inventory of studies on each system or of investments made in hydraulic works in each basin. It is not known to what extent policy declarations and official rulings on functions are implemented in practice. A large number of government agencies do not have sufficient resources to perform the tasks they are set. Until now, most water policies that stem from changes in economic policy remain little more than declarations or policies of intent. In many cases, without any deeper analysis, policies of intent have become laws of intent, and this has generated serious gaps, especially in terms of instruments to implement the laws. In several cases, the spirit of the policy bears little relationship to the provisions of the law or to the results it achieves.

F. Factors to be considered in the creation of river basin organizations

In principle, it is possible to correct the disjointed and poorly based manner in which management solutions for improving natural resources use are usually put forward. Since this article deals with bodies at the river basin or watershed level, the most salient aspects relating to these management systems are presented below.

The main factors conditioning the structure of a natural resources management body at the river basin level are: (i) the size and the ecological, climatic, geomorphological and physiographic features of the basin; (ii) the organization and level of development of local governments, the main types of users and their political power and representativeness, and their form of participation in local government; (iii) the degree of knowledge of the natural elements and resources of the river basin, the length of time that water records have been kept, and the level of knowledge of the functioning of the ecosystems; (iv) the prevailing organization of management in the river basin, by management levels (scientific-environmental, economic-productive, technico-regulatory and politico-social); (v) the endogenous and exogenous actors operating in the river basin (their number and socio-economic features); (vi) the legal aspects of the possession or use of the natural resources, properties, etc., and the way in which users are currently grouped in the river basin; (vii) the level of equipment of the river basin in terms of roads, communications, transport and other forms of services infrastructure; (viii) the possibilities for the participation of other bodies in management and the degrees of co-ordination and operational capacity (with the legal system, the police, research and training, laboratories, the construction sector, etc.);

(ix) the level of public and private activity in the river basin (existing bodies and functions of both endogenous and exogenous actors); and (x) the economic enhancement of the natural resources found in the river basin, as well as the variety of natural elements not yet economically valued (bio-diversity, scenery, exclusiveness, etc.).

The aspects which are influenced by the above factors and which also give its special nature to a river basin body include the following: (i) the functions of the body (co-ordination, supervision, planning, execution, administration, consensus-building, consultation, control, etc.), together with other attributions connected with whether or not it has the faculty to impose decisions for the settlement of disputes among water users in the river basin; (ii) the sources of finance to which the management body has access (property taxes, water charges, fines for pollution, public treasury, regular payments, project funds, donations, sale of services, etc.); (iii) the location, size and equipment of the management body (offices, transport equipment, computer facilities, information systems, etc.); (iv) the type and number of staff and the internal organizational structure, which will reflect the complexity and type of management conflicts encountered in the river basin; (v) the rules for its operation and functions and the annual budget required for the functioning of the body and for investment in projects; (vi) the degree of autonomy with respect to the State and the board of management of the body, to which the head of the body must be answerable in respect of the management results; (vii) the degree and form of participation of the actors involved in the management of the river basin or affected by such management (water parliament, river basin committee, etc.) in respect of which it is important to know their composition and the relative weight of their participation; and (viii) the status of the body as compared with the other bodies operating in the river basin, for example: (its capacity for co-ordination and control and its leadership potential).

The size of a body responsible for directing integrated actions in a river basin must be determined in accordance with the above factors. This by no means exhaustive list of aspects that must be taken into account seeks to avoid situations where the formulation of proposals to improve the work of public or mixed bodies responsible for the management of the environment, natural resources or water alone is based, as has been customary in the past, on hunches, emotional reactions or political expediency rather than on rigorous analysis. For example, customary actions include proposing the establishment of a committee to study the situation and issue findings; putting forward a plan, preferably a “master plan”; changing the names of the relevant public bodies; separating or dividing institutions or parts of them; moving offices; changing the heads of departments every time there is a change in the top authorities; creating new posts or authorities of trust; ordering a commission which enjoys the confidence of the top authorities to change the legislation in force; placing all the responsibility for management on the shoulders of users and abandoning the responsibilities of the State, or vice versa; requesting support from some international agency or bilateral aid through a project; requesting a line of soft credits or bilateral donations; inviting groups of experts to attend workshops or seminars to discuss the salient questions and engage in lobbying; modifying the scope of environmental management, and decentralising or centralising management authority.

Each of these measures may be potentially excellent, but in order for this excellence to become a reality it is necessary to comply with a number of requirements, and this is rarely done. These requirements include the following: (i) recommendations must be properly based on analytical studies which take account of the existing situation and all the aspects involved in making a change in the management system; (ii) the moment at which the proposal is made must be politically suitable and must be decided upon in accordance with the interests of the country; (iii) the actors participating in the water management systems must be aware how important and necessary it is to co-operate in order to ensure that that water resource is managed in an integrated manner; (iv) the users themselves must be capable of financing the management process with their contributions; and (v) specific tasks must be assigned, and the agreements reached among those involved in the various levels of water management must be perfectly clear.

In order to assist in the correct formulation of proposals for the establishment of river basin management bodies, it is suggested that the questions posed in Box 7 should be answered first, as these are the kinds of questions that need to be settled before proposing the establishment of any river basin or watershed management body or putting forward solutions regarding bodies which have been set up but are not yet operative. In Latin America and the Caribbean there are many items of legislation which have become a dead letter because they were not fully or properly prepared, and the lack of clarity has given rise to negative reactions even before the system has come into being, especially when the relevant functions and attributions have not been properly spelt out.

This discussion can be considered as an introductory essay on the topic of public policies for fostering sustainable development and integrated water resources management through river basin management (see Box 8).

SOME QUESTIONS THAT MUST BE ANSWERED IN DESIGNING PROPOSALS FOR THE ESTABLISHMENT OF RIVER BASIN MANAGEMENT BODIES

- What type of body is it proposed to establish, according to the classification given in Table 1? Who is proposing to set up this body, and why?
- What kind of development has there been of other bodies at the river basin level in the country? What are these bodies, and what has been their experience?
- What would happen if some system of co-ordination of actions within the river basin were not established?
- Is it necessary or not to carry out some kind of co-ordination of the actions taking place in a river basin? Which actions should be co-ordinated? What actors are involved?
- Who is currently responsible for carrying out actions in the river basin that need to be co-ordinated?
- What would the actors concerned gain if there was co-ordination of some important actions in the river basin, such as multiple water use? Would the present situation change, and if so, how?
- What would the actors lose if a system were established for co-ordinating important actions in the river basin?
- What are the main obstacles currently preventing the introduction of a system of co-ordinated management of actions in the river basin?
- What type of system needs to be set up for co-ordinating these actions? A formal authority (corporation or agency), a technical office or secretariat, or a mere co-ordination committee?
- What kind of arguments do the various actors put forward in favour of or against the establishment of a system of co-ordination of actions in the river basin?
- What functions and attributions would such a system or body have? What would it do? How would the users of the river basin be represented? What legal weight would the various actors have in the decisions?
- What bodies currently exist, inside or outside the river basin, that can support the work of the proposed body (e.g., the legal system, the police, and rural extension and training services)?
- What system of financing would be established for the proposed body? Who will provide the resources for co-ordination: when, how much, and how? What system of collection will be used? What will the funds collected be used for?
- How will the body be organised? What type of information system will it use?
- What type of legal attributions will it have for enforcing the agreements reached on co-ordinated intervention in the river basin? Can plans be put forward for the execution of co-ordinated actions? How will their application be ensured?

Source: Axel Dourojeanni (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, Economic Commission for Latin America and the Caribbean (ECLAC) and Centro Interamericano de Desarrollo e Investigación Ambiental y Territorial (CIDIAT) and ECLAC (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, LC/R.1399, 21 June 1994, Santiago, Chile.

