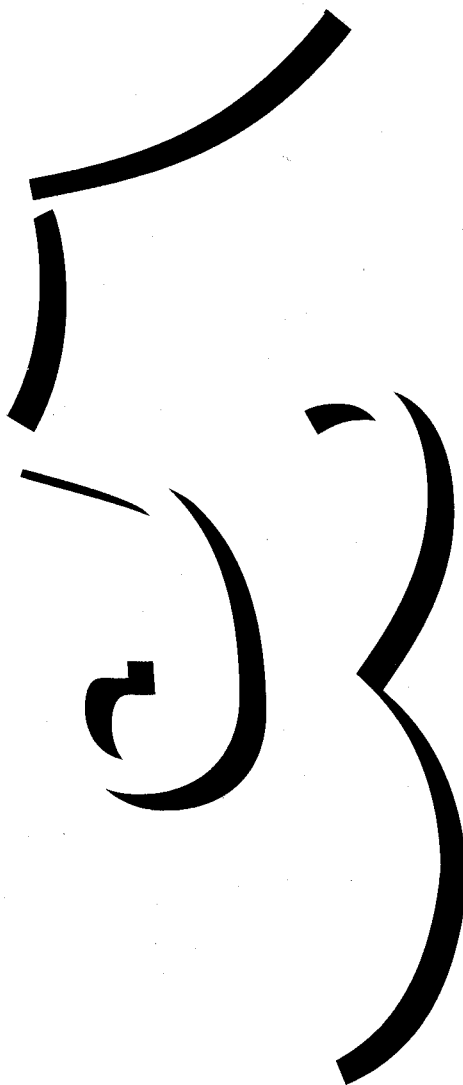


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# Water management *and river basins* in Latin America

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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 coordinating 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 public/private system which is not only 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 the region, 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 check pollution and manage the environment correctly. This article considers some of the essential elements which must be taken into account when proposing to set up such bodies, puts forward some concepts on management at the river basin level and identifies the various ways in which the subject can be approached, and offers some recommendations for improving policy formulation and the functioning of integrated systems for the management of water resources and river basins.

# I

## Sustainable development and river basins

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 realization 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 strips, 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 the municipalities) 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 organizing 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 coordination 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 concessions or rights, they nevertheless affect and depend on each other. The supply

usually comes from a common system, to which surpluses and effluents are returned. Surface, ground and atmospheric water resources, together with the areas of evacuation, 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 manage-

ment 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 coordinated 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 coordination mechanisms and, at the very least, a permanent river basin centre or authority.

## II

### Characteristics of water and watersheds

A watershed is an area which is defined by nature itself,<sup>1</sup> essentially by the limits of the run-off areas of surface water converging towards a single water-course. The watershed, its natural resources and its inhabitants have physical, biological, economic, social and cultural qualities which endow them with their own special characteristics.

Physically, a watershed 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 watershed 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, river basins are natural arteries for communications and trade integration, either along the rivers that run through them or the peaks 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.<sup>2</sup>

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 recognized, for example, in the explanation of the reasons for the establishment of watershed agencies in France: 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

<sup>1</sup> In the words of Guillermo Cano and Joaquín López, "God established the watersheds as natural limits of river basins. For their political and administrative needs, however, men have traced other dividing lines which generally intersect and do not coincide with the natural divisions" (Cano and López, 1976).

<sup>2</sup> A problem in Spanish is that there are no generally accepted terms which distinguish clearly between watershed and river basin, which are usually represented by the same term, "cuenca", possibly qualified by some clarifying adjective.

precarious balance, and the entire natural environment suffers as a result. Consequently, harmonious management of water resources requires: i) above all, recognition of the fact that a watershed or hydrogeological basin forms a single unit; ii) awareness that recognizing and preserving this unity is an essential condition for satisfying in the best possible manner the water demands of the different users; iii) definition of specific objectives appropriate to each area or territory, and execution of the works and

actions needed to attain such objectives; iv) 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 coordination of management processes designed to ensure sustainable development. Water management processes, however, involve their own forms of complexity.

### III

#### 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 coordinated 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 coordination among the users of a single shared resource, such as water, and above all facilitates monitoring of progress in 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 the municipalities are of prime importance. It must be clearly understood that in order to carry out river basin management processes successfully it is essential to coordinate 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 the municipalities, such as that carried out with the participation of 74 such authorities in the River Chicamocha basin in Colombia (Acero Suárez, 1993, pp. 13-17), have a much greater chance of success if the municipal authorities are responsible for the execution of some actions in the project. Likewise, a municipal 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 coordinate 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 coordination 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.

