WATERSHED MANAGEMENT CASE STUDY: LATIN AMERICA

Review and assessment of the status of watershed management

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Preface

On the occasion of the International Year of Mountains, and in response to the clear consensus reached by the international community regarding the need to ensure harmonious and sustainable development of mountainous areas and watersheds, FAO and its partners in the subject, undertook a large-scale assessment and global review of the current status and future trends of knowledge about and techniques for integrated watershed management.

The objective was to promote the exchange and dissemination of experiences on integrated watershed management techniques, identify constraints to the implementation and development of those techniques during the decade 1990 to 2000 and capture relevant new paradigms and approaches. The lessons learned from diverse experiences are being used to define a new generation of integrated watershed management projects.

Experts from four continents contributed to the assessment, which yielded four main outputs: i) a review of experiences in watershed management, based on questionnaires that were sent to active partners in the field; ii) substantive reports of four regional workshops in Nairobi (Kenya), Kathmandu (Nepal), Arequipa (Peru) and Megève (France); iii) four case studies from the Mediterranean basin, Nepal, Bolivia and Burundi; and iv) an international conference in Sassari, Italy.

Watershed management concepts and approaches were reviewed and different experiences assessed. The results of this exercise are presented in several documents, which include the proceedings of workshops and reports on the four case studies.

The conservation, use and sustainable management of watershed resources in order to meet the demands of growing populations have been a high priority for many countries over the past several decades. In this respect, integrated watershed management through people's participation has become widely accepted as the approach that ensures sound sustainable natural resources management and a better economy for upland inhabitants, as well as people living in downstream areas.

The present document is a case study written for the Latin American Regional Workshop on "Preparing the Next Generation Watershed Management Programmes and Projects", organized by FAO in Arequipa, Peru (15-17/06/2003). The aim of the workshop was to provide an opportunity to consider and discuss watershed management programmes and projects, their achievements, gaps and lessons learned since 1990. It also set out to define guidelines and new approaches for the next generation watershed management projects and programmes.

This case study is based mainly on national reports prepared with support from FAO by national coordinators of the Latin American Technical Cooperation Network on Watershed Management (REDLACH). Contributions came from sixteen countries, namely: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic Ecuador, El Salvador, Guatemala, Honduras, Panama, Paraguay, Peru, Uruguay and Venezuela. The study also reviews an FAO report on lessons learned from regional watershed management projects, as well as the results of information sharing and cooperation activities organized by REDLACH and other organizations concerned with watershed management issues. It takes into account results from the First and Second Latin American Congresses on Technical Cooperation and Watershed Management, which were held in Concepción, Chile (1990) and Merida, Venezuela (1994).

The case study also includes a description of activities, results and lessons learned from the FAO-implemented GCP/INT/542/ITA project "Participatory and Integrated Management of the Piraí River Mountain Watershed in Santa Cruz"(Bolivia), from 1992 to 2002.

The case study analyses the evolution and validation of conceptual frameworks and methodological approaches to watershed management, as well as concrete experiences, particularly in the period 1990-2003 as they arise from programmes and projects implemented in the countries surveyed. Lessons learned regarding approaches, strategies, legal and political frameworks, institutional arrangements, participatory mechanisms programme monitoring and assessment procedures are derived from this analysis.

Although each country has its own specific conditions and needs, the programmes and projects analysed share some common features and attributes. These are used to identify innovative approaches and appropriate strategies and to provide guidance for the next generation of watershed management programmes and projects.

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Acronyms

ASACAPI	Beekeepers' Association of Piraí River Upland Watershed
ASOPEC	Ecological Producers' Association
CAN	National Water Commission
CAR	Regional Autonomous Corporation
COHDEFOR	Honduras Corporation of Forestry Development
CONAPCHID	Permanent National Commission for Watershed Management and Protection (Ecuador)
DGRCS	General Directorate for Soil Restoration and Conservation
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
FNR	National Royalties Fund
FRCC	local revolving credit fund
GIS	Geographic Information System
INE	National Ecology Institute
NFF	National Forest Fund (Costa Rica)
NGO	Non-governmental organization
PLAMACH-BOL	National Plan of Watershed Management in Bolivia
PRA	Participatory rural appraisal
REBOLMIC	Bolivian Network for Integral Watershed Management
REDLACH	Latin American Technical Cooperation Network on Watershed Management
REDNAMAC	National Watershed Management Network (Peru)
SANAA	National Service of Aqueducts and Sewer System
SEARPI	Piraí River Flood Channelling and Control Service
SEMARNAP	Department of Environment, Natural Resources and Fishing
SERNA	Department of Natural Resources and Environment
TCP	Technical Cooperation Programme (FAO)
UNEP	United Nations Environment Programme
WM	Watershed Management

Introduction

In large areas of Latin America and the Caribbean, especially highly populated ones that are used for intensive agricultural production, there is an imbalance between agricultural development and natural resource conservation and protection. This induces the deterioration and degradation of natural resources and the environment. An FAO study on land degradation in Latin America and the Caribbean showed that 50 percent of the region is affected by severe or very severe levels of erosion.