Box 8

SOME OF THE ASPECTS THAT NEED TO BE RESOLVED IF WATER MANAGEMENT AT THE RIVER BASIN LEVEL IS TO BE IMPROVED

- Formulation of policies on the granting of “water rights” as a means of promoting water markets; in other regions, water resources are increasingly being seen as public property, with the trend being to manage them using a more community-based approach for the benefit of *all users* and not just the holders of “water rights”.
- Definition of the respective roles of the State and the private sector in the management of natural resources, particularly water resources. Of particular importance are the strategies for the transfer to private users of water management tasks traditionally carried out by the State, bearing in mind that many users are still disorganised and lack an integrated river basin management culture.
- Definition of the way in which river basin entities will be organised in areas where the population of the river basin is largely marginalised, informal and poor, and lacking both traditional organizational structure and property rights.
- The economic and financial rationale and the identification of sources of financing for undertaking, at a minimum, co-ordination activities among water users in a river basin. It is important to note that water resources management at the river basin level, if performed properly, is a complex task. River basin organizations must therefore be assured of the continuity of their actions, particularly as regards technical staff, who must be suitably trained, well paid and sufficiently well equipped to carry out their functions.
- The process of identifying decentralisation and regionalisation mechanisms, as well as expanding the roles and skills of local governments, remains at an early stage in many of the countries of the region. Water management organizations at the river basin level are dependant on whether the regional and local authorities are organised to participate in river basin committees.
- There is still no clear differentiation made in respect of “water management systems” at the national level. Currently there are no true “water resources associations” or “higher councils” operating at the national or local levels. The roles of organizations overlap and interagency co-ordination is plagued by serious problems. All this makes it difficult for river basin organizations to operate, as do loopholes in the law and disputes over budgetary authority. Consequently, it is necessary to clarify each institution's role in water management at the national and regional levels.
- In order for river basin organizations to function, various institutions need to work efficiently. The comptroller's office, the judiciary, the police, the civil defence organization and the banks are just some of the exogenous actors that could be mentioned in this connection. Where such institutions are marked by inefficiency, a lack of resources or corruption, each river basin organization must take action directly or insist that each institution perform its functions properly.
- Another key aspect is the need to standardise and update registers of water users along with measurement and assessment of water use. Until registers are updated to show allocation of water rights as well as information on water measurement and distribution systems, little can be done to improve the distribution and regulation of water quantity and quality; it would be worse still to grant water rights in the absence of such information.
- Many other issues need to be addressed, including: ways to respect the traditional water management systems of long established indigenous communities; methods of involving new districts in water management tasks; the possibility of setting up municipal watershed systems; the overhaul of training programmes on the topic of river basin management; and, in general, the need to exchange experience on legal, economic, scientific and social matters.

Source: Axel Dourojeanni (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, Economic Commission for Latin America and the Caribbean (ECLAC) and Centro Interamericano de Desarrollo e Investigación Ambiental y Territorial (CIDIAT) and ECLAC (1994), *Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas*, LC/R.1399, 21 June 1994, Santiago, Chile.

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Annexes

Annex 1

Recent publications of the Natural Resources and Infrastructure Division on river basin management

Principal publications on river basin management

- “*Gestión de cuencas y ríos vinculados con centros urbanos*” (“*Management of rivers and river basins linked to urban areas*”) by Axel Dourojeanni and Andrei Jouravlev (LC/R.1948, 16 December 1999, available in Spanish only, about 180 pages). This publication deals with situations of conflict that arise over the use of water and of the river basins that supply population centres, and over alterations to water courses as a result of human settlements. It analyses different modalities of river basin management and devotes particular attention to its operational aspects, with emphasis on the participation of local governments. Guidelines for setting up river basin organizations are also presented. Options for funding these organizations are suggested as well as guidelines for valuing the environmental services provided to urban areas by watersheds. An analysis of technical options for river basin management emphasises alternatives for watershed management for drinking water supply and for managing water courses that pass through urban areas. The book also highlights the need to rehabilitate water courses, for their high value in

conserving biodiversity, providing human recreation, mitigating the effects of flooding and controlling water pollution. The publication makes reference to several river basin management situations in Latin American countries and the United States. It includes annexes on decision-making tools for the rational use of water in cities and technical specifications to serve as inputs for managing multiple water use at the river basin level. The text is based largely on material compiled by the authors on consultancy missions, contributions from professionals to water-related events, case studies and personal experiences. An extensive list of bibliographical references is provided. This book compiles and classifies information that is usually dispersed and difficult to access.

- ***“Políticas públicas para el desarrollo sustentable: la gestión integrada de cuencas”*** (“*Public policies for sustainable development: integrated river basin management*”) (LC/R.1399, 21 June 1994, available in Spanish only, about 230 pages). Public policies aimed at co-ordinating measures to promote human development using the area of a river basin as a basis for management have diverged in their approaches and evolution from one country to the next in the Latin American and Caribbean region. None the less, the subject has regained currency since 1990, when the countries of the region seriously set about tackling the issue of achieving sustainable development by reconciling economic growth, equity and environmental sustainability. The river basin and water in particular play a very important role in permitting the participation and integration of the actors involved in development and in the attainment of the goals of environmental sustainability. Such participation makes for a convergence of regional and local levels and, in relation to specific cases, also highlights the dilemmas to be resolved in the privatisation of natural resources, the role of the State and the public sector, and the role of the local and regional levels in the management of natural resources such as water, wildlife, native woodlands and natural ecosystems. Within this context, this paper seeks to provide some considerations for formulating coherent public policies aimed at achieving sustainable development goals based on river basins with public participation. The main motivation for bringing together in a single study the findings drawn from the accumulated experience of over almost 30 years of research in river basin management sprang from the renewed interest in the subject displayed by both national and regional authorities in connection with the organization of river basin agencies. Various legislative bills are under consideration and others have already been adopted which support the establishment of such agencies. The reasons for introducing such legislation are essentially to do with the increasing competition for water and the ever more catastrophic impact of natural phenomena on human life and the economy. Moreover, the environmental issue ultimately demands specific and practical responses which can only be provided through satisfactory management systems. This paper brings together material previously prepared and presented by Axel Dourojeanni and the Natural Resources and Infrastructure Division in connection with numerous events and technical advisory missions related to river basin management and also contains previously unpublished materials. In addition to these material, new topics were incorporated with regard to the historical development of water resources administration, river basin legislation, the comparison between the development of river basins and that of regions, the basis for the organization and financing of river basin agencies, etc. The aim of this paper is to provide basic material for future research. It has the merit of ordering material which is usually dispersed and therefore difficult to obtain by persons working in the field of river basin management, while at the same time presenting a previously unpublished outline of the various approaches to the subject of river basins and indicating gaps in information and research. It is intended merely as a modest first attempt, but nonetheless a very vital one, to order the material and tackle the subject in a systematic fashion.

Other publications on river basin management

- **“Informe del III Taller de Gerentes de Organismos de Cuenca en América Latina y el Caribe (Buenos Aires, Argentina, 16 al 18 de noviembre de 1998)”** (“*Report on the III Workshop for Managers of River Basin Organizations in Latin America and the Caribbean (Buenos Aires, Argentina 16–18 November 1998)*”) (LC/R.1926, 3 August 1999, available in Spanish only, about 30 pages). This document contains a summary of the debates, together with the programme and list of participants of the Third Workshop for Managers of River Basin Organizations in Latin America and the Caribbean. The central theme of the workshop was the experience and evolution of river basin organizations in federal countries, experiences and progress in the creation of river basin organizations, the formulation of master plans and guidelines, and experiences of participation in water management. The report also contains an annex on Mexico’s experiences in setting up River Basin Councils, and another one on the proposal by the Natural Resources and Infrastructure Division of ECLAC to analyse the advisability of creating a logistics centre or system to support the initiatives arising from programmes and projects for integrated river basin management in the countries of the region.
- **“Report on the Second Workshop for Managers of River Basin Authorities in Latin America and the Caribbean. Santiago, Chile, 11–13 December 1997”** (LC/R.1802, 1 September 1999, available in English and Spanish, about 50 pages). This document contains a summary of the debates, together with the programme and list of participants of the Second Workshop for Managers of River Basin Authorities in Latin America and the Caribbean. The central objectives of the meeting were: (i) to analyse the legal, institutional and financial aspects of the creation and operation of river basin organizations; and (ii) to acquire and systematise knowledge of successful experiences in the creation and operation of such bodies and facilitate its application in the region. Efforts were also made to make progress in elaborating technical specifications and designing procedures to create and operate such entities. The discussions focused on the following issues: (i) progress in the creation of river basin organizations in the region, and the outcome of the second General Assembly of the International Network of Basin Organizations (INBO) (Valencia, Spain, 2–4 October 1997); (ii) the outcome of the first Workshop for Managers of River Basin Organizations in Latin America and the Caribbean (Rio de Janeiro, Brazil, 4–6 December 1996) and systematisation of information on river basin organizations; (iii) options for the financing of river basin organizations, with particular reference to organizational, political, legal and administrative conditions needed for this financing to be made effective; (iv) experiences in the creation of river basin organizations and their evolution in the countries of the region; (v) experiences in forms of financing of river basin organizations and economic and financial justification and legal framework for their financing; (vi) formalities and legal requirements for the application of “river basin master plans”, experiences in their formulation and available conceptual models; (vii) progress, difficulties and strategies in the creation of river basin organizations in Brazil and Mexico, and discussion and sharing of experience, with particular emphasis on preconditions for creating and operating such bodies; (viii) experience in creating river basin authorities in countries outside the region.
- **“Reflections on territorial strategies for sustainable development”** (LC/G.1944, 18 March 1998, available in English and Spanish, about 20 pages). Natural resources management cannot be dissociated from the territorial context. Ecosystems are physical and biological realities to be found in specific geographical spaces and whose equilibrium can be disrupted by human actions and/or natural processes. One of the main attributes of natural capital is that it is, or may be, localised, unlike other forms of capital, which can and must be independent of location. Despite all the advances of modern technology, which reduce the importance of location, ecosystems, by virtue of their fixed territorial nature, are characterised by specific physico-biological realities that have inescapable implications for environmental management. In this study, a few