## IV

### Definitions and scope of management processes at the river basin level

Management at the river basin level has made a great deal of progress in the region, but in spite of these advances there is still no consensus on the name to be given to such management. The lack of clear concepts in this respect still militates against the exchange of experience among countries, leads to overlapping of functions, and above all hinders the formulation of policies and laws on this subject.

Table 1 summarizes and orders the concepts and terminology used in dealing with the subject of management at the river basin level in Latin America and the Caribbean. It has been laid out as a matrix relating the stages in such management with the objec-

tives of that process, defined in terms of the amounts of elements and resources covered by the management. In this way, it seeks to facilitate understanding of the actions that can be coordinated in a river basin and the objectives pursued through such coordination. It has also been considered useful to try to clarify some additional difficulties raised by certain differences in terminology between English and Spanish, for which purpose some terms are given in both languages. It is hoped that this attempt to clarify the terminology will help to secure a clearer understanding of the concepts behind river basin management objectives.

TABLE 1

Management at the river basin level: stages and objectives

Management stages	Objectives of management		
	Use and management of water resources of the basin	Use and management of all natural elements and resources of the basin	Integrated use and management of all elements and resources and of man-made infrastructure for the development of the basin
Initial stage	Studies and formulation of plans and projects	Studies and formulation of plans and projects	Studies and formulation of plans and projects
Intermediate (investment) stage <sup>a</sup>	Water resources development ( <i>Desarrollo o aprovechamiento de recursos hídricos</i> )	Natural resources development ( <i>Desarrollo o aprovechamiento de recursos naturales</i> )	River basin development ( <i>Desarrollo de cuencas</i> )
Permanent (operational) stage <sup>b</sup>	Water resources management ( <i>Administración de recursos hídricos</i> )	Natural resources management ( <i>Manejo de recursos naturales</i> )	Environmental management ( <i>Gestión ambiental</i> )
Watershed management ( <i>Manejo de cuencas</i> )			

Source: Prepared by the author.

<sup>a</sup> Investment in order to develop the basin with a view to using and managing its natural resources to promote human development.

<sup>b</sup> Operation and maintenance of man-made works and management and conservation of natural elements and resources.

The bodies responsible for each of the management actions in question may be known as corporations, companies, agencies, commissions, authorities, programmes or projects, directorates, organizations, boards or associations. The general functions and

legal attributes of each of these forms of organization are laid down in each country's legislation, to which must be added the specific organizational requirements of management processes and suitable provisions for facilitating public and private participation.

## V

### The evolution of management systems at the river basin level

The subject of river basin management has been associated historically with the main cultures and civilizations 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 water-courses, 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 organize 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, the evolution during the present century in Latin America of the approach to management for the coordination of actions in a multi-purpose river basin has been neither stable nor uniform. Management systems have been changing more and more, in an irregular manner, and in some cases –at least as far as water is concerned– organization tended to be better in the past than it is now.

To begin with, the coordination of activities at the river basin level was limited. Work was done at this level in order to deal with short-term problems or

specific or sectoral demands for water: permitting or improving navigation, supplying water for population centres or irrigation, controlling flooding, alleviating droughts and building hydro-electric power stations.

The next step involved operating and maintaining the works thus constructed. This form of management was limited to the actual systems constructed, and there was little interest in multiple water use or “river basin management” (i.e., managing the natural resources of the basin). Thus, various systems of water management at the river basin level arose in the region, most of which were only interested in the sectoral uses of the water, as in the case of irrigation (through, for example, Supervisory Boards in Chile and Irrigation District Technical Administrations in Peru).

Beginning in 1940, commissions (in Mexico) and corporations for the integrated development of river basins (i.e., for regional development at the river basin level) were set up. These corporations set out from the construction of water projects to embrace extensive areas under their jurisdiction and make investments in a number of sectors.

Much more recently (1970), the concept of “watershed management” appeared on the scene, mainly with the aim of reducing the deposition of sediment in existing dams and controlling landslides or flooding. Only in a few cases does this type of management cover all the natural resources of the river basin –flora, fauna, forests and land– with a view to their use and conservation. Mixed agricultural/forestry/stock-raising projects have aided progress in this direction, but they do not make up for the lack of a coordinated system of management of natural resources at the river basin level.

The environmental dimension began to be taken into account in Latin America somewhat later (five to



seven years after the 1972 Stockholm meeting). First came studies of the impact of various factors on the environment, and later environmental analyses. To a large extent, environmental management at the river basin level has not progressed past the stage of studies, and if natural resources (especially water) are not managed in a coordinated manner, it will be impossible to achieve true environmental management.