Sustainable development depends on interrelationships among different environmental elements.[1] It allows a region to meet the requirements of its population. The use of natural resources is severely restricted by the fragility of many ecosystems, and this makes it necessary to reach a balance between intensive resource use and environmental conservation.

In the 1950s, the countries of Latin America and the Caribbean started to adopt the concept of watershed management (WM), including management systems that conserve natural resources while allowing sustainable use. In recent years, WM has evolved substantially throughout the region. However, no definitive analysis has been carried out with regard to the progress made and the necessary steps to be taken to improve future programmes and projects.

Considerable progress has also been achieved in WM at the global level, especially during the 1990 to 2000 period, when new approaches and methodologies to promote participatory integrated watershed management were developed. Here too, no clear picture has yet been drawn as to what works and what needs to be improved. A systematic review and assessment of watershed management strategies, their achievements and gaps is therefore a prerequisite for the further development of WM programmes. This assessment sets out to fill that need, placing particular emphasis on recent experiences.

This assessment is needed as the basis on which to develop innovative approaches and appropriate strategies in future WM development programmes. It responds to the various needs and characteristics of different audiences involved in WM at the global, regional and national levels. One of its important aspects was a series of workshops in the world's major regions.

The Latin American Regional Workshop was conducted with the broad objectives of promoting the sharing, dissemination and exchange of information on WM achievements and gaps and of supporting the development of effective WM through better designed and adequately implemented projects and programmes. The workshop set out to.

- assess and identify the nature and extent of achievements and gaps in state-of-the-art WM programmes and approaches in the region;
- identify lessons learned and principal issues emerging from past experiences in the region, with particular focus on the 1990 to 2000 period;
- identify guidelines for the formulation and implementation of the next generation of WM projects and programmes, with special focus on the role of effective WM in the conservation and sustainable use of water resources.

To support this effort, FAO obtained additional information on the state of WM from its Regional Office for Latin America and the Caribbean and conducted national studies in each country in conjunction with the Latin American Technical Cooperation Network on Watershed Management (REDLACH). This paper is largely based on information derived from that exercise, which was carried out in 2002. It also uses the results of previous lessons learned studies from FAO and other WM projects, as well as those from numerous workshops, expert consultations and congresses organized by FAO within the framework of the Latin American Watershed Management Network.

[1] Climate, soil, water, vegetation, wildlife and human activities.

This paper was prepared in order to provide workshop participants with an overview of the situation regarding WM in the Latin American region.

1. Achievements of watershed management programmes and concepts

CONCEPTUAL FRAMEWORK

Ever since it was first applied in Latin America during the 1950s, the WM concept has undergone continuous evolution. This section provides a brief summary of that development.

Traces of irrigation systems, flood control and soil conservation in the Andean mountains of Bolivia, Ecuador and Peru provide clear evidence that pre-Columbian cultures managed watersheds and natural resources efficiently. Similar cases are found in Central America and Mexico. During colonial and republican times these systems were disrupted, leading to the overexploitation and degradation of natural resources. However, after independence and during the first half of the twentieth century, some farsighted legal provisions aimed at conserving natural resource were made.

From 1950 to 1970, watershed management and development were mainly the responsibility of the State, which protected, used and – in some cases – owned natural resources. The State applied a "top-down" approach to management, and today most countries are gradually abandoning this approach.

In the 1950s, some countries began to express concern about natural resource deterioration, particularly in the forestry sector, and the first WM projects were formulated.[2] Until the end of the 1960s, most of these were State-driven projects to protect watersheds and reforest and preserve forest areas.

From 1970 to 1990, WM projects were developed around two main concepts:

- a macro perspective that guided water resource interventions, which was based on the structuralism theory of hydraulic engineering and applied at the level of relatively large watersheds;
- a WM approach directed at conserving and preserving the quality and quantity of natural resources and water, which was based on vegetation control and soil conservation techniques.

Multipurpose projects were designed to manage the multiple uses of water and avoid conflicts among users. At this stage, international agencies cooperated in the preparation of mega-projects, many of which were never implemented and remained as studies only. Several institutions were established, including watershed corporations, commissions and committees.