suggestions are made for improving environmental management at the territorial level, with practical contributions for strategy design. Environmental management includes a wide range of measures encompassing large geographical zones, so that it is preferable to have decentralised systems in order to stimulate the local management capacity required for measures to be sustainable and operational. The role of private and public sector establishments participating in this process should be clearly and explicitly co-ordinated so that national policies may be implemented with support from the whole community and so that conflicts of duties between the different agents of each management territory may be avoided.

- **“Creación de entidades de cuenca en América Latina y el Caribe”** (“*Creation of river basin entities in Latin America and the Caribbean*”) (LC/R.1739, 10 July 1997, available in Spanish only, about 30 pages). The main aim of this paper is to highlight the complex issues involved, as well as describe some of the reasons which make it difficult to implement policies for multi-purpose water resources management at the river basin level in Latin America. The paper suggests a system for the classification of river basin entities and examines the most common disputes and ways of resolving them, with a view to setting up and consolidating these organizations in the countries of the region. One of the most frequent requests made by Governments is for suggestions and support to help set up a national or regional institutional framework capable of guiding actions in favour of sustainable development. The reforms currently being introduced to water-related legislation serve to improve water management systems, formally establish water management agencies and legalise the formulation and implementation of river basin management plans. Legislation on sustainable development of natural resources should seek to combine the functions of water use allocation, regulation, monitoring and long-term planning that the State ought to perform with the advantages of private participation. The document suggests a series of activities for assessing the situation with respect to river basin management in the region, including a questionnaire to determine whether the creation of such entities would be feasible, and technical specifications to streamline the information available on individual river basins.
- **“Planes y marcos regulatorios para la gestión integrada de cuencas”** (“*Plans and regulatory frameworks for integrated river basin management*”) (LC/R.1487, 23 January 1995, available in Spanish only, about 20 pages). In Latin America planned water use in river basins is once again in vogue. There are two fundamental reasons for this trend: greater competition for water and the realisation that environmental considerations need to be incorporated into decisions. The need to develop plans entails strengthening or creating river basin authorities in a number of countries. One of the first tasks of such authorities is to formulate master plans. The report points out that in addition to the technical aspects, it is essential to develop and agree on principles and standards and the procedures for approving such master plans in order to give them legal and regulatory force. The paper also examines the questions of why water use planning is now, despite trends towards privatisation and freer markets, gaining an acceptance that it did not have during the 1970s; how water users have managed without water-use plans; and what damage has resulted from the lack of advance planning. It emphasises that planning should cover only what is possible and necessary; that water users should participate in decision-making; that it is essential to set up a good system of information; that there should be well-defined and legal procedures for reaching decisions; and that the decision-making process should be public.
- **“Sharing responsibility for river basin management”** (LC/R.1365, 7 February 1994, available in English only, about 20 pages). This paper analyses the possibilities and alternatives for participation of all users in the management of river basins in Latin America and the Caribbean. Particular attention is paid to the formation of participative institutions as an important means of achieving effective decentralisation of water resource management. The paper analyses the

region's experience in this regard and evaluates the attempts in many countries to decentralise water management, with special reference to environmental management.

Publications on management procedures for sustainable development

- ***“Procedimientos de gestión para el desarrollo sustentable”*** (*“Management procedures for sustainable development”*) by Axel Dourojeanni (*Serie Manuales* N° 10, LC/L.1413-P, August 2000, available in Spanish only, about 370 pages). This guide provides tools for guiding management processes for sustainable and equitable human development in clearly defined geosocioeconomic areas. The document is based on numerous development experiences in Latin American and Caribbean regions, microregions and river basins. The manual is based on a logical sequence of steps, originally designed by Axel Dourojeanni in 1976. The main process is based on the adaptation of the method for optimising decision-making known as “Goal Programming”, which is in turn a variation of linear programming. The main contribution of this manual is that, without resorting to formulas and mathematical optimisation processes, it deals in an orderly manner with the numerous issues and disciplines involved in the processes of managing human development in rural and urban areas. The sequence of steps co-ordinates four simultaneous decision processes: (i) implementing action; (ii) integrating disciplines, (iii) transactions among actors, and (iv) incorporating the environmental dimension. The first process targets economic development, the second is aimed at integration, the third at equity, and the fourth at environmental sustainability. The method is co-ordinated around a central axis of implementing action. This process is summarised in a series of 10 steps, which identify: (i) actors; (ii) criteria; (iii) problems; (iv) objectives; (v) evaluation and diagnoses of the surrounding conditions; (vi) restrictions; (vii) designing solutions; (viii) designing strategies; (ix) development of work plans, and finally (x) implementation of programmes and monitoring. The chapters of the guide explain each step of the sequence with examples applied to the territories defined by natural boundaries (river basins, coastal areas) and by political-administrative divisions (municipalities, provinces, regions and states). The manual is intended to offer guidance for the manager or assessor of development processes in determined areas for taking decisions with the participation of the actors involved in these processes. The method has the potential to be universally useful and, duly adapted, can be applied to help decision-making and strategy design at any level, from the municipality up to the national level. The manual is written to be used by both hands-on managers and by training personnel, as well as consultants who lend technical assistance in the areas and dimensions mentioned. The method is widely used in many Latin American and Caribbean countries, as well as in Europe, and several cases vouch for its practical usefulness and applicability. Particular advantages are the manual’s usefulness for encouraging public participation, planning and implementing interdisciplinary studies, guiding technical assistance work in rural and urban areas, helping to draw up reference frameworks for regional and river basin development projects and guiding the selection and evaluation of programmes and projects.
- ***“Management procedures for sustainable development (applicable to municipalities, micro-regions and river basins)”*** by Axel Dourojeanni (*Serie Medio Ambiente y Desarrollo* N° 3, LC/L.1053, September 1997, available in English and Spanish, about 70 pages). This paper summarises the method described in the document entitled ***“Procedimientos de gestión para el desarrollo sustentable”*** (see above).
- ***“Procedimientos de gestión para el desarrollo sustentable (un breve glosario)”*** (*“Management procedures for sustainable development (a short glossary)”*) (LC/R.1450, 20 September 1994, available in Spanish only, about 20 pages). This paper describes and explains the terms used in the document entitled ***“Procedimientos de gestión para el desarrollo sustentable”*** (see above).

Annex 2

Steps for river basin planning based on management procedures for sustainable development

Management procedures for sustainable development (applicable to municipalities, micro–regions and river basins) is a participative planning method developed by Axel Dourojeanni, which was originally published in 1989 by the Latin American and Caribbean Institute for Economic and Social Planning (ILPES) under the name of “*Guía para orientar procesos de gestión para el desarrollo en cuencas y microrregiones de alta montaña*” (“*Guide to orient management processes for the development of high–mountain river basins and micro–regions*”) (*Serie Ensayos* N° 89/05) (see page 51).