To sum up, then, coordination of action at the river basin level in Latin America has taken place in the following chronological order:

i) the question of water control and use in river basins is approached through the construction of water projects (water resources development);

ii) the question of the management of water in river basins is tackled (water resources management);

iii) there is then a direct transition to river basin development;

iv) the question of watershed management is taken up, especially with a view to controlling the erosion that affects existing dams, preventing landslides, and controlling spates;

v) there is then a direct transition to consideration of the question of environmental management.

What stands out in this evolution is that there has been an abrupt decision to coordinate (at least on paper) environmental management at the river basin and regional level,<sup>3</sup> without yet having fully coordinated the measures for the development and management of at least some of the main natural resources of a river basin, such as water.

The question of river basins has currently taken on new validity. It is hoped that the classification of

this matter and its review in the light of the past will further the proposal of suitable bodies for carrying out the management duties in each case, learning from valuable past experience.

In the 1990s, the combination of greater concern with the environment, the increasingly serious effects of natural disasters such as floods on man-made works, 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. The 1993 floods in the United States and Europe caused heavy losses, and the possible pollution of some lakes in Southern Chile could be a disaster not only from the ecological or emotional point of view, but also because it would cause serious economic losses (we thus see that this issue can affect less developed countries too). It would appear that it will be economic considerations, rather than environmental ones, which will finally induce politicians and Executives 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 where big investments in water projects have already been made for some reason.

## VI

### Recommendations for avoiding failures in water and river basin management processes

In order to deal properly with the various factors that affect environmental management at the level of river basins, natural resources, or that of water alone, it is necessary to refer to the current debate on the

roles of the public and private sectors. It is also necessary to take up the question of water policies and their links with economic policies and democratic participation. Only then will it be feasible to determine which are the most suitable management systems for the environment in general and for water as a part of it.

Failures in the establishment of management systems for water and river basins usually occur

<sup>3</sup> This is confirmed by the establishment in Colombia of Autonomous Regional Corporations (31) under the Ministry of the Environment (Act No. 99 of 16 December 1993). The function of these Corporations is to execute national policies on natural resources and the environment.

because of the relative lack of due consideration in the presentation of proposals for the establishment of the corresponding bodies, be they public enterprises, corporations, committees, agencies, etc. Generally speaking, the aim is to endow them with holistic qualities: they must be economically efficient, self-sustaining and competitive; they must have a social orientation, must promote equity, and be environmentally responsible; and they must be made up of representatives of both the public and private sectors, must permit community participation, and must be of a conciliatory and non-authoritarian nature. In the final analysis, all this means that what is sought for is a super-agency that will promote sustainable development. Creating such an agency is like trying to use genetic science to create an animal that not only provides meat and milk but also lays eggs and gives wool, while at the same time being pleasant and tolerant, in order not to cause political problems, and not eating much, so that it is cheap to maintain.

Experience shows that it is possible to move gradually towards the formation of a body which at least fulfills some of the basic functions, such as avoiding, reducing or solving conflicts between water users. In order to do this, it is necessary to be well informed from the start at least on the following aspects: i) economic and water-resource policies; ii) the characteristic features of water resource and river basin management; iii) the characteristics of water management systems and the actors involved in them; and iv) the most suitable forms of operation of a public or private body responsible for managing the water and natural resources of a river basin.

According to Irving Fox (1970),<sup>4</sup> there is no consensus on what is to be understood by "water resources policy". He notes, however, that such policies are usually characterized by three elements which determine how those resources are managed and used in a given society, namely: the basic rules, the organizational principles, and the basic procedures.

Fox does not actually define each of these characteristics: he merely gives examples. Thus, he considers that the basic rules may deal with such matters as assignment of water rights and user priorities, where appropriate, and the like. With regard to

organizational principles, an example could be the stipulation in a policy on water use that there should be a single body at the level of each river basin, made up jointly of users and the State, with broad attributions and autonomy for directing regionally integrated multi-purpose water resource projects: in other words, in policy formulation it would also be necessary to consider the organization of the management system for applying that policy. Finally, basic procedures would concern the means, steps or bodies for putting actions into effect: for example, it could be laid down that before granting water rights proof must be presented that the water resources actually exist, that there are no conflicts over use with other users, and that the water will be used for a given purpose and within a given space of time.

In order to be complete, then, a water policy should be as much one of intention as of execution, regardless of whether it falls under one or the other category. Thus, the difference would depend not so much on the content as on the detail in which it is spelt out.

In addition to the three characteristics mentioned by Fox, there is the need for policy declarations to be accompanied by the establishment of priorities and the indication, at least in outline form, of the policy instruments for putting the policies formulated into effect.