The method, here presented in highly condensed form, is a planning tool to assist in achieving the political goal of sustainable development within a well–defined planning sphere (e.g., a micro–region, river basin, municipality), using a highly participative approach. The method covers four interrelated management processes and describes how the different objectives of economic growth, social equity and environmental sustainability can be reconciled. The goal of a sustainable development policy is to achieve a dynamic equilibrium between the objectives of economic development (economic growth), social development (equity) and environmental development (environmental sustainability).

The process of executing actions

The chief engine of development is economic growth. In many countries experience has shown that without a minimum of economic growth it is impossible to reach greater levels of equity and environmental sustainability. Therefore, the process of executing actions, which is, in essence, what economic growth is about, is the pivotal element of the method. The process consists of a vertical sequence involving ten steps (see Figure 1):

- **Identifying the actors** (the individuals, groups or organizations actively or passively involved in management within the planning sphere) and choosing genuine representatives who will directly participate in planning as part of a negotiating forum.
- **Listing and ranking the criteria** (standards, terms of reference) that underlie the views of the actors. This determination is vital for understanding the positions the actors represent in the management process.
- **Listing and ranking the problems** (areas of disagreement) expressed by the actors on the basis of their needs and desires.
- **Determining and ranking the objectives** (goals) the actors would like to attain and establishing a target image (reflecting a synthesis of the objectives of the actors).
- **Making an inventory, assessment and diagnosis of socio-economic factors and environmental sustainability within the planning sphere**, thereby generating an abstract shared sphere (a multifaceted model of the planning sphere).
- **Comparing the target image with the abstract shared sphere to identify the constraints** (obstacles) that make it difficult to move directly from the actual situation to the desired situation.
- **Generating and ranking alternative solutions** (what to do?) to overcome the constraints that have been identified.
- **Developing strategies** (how to do it?) to implement solutions.
- **Drawing up a timetable for the actions to be taken** (operational programmes).
- **Putting actions into effect within the planning sphere** (real shared sphere).

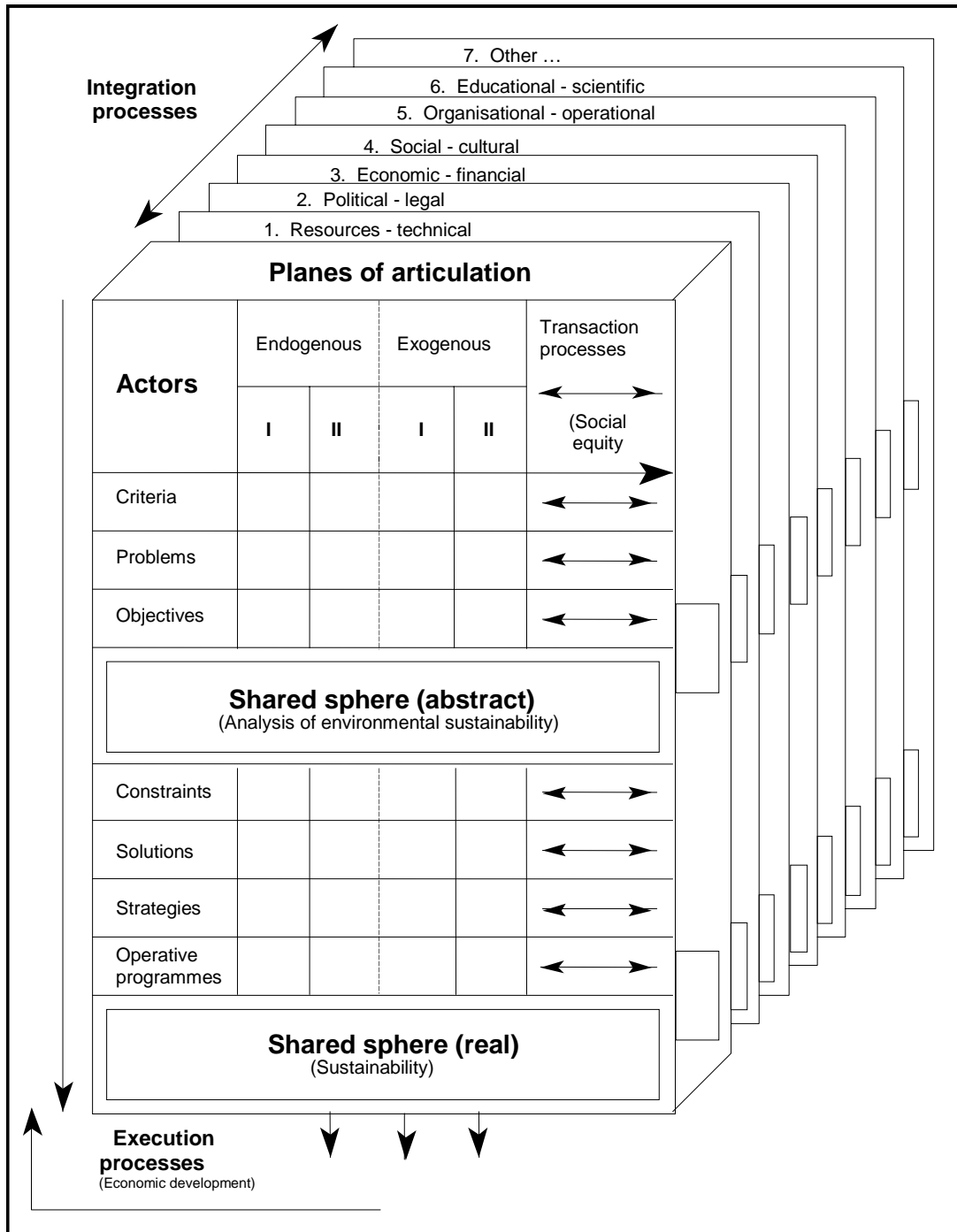
The process of transaction between actors

The method is based on a participative approach aimed at enhancing equity (equality of opportunity) in regional planning. To accomplish that aim, a mechanism is needed to facilitate active participation by all actors. The process involves organising and holding ongoing negotiations between actors.

Actors representing the various forces, both active and passive, within the planning sphere meet around a negotiating table to attempt to reconcile their differences as they work through the sequence of executing actions. The negotiations are co-ordinated by a support group, consisting of a multidisciplinary team.

It should be pointed out that the process of transaction between actors takes place through a cycle of consensus-building. Starting at a very general level of perception, at which the actors share their experiences in a round-table discussion, negotiations proceed, paralleling the action-execution sequence, until they reach the level of detailed formulation at which the definitive steps to be taken are formulated and agreed upon.

Figure 1
CONCEPTUAL AND OPERATIONAL FRAMEWORK OF INPUTS TO SUSTAINABLE DEVELOPMENT WITH SOCIAL EQUITY (THE “MAGIC CUBE”)



Source: Axel Dourojeanni (2000), *Procedimientos de gestión para el desarrollo sustentable*, Economic Commission for Latin America and the Caribbean (ECLAC), LC/L.1413-P, August 2000, *Serie Manuales* N° 10, Santiago, Chile.

The process of incorporating the environmental dimension

The goal of maintaining the environmental sustainability of a planning sphere is addressed by this process, which essentially consists of identifying and attempting to resolve in a group context environmental problems that are often not perceived as problems by actors individually. The sequence to be followed is:

- identifying the actors involved in environmental conflicts;
- analysing the environmental criteria proposed by the actors;
- identifying the environmental conflicts between actors resulting from environmental impacts;
- selecting and ranking the conflicts to be avoided;
- establishing land use priorities in order to manage environmental conflicts;
- identifying constraints in order to resolve environmental conflicts;
- developing solution options for overcoming constraints;
- designing strategies for applying technical solutions;
- designing programmes and projects for resolving environmental conflicts; and
- executing programmes and monitoring the environment on an on-going basis.

The process of integrating subject areas

The difficulty that actors with differing professional and cultural backgrounds may have in communicating with one another is a particular problem in participative planning. The process of integrating subject areas helps actors from different disciplines (e.g., economics, sociology, ecology) to find a common ground for communication, dubbed the plane of articulation. To do so, in the initial phase of negotiations the actors must acquire some basic multidisciplinary knowledge and define a common terminology to serve as the basis for effective negotiations.

As work progresses, an effort will be made to interweave the various disciplines to achieve a truly interdisciplinary undertaking. The idea is that each discipline involved in the project will incorporate the progress made by the others and build on it. Another way in which subject areas can be integrated is in economic terms. Economic integration entails an economic valuation of the factors that go into a particular decision, so that the negotiators have figures on which to base their decisions.

Source: Axel Dourojeanni (2000), *Procedimientos de gestión para el desarrollo sustentable*, Economic Commission for Latin America and the Caribbean (ECLAC), LC/L.1413-P, August 2000, *Serie Manuales* N° 10, Santiago, Chile and Axel Dourojeanni (1997), *Management procedures for sustainable development (applicable to municipalities, micro-regions and river basins)*, Economic Commission for Latin America and the Caribbean (ECLAC), LC/L.1053, September 1997, *Serie Medio Ambiente y Desarrollo* N° 3, Santiago, Chile.

Annex 3

River Basin Councils in Mexico

Background

The National Water Law, adopted in December 1992, provides for the creation of River Basin Councils, defined as bodies for co-ordination and consensus-building between the National Water Commission (CNA), the offices and units of federal, state or municipal agencies and representatives of the users of each particular river basin, in order to develop and carry out programmes and initiatives for improved water administration, development of water control works and the respective services and the preservation of resources in the river basin. Consequently, the River Basin Councils constitute the primary tool for integrated water resources management.

In compliance with the objectives, targets and strategies proposed in the 1995–2000 Hydraulic Programme, the Mexican Federal Administration set about establishing and developing River Basin Councils, as provided in the National Water Law. The process of establishing and developing River Basin Councils has been gradually consolidated over the last few years, and is now one of the most solid pillars of the structural changes underway in the water resources sector.

The organization of River Basin Councils acknowledges four territorial levels (river basin, sub-basin, micro-basin and aquifer) to co-ordinate the interests of the different users recognised in the National Water Law, those of non-governmental organizations and the three levels of government (Federal, State and Municipal). The legal and regulatory

basis of the River Basin Councils, their Rules of Organization and Operation, and the public representativeness provided by the State, Subregional and Regional Users Committees and Representative Assemblies, constitute a broad and stable organizational structure, which put them in a good position to conduct modern water resources management.

Strategies

In 1997 a general strategy was proposed to overcome the difficulties inherent in a process of public participation that was becoming increasingly complex, due both to the worsening scarcity of water resources and to the growing competition among users. The implementation of this strategy was planned as four successive and interdependent stages which, applied countrywide, gradually generated a synergy of participation that reached, firstly, all the spheres of the CNA and, later, state governments, different types of users and parties involved in the organised management of the resource. The stages of the strategy were denominated: (i) planning, (ii) establishment, (iii) initial consolidation, and (iv) operation and development.

Planning. This stage consisted of promoting and disseminating the principles which underpin ordered and integrated water management. This was directed at water users, state and municipal governments, universities and institutes of higher education, and social groupings such as Associations, Professional Associations, and non-governmental organizations. Emphasis was placed on the importance of the resource for life, economic development and the preservation of ecosystems. A substantial part of this stage consisted of developing an ordered and systematic representation of the prevailing water conditions in the corresponding river basins, the concepts and scope of the River Basin Councils and their related bodies. It also included identifying and holding initial discussions on the possible priorities of a preliminary programme of work for the river basin. The early work included classifying the water users in the river basin and its surrounding area, and forming a group to promote the River Basin Council, which was commended with the task of contacting a larger number of users and representative bodies in the river basin and inviting them to participate in the future work of the Council. The work of this stage concluded with the formal establishment of State, Subregional and Regional Users Committees for each of the uses provided in the National Water Law, and with an Assembly of User Representatives who would represent users before the corresponding River Basin Council. From the first activities of promotion and dissemination, to the holding of the Assembly of Users, this stage took between one and two years of uninterrupted work, depending on the degree of complexity and the geographical area covered by the respective River Basin Council.

Establishment. Together with the Users Spokespeople designated by the Assembly of Representatives, the second stage of creating and developing the River Basin Councils began. For each case, a formal invitation was issued to governments of the states which form part of the river basin, and the legal document (Establishment Act), which served to formalise the establishment of the Council, was jointly reviewed. This document indicates the first priorities to be addressed by each Council and requires the constitution of a Follow-up and Evaluation Group, which is responsible for implementing the decisions of the Council. The Group is also responsible for compiling and analysing new information and data needed to put to the consideration of the Council future plans, programmes and actions for water resources management in the river basin. The establishment of a River Basin Council is a stage that takes approximately 3 to 4 months, during which the agendas of the parties are reconciled, the Establishment Act is created and reviewed and the logistics needed for the formal public establishment are agreed upon.

Consolidation. This is the most important stage of the River Basin Council, since this is when the ultimate feasibility of the organization is determined. During this time the organizational and operational aspects are strengthened, as the Council's management capacities gradually develop, and it gains wider knowledge of water issues of the region, river basin and aquifer. This stage also includes the

organization of participative meetings and workshops involving diagnoses and proposals of solutions to local problems.

Each of the operating River Basin Councils has a Follow-up and Evaluation Group, which is essential for consolidation. All the parties involved participate in this Group, as well as any other actors who are both representative and relevant to the future water resources management in the river basin, such as the representatives of public and private agencies, and regional or local institutes and universities. Each Follow-up and Evaluation Group is encouraged to meet regularly (4 times during 1999 and monthly during 2000) to strengthen the organization's capacity for participation in planning, co-ordination and consensus-building, which are the substantive functions that the law confers upon River Basin Councils. The meetings analyse and examine relevant issues of general interest for water policy in each river basin or water region.

In addition, as part of the consolidation strategy, it has been possible to forge stable relations and communications between the upper structure of the River Basin Councils and large sectors of users, through representation based on Users' Assemblies for each river basin and on State and Regional Users' Committees for each type of water use. This has also served to increase the representativeness and legitimacy of the River Basin Councils. In this framework, 25 constituted Assemblies have a support network of more than 350 State, Regional and Subregional Users Committees.

The initial consolidation of River Basin Councils is estimated to take about 3 years. This time covers from the establishment of the Council to the first renewal of the Users Spokespeople.

Development and operation. During this stage the River Basin Councils reach full maturity. They achieve broad operational and financial autonomy, and therefore become self-supporting. At this stage they move beyond mere user representation to co-ordinate processes of information and consultation with users' base organizations. This is expected to take around 5 years to achieve. During this period, the River Basin Council sets up and discharges its first Water Agenda, which clearly sets forth priorities and relevant issues. The early activities come to maturity and, through consultations and consensus, develop into Plans or Programmes of Integrated Water Management for the River Basin. By now the River Basin Council has formed its auxiliary bodies, including the Follow-up and Evaluation Group; River Basin Commissions and Committees as required depending on the regional problems identified; Technical Groundwater Committees to deal with the over-exploitation of priority aquifers in the jurisdiction of the Council; and the Water Information and Consultation Centre also becomes operational.

Results

Over a three-year period a support organization was created for joint water management. Thus far it includes 25 River Basin Councils and 6 River Basin Commissions countrywide, 3 River Basin Committees and 38 Technical Groundwater Committees in the aquifers which display the worse degrees of over-exploitation. Each River Basin Council has a Follow-up and Evaluation Group which involves all the parties and meets regularly to analyse and discuss the river basin's water issues, in line with an established annual programme of activities. The Follow-up and Evaluation Group can create internal specialised working parties to provide technical support when it is required on very specific issues.

This support organization for joint water management has met on more than 300 occasions over the past 3 years. During 2000 the Follow-up and Evaluation Groups have held more than 100 meetings and have systematically examined issues which include the following: (i) rules of organization and operation for River Basin Councils; (ii) balances and availability of water by river basin and by aquifer; (iii) compilation and co-ordination of municipal, state and federal hydraulic investment programmes for 2000; (iv) information systems for water management; (v) presentation and analysis of the Public Register of Water Rights in the river basin; (vi) presentation and analysis of the regional hydraulic strategy diagnosis and guidelines; (vii) presentation of the citizen's water movement; (viii) presentation and analysis of the bases for hydraulic programming at national, regional and river basin level;

- (ix) identification of projects and programmes of hydraulic investment in river basins for 2001; and
- (x) review and consensus-building on river basin water problems and proposed solutions.