Policy declarations can also be analysed in terms of the methodological sequence selected to guide management procedures for sustainable development (prepared by A. Dourojeanni and included in ECLAC, 1993). This sequence is useful for guiding the formulation of water policies along lines which are a good deal stricter than those usually followed. It maintains that in order to carry out actions effectively it is necessary: i) to determine what actors are involved in the management process; ii) to find out what the criteria of those actors are (policies, principles, functions, etc.); iii) to identify the problems they raise in the light of those criteria; iv) to determine what their objectives are; v) to delimit the areas within which it is aimed to achieve those objectives; vi) to find out what obstacles stand in the way of their attainment; vii) to propose solutions for overcoming those obstacles; viii) to decide on the strategies to be followed in order to secure those solutions; ix) to design and evaluate programmes and projects for carrying out the selected strategies, and x) to carry out the programmes and projects.

<sup>4</sup> This study was presented by Professor Irving Fox, Associate Director of the Water Resources Center of the University of Wisconsin, at the meeting of the panel of United Nations experts in Buenos Aires (1970).

In accordance with this sequence, policy formulation is carried out primarily at the time when it is necessary to establish the action criteria and objectives of the actors. These criteria are mostly declarations of intentions. In contrast, execution policies can only be formulated when the solutions and strategies have been designed. Thus, the formulation of water policies is a process which must be carried out step by step, in a systematic manner, in order not to overlook aspects which are essential for their successful application.

The formulation of water policies in the countries of the region has rarely followed a strictly defined path. They are generally formulated because of short-term situations, without following any set procedure. As already noted, water resources policies in the region have in some cases favoured the formulation of plans as the mechanism for their implementation, in others the reformulation of an existing Act (not as the culmination of a process of formulation of water policies but rather as the beginning of that process), in other cases the establishment of new agencies, and so forth. It is a source of concern, however, that the great majority of these proposals do not fit in as they should, although systems of organization, laws and plans—to name only a few components of a policy designed to be executed—should interlink properly with each other.

In these circumstances, what is done is to adopt measures that are of a piecemeal nature or are simply designed not to clash with an economic system; to boost the application of other Acts (as in the formulation of the General Water Act in Peru, which was designed to support the 1969 Agrarian Reform Act); to settle specific and sometimes transitory conflicts between users; to satisfy certain electoral groups, or to fit in with some regionalization project. In these conditions, water policies are normally formulated in a subsidiary and incomplete manner.

Although these policies must back up national development policies, it must be remembered that both water resources and the processes of their use have their own special characteristics which cannot be ignored without entering into serious contradictions. Already in 1970, Irving Fox warned of the problems that are likely to arise when it is sought to associate water management with a free market economy without taking the special features involved into account. The special features of water as an economic resource demand—if not the leading participa-

tion of the State, as maintained by Fox—at least joint management by the State and users in order to administer its supply at the level of a river basin or interconnected system (see annex 1).

In a water system shared by various users, the services for satisfying different demands may be in private hands (drinking water, agriculture, hydro-power, etc.), but the management of the supply of water in the basin (including all possible forms of reuse) must be in the joint hands of users and the State. This is the only way of settling the conflicts that may arise, providing resources for avoiding common problems such as pollution and flooding, and controlling externalities (such as the effect of river flows on coastal strips adjacent to the mouth of the river). This principle also holds good with regard to the organization of a commune: although there are properties run by private individuals, there must also be a municipality which governs the shared areas and prevents private properties from giving rise to externalities which affect the rest of the inhabitants.

In some countries, regionalization has given rise to serious contradictions between development policies and those governing water resources. In Peru, for example, there have been a number of cases where the regionalization measures adopted by different governments have meant that some river basin authorities which previously came under the central government found themselves subject to two or even three regional authorities because the river basins they administered were intersected by the limits of several regions.

It is not easy to say in what way and to what extent the policies of a country condition water management processes. Since the effect that the prevailing policies have on water resources management is often not recognized, it is difficult to propose ways of improving them. In other words, if it is not known how the application of the policies currently guiding water use really works (cause and effect), it is not feasible to propose properly founded improvements.

In many countries there is no compendium of the laws governing the management of water resources and watersheds. Sometimes there are no registers of users by river basins or water systems either, nor is there any inventory of the studies made in either of these areas (Gómez and Dourojeanni, 1991). It is easy to find out the contents of policy declarations, organizational charts and official regulations on functions, but it is very difficult to know how far they will

be put into practice. A large number of public departments do not have sufficient resources to fulfill their tasks properly.