A substantial part of the programmes of activities carried out consisted of discussing and consulting with all the river basin councillors on the “rules” which currently regulate their “organization and operation”. Training workshops were also held on subjects such as water legislation and administration, conflict management and negotiation, strategic planning and other more technical areas related to the behaviour of surface and groundwater.

In summary, the achievements have been: (i) the establishment of River Basin Councils that are strong enough to survive the change of government and which have regulated organizational and operational bases, which should facilitate water planning and management; (ii) wider and better participation by users, based on water information and basic documentation; (iii) better integration of all the actors involved; (iv) regular, programmed training processes; (v) full assimilation of the concept of River Basin Councils and their role in water management by river basin, both by the institutions of the water resources sector and by water users; and (vi) stronger public and governmental support for the financial consolidation of the programmes.

Each River Basin Council will focus its attention on the issues relevant to each individual river basin, as far as its consolidation and maturity allows. Thus, while the Lerma–Chapala River Basin Council held its Fourth Ordinary Session in August 2000, at which agreement was reached on the bases for updating the river basin surface water distribution agreement, the River Basin Councils of the Yaqui–Mátape and Mayo Rivers in the States of Chihuahua and Sonora, and the Tuxpan and Jamapa Rivers in the States of Puebla, Hidalgo and Veracruz are just starting operations since their establishment in August and September, respectively.

Perspectives

At the end of the first stage of the process of creating and developing River Basin Councils, each of these organizations has a Basic Water Agenda that sets forth the problems and priorities to be addressed in the coming years; they also have Rules of Organization and Operation provided by the CNA, as provided in the regulations of the National Water Law, and they work on a first Draft Plan or Programme of Integrated Water Management for each of the country’s main river basins, which has to indicate objectives, medium– and long-term strategy outlines, and identify the main investment projects and programmes for the following years. All of this is, of course, widely discussed with the participants.

As the River Basin Councils begin to participate more widely and directly in the process of planning water uses in each river basin, the new forms of joint water resources management should provide: (i) a new order for administering and using water better; (ii) programmes that are better structured and more deeply rooted in the regional culture in order to improve: efficiency of water use, river basin conservation and management, management and regulation of over–exploited aquifers, care and culture of water and other issues relevant to individual regions; (iii) greater awareness of the shared responsibility of users and governments to resolve water availability problems and improve water quality; and (iv) new ways of financing the provision of water services and hydraulic infrastructure systems in the river basin and making them financially self-sufficient. In the medium and long term, the River Basin Councils are intended to be organizations with greater powers and resources and more management autonomy, which will co-ordinate the efforts of users, non-governmental organizations and agencies at the three levels of government to achieve water sustainability and contribute to the economic development of the regions in which they and their operations are based.

Over the last two years, the focus has been on getting the River Basin Councils established and on laying down the foundations for their gradual consolidation. Thus, the indicators for measuring their progress and achievements have been defined in quantitative terms according to the number of agencies set up and meetings held, as well as the observation and follow–up of key points of the process. As River Basin Councils mature and become consolidated, it is intended to provide follow–up and measure

performance on the basis of the objectives and targets indicated in the corresponding water management plans and programmes. This will entail the development of a new system of management indicators to provide a better reflection of the water situation in each river basin, in quantitative and qualitative terms. These indicators should signal how and to what extent progress is being made in the implementation of objectives and targets in terms of management, sanitation, efficient water use, river basin conservation and recognition of the value of water.

Source: Guillermo Chavez (2000), *Avances y perspectivas de los Consejos de Cuenca*, paper presented at the First National Meeting of River Basin Councils (Mexico City, Mexico, 25–27 October, 2000) and ECLAC (1995), *Agenda 21 and integrated water resources management in Latin America and the Caribbean*, LC/G.1830, 12 April 1995, Santiago, Chile.

Annex 4

River Basin Committees and Water Agencies in Brazil

In Brazil, responsibility for water resources management is shared by the Federal Government and the states. The Federal Government has jurisdiction over: (i) the lakes, rivers, and any water courses of any kind on lands owned by the Republic, or which water more than one State, serve as borders with other countries, or run into or from a foreign territory; and (ii) hydraulic energy potential. The federal, state and municipal governments are jointly responsible for environmental protection and pollution control, and the latter are also responsible for the provision of public services of local interest.

At the federal level, the *National Water Resource Policy Law* (Law N° 9,433 of 8 January 1997) provides for the creation of the River Basin Committees and the Water Agencies. The law stipulates that the River Basin Committees can act in the following spheres: (i) an entire river basin; (ii) the river sub-basin of any tributary to the principal watercourse of the basin, or any tributary of that tributary; or (iii) a group of contiguous river basins or sub-basins. The establishment of the River Basin Committees for rivers that are the property of the Union must be by act of the President of the Republic.

The River Basin Committees have the following responsibilities in their respective areas of action: (i) to promote the discussion of issues relating to water resources, and to co-ordinate the work of the entities involved; (ii) to arbitrate, as the first administrative recourse, conflicts relating to water resources; (iii) to approve the Water Resources Plan for

the river basin; (iv) to monitor the execution of the Water Resources Plan for the river basin and suggest the measures required for its goals to be met; (v) to propose to the State and National Councils on Water Resources which impoundments, diversions, catchments, and discharges are of minor importance for purposes of exemption from the necessity of obtaining an award of water-use rights, depending on the ownership of the water; (vi) to establish mechanisms for the receipt of fees for the use of water resources and suggest the fees to be charged; and (vii) to establish criteria for and promote the apportionment of the cost of multiple-use projects of common or collective interest. Decisions of the River Basin Committees may be appealed to the State or National Councils on Water Resources, depending on their respective sphere of competence.

The River Basin Committees are composed of representatives of: (i) the Federal Government; (ii) the States or the Federal District in which they are located, even if only partially, in their respective areas of action; (iii) the Municipalities in which they are located, entirely or in part, in their areas of action; (iv) the water users in their areas of action; and (v) civil water-resources agencies that have a demonstrated record of action in the basin. The representation of the executive powers of the Federal Government, the States, the Federal District, and the Municipalities is limited to half the total number of members. In the case of River Basin Committees that share in the management of basins of rivers that run along and across borders, the representatives of the Union must include one from the Ministry of Foreign Affairs. The River Basin Committees of basins whose territory includes indigenous lands must include representatives from: (i) the National Indian Foundation (FUNAI), as part of the representation of the Union; and (ii) the indigenous communities living or having interests in the basin.

The Water Agencies serve as the executive secretariats of the River Basin Committees. They have the same area of action as one or more River Basin Committees. The creation of Water Agencies must be authorised by either the National or the State Councils on Water Resources at the request of one or more River Basin Committees. The creation of a Water Agency is subject to the fulfilment of the following requirements: (i) the prior existence of the River Basin Committee or Committees; and (ii) financial viability ensured by fees for the use of water resources in its area of action.

The Water Agencies have the following responsibilities within their area of action: (i) to maintain an up-to-date register of water resources available in their area of action; (ii) to maintain a roster of users of the water resources; (iii) to collect fees for water use, under authority delegated by the grantor; (iv) to review and comment on proposals for projects to be financed from fees collected for water use, and transmit their comments to the financial institution responsible for administering these resources; (v) to monitor the financial management of fees collected for water use in their area of action; (vi) to manage the Water Resources Information System in their area of action; (vii) to enter into agreements and contracts for the financing and services with which to carry out their responsibilities; (viii) to prepare a budget proposal and submit it for review by the respective River Basin Committee(s); (ix) to arrange for the studies necessary for the management of water resources in their area of action; (x) to prepare the Water Resources Plan for review by the corresponding River Basin Committee; and (xi) to propose to the corresponding River Basin Committee or Committees: the classification of bodies of water according to their use, for transmittal to the appropriate National or State Councils on Water Resources, depending on their ownership; the fees to be charged for water use; the plan for the application of the fees collected for water use; and the apportionment of costs of multiple-use projects of common or collective interest.

At the state level, many states have their own water laws. All state level water laws provide for the creation of the River Basin Committees. The composition of the River Basin Committees varies from state to state. In some states only water users participate in the committees, while in other states the participation is extended to a much broader segment of the society.