For the present, most water policies derived from changes in economic policies are no more than declarations: that is to say, policies of intention. It must be remembered, however, that very often, without any real in-depth analysis, policies of intention have been turned into laws—likewise merely of intention—resulting in serious gaps, especially as regards instruments for putting them into practice. In a number of cases there is no relation between the spirit of the policy, the letter of the law, and the final results of its application.

The purpose of a river basin management body forms part of the State's responsibility for watching over the natural heritage of the nation. A body of this type may be public, private or mixed, and it may assume various legal forms, but it is essential that it should operate efficiently and effectively, that it should serve its users while at the same time watching over fulfillment of the national environment laws, and that it should carry out its management functions with the participation of the various actors involved, including the municipalities located within the area of the river basin.

With regard to economic policies, river basin management bodies usually obtain their financing through the appropriation of part of the economic rents generated by the use of the natural resources of the region. The generation of these rents depends partly on the biological, physical and chemical characteristics of the natural resources which permit them to increase their biomass and maintain themselves

through their natural cycles. The use of hydropower, for example, represents the appropriation of a natural resource.

The natural resources economy is still an incipient field which, with time, will allow sounder decisions to be taken on the definition of sources of financing for management. As the World Bank (1993) points out, for example, water as a good takes on different connotations depending on the capacity to consume it or not (subtractability) and to deny a user access to it or not (excludability): it may be a public good if there is free access to it and is not consumed if one person's use does not prevent use by another, but it can also be a private good (for example, if it is in the swimming pool of a private house). It can be a toll good, as in the case of water for navigation; an open access good, or a merit good, as in the case of drinking water.

These different characteristics of water can give rise to different kinds of income for a body responsible for coordinating its use for multiple purposes. In order for this to take place, the body must have registers which enable it to measure the various uses of water and evaluate their profitability, and instruments for collecting income.

From the theoretical point of view, payment for use of the resource should not alter the rationale of the capitalist calculation of production nor distort the formation of the prices of the goods produced in the river basin. Since water is a factor of production, its use should be reflected in real terms in production costs. If this is not so, its long-term use becomes impossible, as there will be a tendency towards its depletion and destruction.

## VII

### Recommendations for improving policy formulation

There are some basic considerations that must be respected if it is desired to formulate policies for the management of the environment, of natural resources, or of water alone which have a modicum of coherence. If the policies themselves are not coherent, then neither will be the actions of the management bodies responsible for putting them into practice.

In principle, it is obvious that not every declaration of principles necessarily qualifies as a policy, whether of intention (politics) or of execution (policy proper). In order for it to qualify as such, it must contain certain basic rules, organizational principles, and basic procedures.

It is also necessary that a declaration of proposed changes or the announcement of new policies should

take clear account of the advantages and disadvantages of the application of the existing policies. In no event should a new policy make the situation worse or undermine the effectiveness of another recently announced policy.

It is also important that the hypotheses which form the basis for a policy of intention should be proved with rigorous exactitude, using for example the methods described in the sequence of management procedures for sustainable development (ECLAC, 1993). Fulfillment of this requirement is essential in order to move from mere politics to real policies.

In environmental matters (including water and other natural resources) it is necessary to understand the restrictions imposed by the behaviour and needs of the environment in general and water in particular, and to incorporate them in the declared water policies. The natural system does not change its behaviour simply because human society decides to change its type or form of government or its economic or trade system.

Beyond all doubt, declarations of environmental policy, and especially of water policy, must take account of the prevailing economic policies and the functions of the public and private sectors. This is vital for determining the policy instruments to be used and the type of organization needed to apply them.

In policy declarations concerning the environment in general, the management of natural resources, or that of water alone, it is necessary to specify what system of organization will be applied and above all what economic instruments will be used to make that system work, whether it be public, private or mixed.

One of the conditions demanded by the environment is continuity of action: environmental management systems must last longer than the term of office of a particular government. It is therefore necessary that policy declarations should be accompanied by a draft Bill or rules designed to give the management system the necessary continuity and ensure its financing, effectiveness, adaptation and legitimacy.

In order for environmental policy to be successful it must be understood by the population at large. In this respect, it is important to give the public details of those who took part in the formulation of the policy and those who will be involved in its sub-

sequent application, as well as the way in which decisions were taken. Clear details should also be given of the role of each actor and his relative part in the process of application and observance of policy instruments.

At a time when there is a trend towards the application of a social market economy, it is essential that the economic and environmental objectives should be mutually compatible. Both types of objectives can be attained at the same time, provided that the behaviour of the economic and ecological systems is clearly established and that suitable harmonization mechanisms are designed.

In order to enlarge on this latter point with regard to a single element, such as water, some ideas put forward in a study by Erhard-Cassegrain and Margat (1979) are reproduced below.

First of all, when dealing with water resources the reasoning applied with regard to the optimum economic yield differs from that corresponding to water use: the optimum economic yield in a market is obtained by giving full play to competition and rivalry, but the optimum economic yield in the multiple use of water resources is obtained through a calculated and reasoned objective process involving the participation and agreement of the actors taking part in it, including the State.

This does not mean that the application of economic instruments is not useful and highly important for attaining the objectives of optimum water use, especially at the sectoral level. Such instruments serve to correct and promote the efforts of users as a whole, and above all to obtain resources for combatting the effects of natural phenomena that affect all users, such as floods and droughts, for draining away rainwater from urban centres, for reducing pollution, and for avoiding misuse of the territory and its resources.

Demand for a natural resource such as water has a dual effect on its supply. On the one hand, water is extracted from the environment (rivers, wells) and used in various ways, while on the other hand it is returned to it in different amounts and qualities (to the same or another river or to the water table). This dual interaction does not apply to all the resources traded in the market, so that in the case of water it is not enough to consider only the efficiency of its extraction and use: the efficiency with which it is returned must also be taken into account.

As noted earlier, water management involves the handling of conflicts among users competing for the same resource, many of whom have no idea of the way they interact and thus mutually benefit or prejudice each other. Environmental management, and that of water in particular, must help to forestall and avoid such conflicts as far as possible by studying the interrelations of the actors and suggesting negotiations or environmental trade-offs among them.

In the formulation of environmental policies, especially with regard to water, a natural system such as an ecosystem or river basin or a resource such as water is often arbitrarily split up, for management purposes, by user groups; by the sectors responsible for its control; by consumptive or non-consumptive types of use; by the source where the water is obtained (surface or ground water); by sections or stretches of rivers, or by other criteria.

The natural system is thus arbitrarily split up, leading to the likewise piecemeal management of a naturally integrated system. According to Erhard-Cassegrain and Margat (1979), it is not enough to rationalize the delivery of water to each user in terms of quantity and quality: it is also necessary to take into account the way in which the user will return it to the environment (quantity, quality, place and time). The return of the resource can have negative as well as positive effects and vice versa: for example, a large flow of domestic waste water will reduce the concentration of chemicals due to liquid industrial effluents and will also serve to transport them.

The concept of "water economy" does not depend automatically on the reduction to the minimum of the amount of water extracted from the system or used in a given process. If the water is re-used in other processes, it may be more economical to use more water in the first process. Thus, for example, in some areas the use of little water for irrigation will result in higher costs and increase the content of salts in the ground, but if the water can subsequently be collected, treated and re-used, it could be more economical to use more water in the first process.

It is not enough merely to assign water use by sectors (domestic, agricultural, industrial): it is also necessary to take account of the interactions involved, since there is a conflict between each type of demand and the supply system (ground water for irrigation, river water for industry, sections of rivers for irrigation associations, extraction of materials

from the river bed for municipalities). This means arbitrarily splitting up the physical units of the supply system as a function of the different uses, as in the case of dividing up a river into sections assigned to different user groups but ignoring the implications of their interdependence along the whole river. In this type of approach, water demand is sometimes projected only in terms of types of resource supply (demand for ground water for the cities, demand for river water for industry).

Demand is almost always evaluated in terms of quantity and not quality, as though the two could be separated. It is forgotten that the two factors interact at each of the points where water is returned to the main system, and it is also forgotten that extracting or returning water involves changes in its quality and in the capacity of the environment to absorb certain pollutants.

The value of water as an input in a production process is usually assigned without taking account of the interactions that exist between its extraction, use and return. When a value is placed on water, for example, no cost is fixed as a preemptive measure to take account of the pollutants that will be emptied into a watercourse when a certain amount of water is returned, and no charge is made for the use of water as a vehicle and sometimes as a diluent for wastes in addition to its use in production processes.

The costs of negative external effects or externalities, such as the contamination caused by the use of water as a vehicle for wastes, are ultimately internalized in accordance with the principle that the polluter must pay. Usually, however, this rule is applied when an industry has already been damaging the environment for several years and users begin to complain. In order to avoid this situation, preventive actions are needed both in terms of collecting payment and in applying anti-pollution measures. Between the time when water is polluted and the time when action begins to be taken to cleanse it, there tends to be a period of inaction. What happens is that the authorities do not take into account from the beginning that the user is not only employing water in his production processes, but is also using it as a vehicle for his wastes. This use could be calculated and charged for from the beginning, for example by estimating the alternative cost to the factory of using trucks instead of water and watercourses to carry away its wastes.