At the local and municipal level, there is a tendency for the municipalities belonging to the same river basin to form intermunicipal river basin consortia or municipal associations in order to deal with water-related problems of common concern. The responsibilities of these entities are principally related to water supply and water pollution control.

Conclusions. The Brazilian experience with the River Basin Committees suggests that, in order to achieve success in their creation and operation, it is advisable: (i) to ensure the participation of water users and civil society; (ii) to avoid excessive regulation; and (iii) to establish them only where and when it is really necessary. They should be created, first and foremost, where there are potential conflicts among water users and where there is a local agenda with water-related problems highly positioned in the ranking of the most significant issues.

Source: Monica Porto; Rubem La Laina Porto and Luiz Gabriel Azevedo (1998), *A participatory approach to watershed management: the Brazilian system*; ECLAC (1995), *Agenda 21 and integrated water resources management in Latin America and the Caribbean*, LC/G.1830, 12 April 1995, Santiago, Chile and ECLAC (1996), *Progress achieved by the Latin American and Caribbean countries in the implementation of the recommendations made in chapter 18 of Agenda 21 on integrated water resources management*, LC/G.1917, 19 June 1996, Santiago, Chile.

Annex 5

Watershed management in the United States

A concept well known to natural resources managers, watershed management is gaining wider recognition. The principal reason for its rise to prominence is that many people from diverse groups, including researchers, policy makers, politicians at various levels of government, community groups and the private sector, believe that watershed management, with its co-ordinated, voluntary and consensus-based solutions, helps them first recognise and then address problems and areas of mutual concern.

In watershed management, a watershed is a geographic designation as well as an administrative unit:

- From the geographical viewpoint, a watershed is defined by the flow and movement of surface water. Watersheds exist at different scales or levels, depending upon a particular point of reference. In other words, there are watersheds within watersheds, with smaller watersheds nested within larger ones. At the same time, various human activities may occur within a watershed, and these may affect its natural conditions. This means that, to understand the conditions of a watershed, more than a natural flow of water needs to be examined.
- From the administrative viewpoint, as an hydrologic system, a watershed provides a more comprehensive and rational setting to resolve water or natural resources problems, particularly

those having to do with water quality or quantity or wildlife habitat, than areas defined by political boundaries, whether national, state, provincial, municipal, tribal or local. The fact that watersheds can be subdivided into various sized segments enhances their value as an appropriate and workable management unit.

Of course, watershed management is not the only strategy for defining an area or spatial unit for the purpose of managing its natural resources. Ecosystem management also considers the broad regional context as the appropriate framework for addressing natural resources issues. The ecosystem management approach generally is based on the occurrence of biota in an area. Debate is ongoing about whether watershed or ecosystem management better provides a framework for managing natural resources. Both, however, share a commitment to move beyond single-issue problems viewed on a micro scale to a holistic consideration of broader regional patterns, along with a consideration of the complex interaction of humans with the environment.

Watershed management in history

In the United States, the historic roots of watershed management are evident in the period from late twenties to early forties. These roots are essentially twofold:

- The first was the establishment of the Tennessee Valley Authority (TVA) as an effort to improve regional water development and management. Its creation reflects the premise that river basins should be managed as a unit and that institutional arrangements are needed for integrating the management of land and water resources.
- The second was the establishment of conservation districts, part of a national programme administered by the United States Soil Conservation Service (renamed in 1994 the Natural Resources Conservation Service), which encouraged land and water integration at the regional level. Partnerships among public, private and government interests to control erosion at the watershed level gained prominence during this period.

In Latin American countries, in contrast, interest in watershed management is of much more recent origin. Its historical roots can be traced back to the seventies when students from several Latin American countries returned from their studies in the United States and organised pilot watershed management projects.

The concept of watershed management evolved over time, absorbing new ideas and concepts and reflecting shifts in thinking. The initial version of watershed management stressed managing watersheds as a water augmentation strategy, with a prime strategy for increasing the supply of water being to manage the vegetation within a watershed. This version of watershed management was common in the semiarid areas of the United States in the forties and fifties, while in Latin America this point of view prevailed in the seventies.

Contemporary watershed management

Defining watershed management as practised today is not an easy task. While some describe it as a catchall phrase, in its accommodation of different activities, others refer to it as an evolving approach with many variations. This notwithstanding, sufficient agreement exists among many watershed management advocates to provide a description of some basic working premises that underlie the concept and its application today.

Modern understanding of watershed management involves recognising the complex workings of a watershed. Its principles are based on an awareness that land use, soil and water are all connected. This land and water connection is an essential factor to consider when managing watersheds. Further, the strategy acknowledges that issues overlap, that streams are to be studied along with lakes and wetlands;

that land uses and community activities are tied to water quality; that groundwater is connected to surface water; that wildlife habitats depend on the condition of water and land; that upstream is linked to downstream; etc.

Recognising the complexity of the natural world this modern approach to watershed management reflects awareness that human affairs are not conducted in isolation, nor do they play out as separate and independent acts, but often have implications beyond the immediate situation, to affect other actions and in turn to be affected by them. Human involvement in a watershed, therefore, can have far-reaching implications. As a result, watershed management is concerned with such human-related activities as agricultural practices, urban runoff, private property interests, beneficial uses, sustained economic vitality, net environmental benefit and water quality concerns, especially non-point source pollution.

In sum, managing a watershed is a strategy to promote its co-operative use among various, even competing interests, while at the same time protecting the watershed's natural or environmental values as well as public health.

People working together

Watershed management involves the participation of stakeholders, that is individuals, organizations, and agencies that are involved in or affected by water resources management decisions for a watershed management zone. Stakeholders' interests in watersheds involve political, social and economic considerations. Assembling a watershed management team to speak to these varied interests can involve representatives of all levels of government, public interest groups, industry, academic institutions, private landowners and concerned citizens.

Broad stakeholder involvement has various implications. With power shared at different levels, new types of governance can be established. The reliance on specialised agencies characteristic of the initial approach to watershed management too often resulted in inconsistent and fragmented efforts that often conflicted, overlapped or otherwise were insufficient. The result frequently was a form of institutional paralysis known as decision-making gridlock.

By working together and sharing information, stakeholders agree on ground rules to guide their participation in management activities. They come to an understanding about their particular roles and mutually agree on adopted priorities and shared responsibilities. With such broad and varied participation, the focus on environmental issues is thus broadened to also include consideration of social and cultural goals such as economic stability and quality of life issues.

Watershed management often involves conflict resolution. The consequences of personal confrontations and legal entanglements have been shown to be damaging and costly. Collaboration now is generally viewed as the best way to resolve conflict, especially with regard to environmental issues.

Further, watershed management accommodates the interest of local stakeholders who often have complained of being left out of the policymaking process. All stakeholders are partners in adopting watershed management goals.

Conclusion

For a number of reasons, watersheds provide an appropriate framework for managing natural resources. The most obvious reason is that watersheds are naturally defined surface areas and provide a focus for observing the effects of human activities on land and water. Managing a watershed often means managing human activities to lessen any damaging effects on natural processes.

At the same time, an acceptance of watersheds as managing units implies less reliance on bureaucratic techniques; instead, the workings of a watershed determine what decisions are made and

what actions are taken. At least in theory, natural watershed processes, rather than bureaucratic structures, provide the rationale for management plans. Part of the appeal of watershed management is an awareness that watersheds are in fact systems of flowing water, and that an effective application of its principles begins with an appreciation of river flow.

Source: Joe Gelt (1998), "Managing watersheds to improve land and water", *Arroyo*, Volume 10, N° 3, August 1998 (available at <http://ag.arizona.edu/AZWATER/arroyo/103.html>).

Annex 6

Regional Autonomous Corporations in Colombia

Law N° 99 of 22 December 1993 created the Ministry of the Environment and the National Environment System. The latter is organised as follows: Ministry of Environmental Affairs, Regional Autonomous Corporations, and districts or municipal governments. The Ministry of Environmental Affairs is the agency responsible for setting guidelines for the management of the environment and renewable natural resources, and is charged with fostering a relationship of respect and harmony between human beings and nature and designing policies and regulations aimed at the recovery, conservation, protection, development, management, and utilisation of the country's renewable natural resources and environment, in order to ensure sustainable development.