This problem is getting worse and worse because water supply management systems, which are also fragmented, have no coordination machinery. Some bodies (such as Ministries of Health) deal with water quality, others (such as the municipalities or ministries responsible for the mining sector) deal with the extraction of aggregate for construction purposes, others are concerned with river defences, others with ground water, still others with the granting of water use rights, and so forth. The lack of coordination leaves many gaps in the management. The situation is also explained by the fact that many plans prepared by these bodies merely extrapolate the fragmentation in question. For example, each sector projects its own demand, but it does not consider the effects that this demand will have on the river basin, on supply, or on the various other demands. Consequently, very few proposals for reducing demand come from sectors which prepare their plans independently. All the sectors demand the maximum, and if they can they preemptively appropriate as many water use rights as possible. They fight not only for what they need today, but also for what they might possibly need tomorrow.

Thus, hardly any sectoral policy seeks to change demand trends by, for example, relocating industries to more suitable places: it merely tries to satisfy the demand. No provision is made for possibly acting simultaneously on both supply and demand, because there is no integrated management system which depends primarily on the users themselves and which can put forward measures that will be of benefit at the individual and collective level in order to achieve economies of scale.

When there are no integrated development policies, the technical rationale is confused with the economic one, which in turn is confused with the financial rationale. Instead of adopting a criterion with regard to the selection of objectives which serves to solve situations of competition (it should be

recalled that water management is basically conflict management), in the end criteria are adopted which are useful and sensible for individual sectors but make no sense for the whole, to such a point that they may end up causing bigger losses for the sectors themselves (higher costs for water regulation and catchment, for the control of extreme phenomena and for combatting pollution).

Efforts to maximize the economic and water-related benefits of each sector independently of the others militates against the achievement of maximum benefits for the whole, and the final result is economic, social and environmental losses for all. The situation becomes confused if the water economy is understood as a "material economy" of this resource. It would seem rational to save water and thus reduce consumption, and it would also seem rational to select the water supply solution which is cheapest in the financial sense, but these two concepts are contradictory and sometimes incompatible when seen as part of a single objective.

When there is no integrated management system it may also happen that the benefits generated by one actor for other water users (such as reduction of the effects of floods or droughts thanks to the construction of a hydro-electric power station dam) are not recognized or paid for, although those affected complain and sometimes obtain compensation when there are negative effects. Thus, water management and economic management must be considered from the top down, in an integrated manner and not piecemeal. If the analysis is only carried out in respect of separate parts, it may mistakenly be concluded that materially optimizing each separate water use will lead to optimum economy. In practice, however, the best economy will be obtained by analysing the system as a whole.

The most suitable economic management instruments can only be selected by taking account of this integrated nature of the system.

## VIII

### Recommendations for improving proposals for the establishment of river basin management bodies

In principle, it is possible to correct the disjointed and poorly based manner in which management solutions for improving natural resource 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 the municipalities, 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 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 basin, by management levels (scientific-environmental, economic-productive, technico-regulatory and politico-social); v) the endogenous and exogenous actors operating in the basin (their number and socioeconomic 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 basin; vii) the level of equipment of the 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 coordination 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 basin (existing bodies and functions of both endogenous and exogenous actors); and x) the economic enhancement of the natural resources found in the basin, as well as the variety of natural elements not yet economically valued (bio-diversity, scenery, exclusiveness).

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 (coordination, supervision, planning, execution, administration, consensus-building, consultation, control), 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 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); iv) the type and number of staff and the internal organizational chart, which will reflect the complexity and type of management conflicts encountered in the 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 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 basin: its capacity for coordination 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, make-shift measures, 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 decentralizing or centralizing 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 cooperate in order to ensure that that resource is managed in an integrated manner; iv) the users themselves must be capable of financing the management process with their contributions; 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 annex 2 should be answered first, as these are the kinds of questions that need to be settled before proposing the establishment of any 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.

## IX

### Future tasks

The most obvious strategy, when there is a lack of collective interest—either because of ignorance or because of fear of suffering the effects of yet another bureaucratic system—and there is a shortage of resources in the initial stage, is to establish river basin authorities on a step-by-step basis.

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. Water authorities are

only concerned with the management of the water and associated natural resources of the basin, and will therefore have fewer conflicts of authority with national or local bodies.