The law establishes the Regional Autonomous Corporations as public-service corporations, made up of territorial units that, on account of their characteristics, constitute a single geographical ecosystem or form a geopolitical, biogeographical or hydrogeographical unit. As can be seen, the river basin criterion is only one among several when determining the geographical jurisdictions of the Regional Autonomous Corporations. They are endowed with financial and administrative autonomy, their own assets and legal status. Their sources of funding are, among others: pollution charges, a charge for water use, the environmental percentage of property taxes and transfers from the electric power sector. They are responsible, within their jurisdictions, for managing the environment and renewable natural resources, with a view to promoting sustainable development in keeping with the overall principles embodied in the law.

The Regional Autonomous Corporations are directed by a corporate assembly, made up of all the legal representatives of the territorial units in the jurisdiction. The corporation's administrative body is the executive council, made up of the governor or the governors of the departments in whose territory the corporation operates, a representative of the President of the Republic, a representative from the Ministry of the Environment, no more than four mayors from municipalities in the territory of the jurisdiction, two representatives from the private sector, one from the indigenous, or ethnic communities, traditionally settled in the territory, and representatives from non-profit organizations that are registered in the area of jurisdiction of the corporation, and whose aim is to protect renewable natural resources.

Source: ECLAC (1995), *Agenda 21 and integrated water resources management in Latin America and the Caribbean*, LC/G.1830, 12 April 1995, Santiago, Chile.

Annex 7

Physical and economic attributes of water resources

Mobility

The hydrological cycle of rainfall, absorption, run-off and evapotranspiration determines the nature of the water resource. Water is a fugitive, both in time and space, and elusive resource which flows, evaporates, seeps, precipitates, and is transpired without regard to private property rights or administrative and national boundaries. The fugitive and elusive nature of water hampers the identification and measurement of the resource, and makes property rights relatively more difficult to establish and enforce than in most other natural resources. For these reasons, water has many features of a common property rather than a private property resource. In most countries of the world, water users are rarely accorded ownership rights to the sources of surface water, such as rivers, lakes and large reservoirs, rather water rights are usufructuary in that water users are given rights to access and use such water only for beneficial and socially recognised withdrawal or instream uses.

Variability and uncertainty in supply

The nature of hydrological cycle determines water supply, which is variable in time, space, and quality, and its peaks usually do not coincide with the high demand periods. Storage facilities are often needed to smooth out supplies. The mitigation of problems associated with the

extremes of the probability distributions of availability (e.g., flood control) has many public good characteristics (i.e., low subtractability and low excludability). The variability and uncertainty in supply present problems in specifying property rights and impede efficient resource use by reducing the expected value of engaging in water-related activities. Since under conditions of uncertainty, deferred use does not guarantee future availability, institutions are necessary to establish the rules for diversion and storage.

Indivisibility

Water is “lumpy” (i.e., not perfectly divisible in terms of storage and transportation) and tends to be naturally concentrated into site specific common pools or streams. Investments in water-related infrastructure often entail high sunk costs. The large size and extremely long time horizons of some investments pose challenges for private sector provision. Significant economies of scale exist in water storage, conveyance and distribution. Water may be used for more than one purpose and water investments often produce joint products. This gives rise to economies of scope and also complicates pricing and allocation decisions. Because of economies of scale and scope, the delivery of water-related services has many of the characteristics of a natural monopoly, hence these services are generally supplied publicly or under regulation. Groundwater constitutes a notable exception in that economies of scale are relatively small and many supplies can therefore operate efficiently; it is in part for this reason that groundwater is developed largely by the private sector. On the other hand, since surface and groundwater commonly belong to a hydrogeologically integrated system, they must be managed, and their use regulated, in an integrated manner. Not doing so can create serious problems, provoke conflicts among their users and undermine the security of water rights. On the whole, indivisibility means that water allocation, management and use must involve group decisions and actions, rather than those of individual water users.

Diversity of uses

Water is used in a wide variety of ways. Among and between most types of users, water consumption is characterised by high subtractability, and exclusion of competing users is possible, indeed desirable (i.e., water has characteristics of a private good). In other instances, usually associated with amenity and recreation values, wildlife habitat and other instream uses, consumption is characterised by low subtractability and exclusion is difficult and perhaps undesirable (i.e., water has characteristics of a public good) giving rise to the “free-rider” problem (non-payers cannot be excluded from enjoying the benefits of water use). The public good nature of many of the uses of water is an important impediment to their provision by the private sector (provision of goods with public goods characteristics tends to fall below the social optimum when left entirely to an unregulated market) and provides a strong argument in favour of their provision by the public sector or under regulation. In addition, water is a multi-dimensional good (i.e., people derive value from multiple interdependent physical attributes of water which can be viewed as different products). This characteristic of water requires the inclusion of all important properties of water which determine its market value in the definition of use or property right or their regulation when one user's behaviour can affect other users.

Sequential use

Water in a given river, lake or stream is almost never fully consumed by any particular user, rather it is typically used by many and varied entities as it flows from upper watershed to its eventual destination. Water is a universal solvent and a major geomorphological transport mechanism. Changes in the timing, location, quantity and quality usually have their effect in one direction only propagating through return flows from water uses and other human activities in the upstream reaches to downstream water users. Because of this unidirectional feature of water, conflict resolution through negotiation or mutual control is usually ruled out, rather it requires complex allocative institutions for solution.

Interdependency among users

The physical characteristics of water mentioned above cause a high degree of interrelationship among water uses and users which gives rise to pervasive externalities or third-party effects. Water resources are interconnected both quantitatively and qualitatively, so that how they are used in one place directly or indirectly affects other places and other users. Changes in withdrawals, consumption and return flows by one user usually have unintended direct impacts on the location, quantity, quality and timing of supply for downstream users. The interdependency among uses and users makes security in water rights (i.e., protection against intrusion by others) difficult to establish. Since use and transfer decisions often affect third parties (i.e., uses and users who do not directly participate in the water use and transfer in question but are nevertheless affected), a market system in water rights cannot perform efficiently without adequate institutional arrangements which force water users to consider the full opportunity costs of their decisions. This precludes simple property right systems and demands that these relationships be taken into account in the definition of property rights and in the regulation of their transfers. The existence of pervasive externalities and the need to provide protection to third parties imply that water rights lack the exclusivity of ownership which effective markets require. Most externalities are internalised within the river basin. This suggests a extremely useful role for integrated river basin management and river basin agencies.

Bulkiness

Since water is heavy and non-compressible, it is very expensive to transport, particularly if energy for lifting is required. It usually has a relatively low value per unit weight. Therefore, costs of transportation, storage and distribution tend to be high relative to economic value at the point of use, and usually, there are no national or regional transportation networks, such as those developed to transport more valuable and less bulky resources.

Availability of alternative supply sources

Although available water supply sources may differ in their critical characteristics (e.g., water quality, reliability, modes of delivery), all of them are substitutes for one another to some extent. As a result, most potential users have a wide range of alternative supplies of water (e.g., groundwater, conservation) and alternative technologies (thermal generation). Users can substitute labour, management or capital for water in many uses. On the other hand, there is little or no substitute for water for many important uses.

Conflicting cultural and social values

Even where economic efficiency might be best served by market allocation, other social and cultural goals may oppose the result dictated by pure efficiency considerations. This underlines the dualistic nature of water: as a commodity to be traded to maximise aggregate welfare through economic growth and as an essential but intangible attribute of the ambience of any society which is often central to the maintenance of its traditions and culture. In addition, some aspects of water use are often perceived as having important national defence, security-related, national integration, humanitarian and other aspects. The focus on the cultural and social values of water often obscures the fact that only its very small fraction is typically used for preserving life, with the rest being used for productive purposes, convenience and comfort.

Source: Robert Young (1986), "Why are there so few transactions among water users?", *American Journal of Agricultural Economics*, Volume 68, Number 5, December 1986; Robert Young and Robert Haveman (1985), "Economics of water resources: a survey", in Allen Kneese and James Sweeney (Editors), *Handbook of natural resource and energy economics. Volume II*, Elsevier Science Publishers, Amsterdam; and Marie Leigh Livingston (1993), *Designing water institutions. Market failures and institutional response*, Policy Research Working Paper N° 1227, The World Bank, December 1993, Washington, D.C.



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