The water authorities of a river basin should therefore only be responsible for the management of multiple water uses and of the natural resources of the river basin, 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 organizing relatively small water management bodies for priority river basins. These bodies would have the features described earlier, but at the beginning of their operations they would 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 organize 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. The formal registration of users, with details of the volumes of water involved, quality, location, flow regime, etc., could be carried out by private consultants technicians and lawyers, suitably trained and recognized 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 use rights.

Decisions on special charges and investments will 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 basin, in coordination with the public and private sectors, should gradually equip the basin with systems for measuring the quantity, quality and periodicity of the water, as well as carrying out studies and helping users in technical and financial matters.

#### ANNEX I

### Private enterprise economies and water management

In countries which rely largely on private enterprise for the production and distribution of goods and services, it is generally assumed that market competition allocates resources and distributes goods and services in line with the general public interest. If this is so, then why should the governments of these countries need to establish a water resources policy? The answer is that even in cases where the private market works reasonably well as a resource allocation mechanism there are still a number of reasons which make necessary government action to ensure suitable investment in water resources and guarantee adequate supply and distribution of water and water-related services.

This is because *it is more difficult to determine ownership rights in the case of water than in the cases of most other resources*. The precise determination of such rights, however, is essential for the proper functioning of economic institutions under private enterprise. As water flows from one place to another (lawyers call it an "elusive" resource), and as this flow varies according to the changing hydrological conditions, the determination of ownership rights over water has raised knotty problems. In areas where water and its use are highly developed, it has been necessary to establish precise legislation governing water use rights. In order for such legislation to serve the public interest, it is necessary to take account of national aims and scales of values, and the legislation must be formulated in such a way as to serve those principles and values. To put it in a nutshell, legislation on water distribution must serve the aims of national policy.

Another reason why a private enterprise economy is not likely to lead to optimum results through the free play of market forces where water resources management is concerned is that *there are big economies of scale in water use and development*, so that competition among various units engaged in the handling and distribution of water is anti-economic.

Thus, for example, there is no room for companies or other bodies which compete with each other in the supply of water for family or agricultural use, and it is against all economic logic that there should be navigational canals or even electric power systems which compete with each other in the same region. In an unregulated private enterprise economy, however, competition is essential if reasonably good results are to be obtained.

A third factor that militates against the proper functioning of an unregulated private enterprise system in the area of water resources is *the importance of what could be termed the "external" effects of water use*. A dam located at some point in a river basin naturally influences the water flow and thus affects the costs and benefits of downstream locations. In order to derive the greatest benefits from hydroelectric power, the dams within a river basin should be planned and managed in such a way as to take these interrelationships into account. When a water flow is used to dispose of wastes, these "external" effects (pollution) may be harmful. Where various private enterprise units are involved in the use and management of a river system, these "external" effects, whether positive or negative,

may not be taken into account unless government action forces this to be done, yet if they are not taken into account it will not be possible to achieve efficient results.

There is also another reason why a private enterprise system is not in a position to attain optimum results without government action, and this reason is that *some of the services deriving from the use of water cannot be split up into units for purchase and sale in a competitive market*. Thus, for example, when a construction project is carried out to control the effects of spates, it will protect all property owners in a given stretch of the river, so it will not give owners the option of deciding whether they want to buy that protection or not. Likewise, in

the case of the recreational value of bodies of water, this value will benefit the public at large and cannot be bought and sold on the market.

The net result of the multiple physical and economic features of water resources is that, even in a private enterprise economy, a large measure of public intervention is needed if it is desired that water use and management should serve the aims and scales of values of society. In turn, government intervention must be subject to a number of policies and rules relating to social objectives on the one hand, and to the physical and economic characteristics of water resources on the other.

Source: Irving K. Fox, Problemas de política hídrica, *Recursos hídricos*, vol. 1, No. 3, Buenos Aires, 1970.

## ANNEX 2

### 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 coordination of actions within the river basin were not established?
- Is it necessary or not to carry out some kind of coordination of the actions taking place in a river basin? Which actions should be coordinated? What actors are involved?
- Who is currently responsible for carrying out actions in the river basin that need to be coordinated?
- What would the actors concerned gain if there was coordination 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 coordinating important actions in the river basin?
- What are the main obstacles currently preventing the introduction of a system of coordinated management of actions in the river basin?
- What kind of arguments do the various actors put forward in favour of or against the establishment of a system of coordination of actions in the river basin?
- What type of system needs to be set up for coordinating these actions? A formal authority (corporation or agency), a technical office or secretariat, or a mere coordination committee?
- 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 coordination: 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 organized? What type of information system will it use?
- What type of legal attributions will it have for enforcing the agreements reached on coordinated intervention in the river basin? Can plans be put forward for the execution of coordinated actions? How will their application be ensured?

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