Generally, in the years prior to 1990, regional development approaches were already being applied to major watersheds, and the concept of integrated rural development was emerging. Government bodies were in charge of planning, implementing and directing the development processes. This evolved into an integrated natural resources management approach, which includes the concept of sustainable development and gives watershed inhabitants and resource users a leading role in project implementation. Such an integrated WM approach is concerned not only with natural resource use, soil conservation, water, agriculture and forestry, but also with economic and social impacts and the balance between resource use and conservation.

Based on this concept, the First Latin American Congress for Watershed Management (1990) approved a definition of integrated WM that focuses on the sustainable management of natural resources (see Box 1).

[2] Including those for the Cauca Valley in Colombia and the forestry and water sectors in Argentina.

Box 1: REDLACH watershed management concept (1990)

Integrated WM: "is management carried out on a specific watershed, in order to use and protect natural resources and with a view to achieving optimal and sustainable production… to improve the quality of life of its inhabitants, and maintain environmental balance".

Source: First Latin American Congress for Watershed Management (REDLACH), Concepción Chile, 1990.

This definition stresses the important role that watershed users and inhabitants play in validating and ensuring the success of sustainable and lasting actions.

The 1990 to 2000 period was characterized by a major conceptual evolution that emphasized stakeholder participation and focused on the objectives of society as a whole. WM calls for a participatory planning process that includes users' and local populations' political, social, economic and environmental concerns. The inclusion of environmental concerns helps prevent or mitigate possible negative environmental impacts on the watershed. It also helps harmonize the various actors' interests and priorities, along with economic growth and social equity. The Second Latin American Watershed Management Congress (1994) updated the WM concept by stressing the need for broader participation of local populations in such issues as watershed planning and management (see Box 2).

Box 2: REDLACH watershed management concept (1994)

The concept of WM has evolved over the years and is now defined as the: "participatory process of watershed inhabitants and users who formulate, manage and execute an integrated group of actions on the natural environment and on social, economic, institutional and legal watershed structure in order to attain the specific objectives required by society".

Source: Second Latin American Congress for Watershed Management (REDLACH), Merida, Venezuela, November 1994.

Regarding the concept of WM, the main lesson learned is that the integrated approach should consider not only the integrated use of natural resources, but also economic, social and environmental goals, along with traditional soil conservation, water use and agricultural/forestry production systems. When environmental issues are taken into account, it becomes possible to: i) establish and guide interactions between those causing environmental disturbances and those suffering the effects; and ii) mitigate and prevent future negative impacts. For instance, WM cost–benefit ratios could be measured against productivity, sustainability and equity parameters, in order to assess and valuate the social and environmental benefits.

Since the first REDLACH congress (1990), most WM projects have focused on an integrated approach, which takes account of both the social and the natural environment with a view to achieving a balance between productive development and environmental conservation in order to optimize watershed use in the region.

VALIDATION OF THE METHODOLOGICAL FRAMEWORK

Latin American history shows that natural resource management is not new, but goes back to the Incas who developed efficient WM systems based on practices and infrastructure that can still be seen in many areas of Peru and Bolivia.

Some decades ago, watersheds were used to solve specific problems and demands, such as improving navigation, providing water for domestic use and irrigation, flood control and power supply. Management focused on operating and maintaining existing practices and infrastructure without

further concern for WM *per se*. Consequently, various water management systems were implemented in each watershed, and most of these took into account water use for only one sector, such as irrigation or hydroelectric generation.

This sectoral view led to inappropriate use of natural resources, and resulted in damaged land resources[3] with subsequent losses of biodiversity. There was no systematic WM. Conflicts between conservation and development continued because development was economically oriented. It gradually became clear that projects lacking the active participation of watershed actors are likely to fail, and may even cause irreversible damage to the environment. Many issues emerged in Latin America as a result of environmental impact assessments in the late 1970s and early 1980s.

During the 1990s, the integrated natural resources management approach and environmental variables began to be applied, combining development with environmental protection. These were based on the global watershed method and a participatory planning approach that supports the active participation of beneficiaries and local organizations at every stage of a project, from design to final assessment.

After a period of extensive validation and adjustment, the integrated micro-watershed management approach started to be applied. It provides direct support to local planning and implements actions that the communities themselves consider to be top priorities. Initial stages aim at reinforcing the government entities in charge of natural resource management by improving their managerial skills and ability to involve project beneficiaries at the local and national levels. Priorities for the planning and organization of watershed-related actions are set, and a management plan for the watershed is prepared. Planning is participatory, and community projects to improve the population's quality of life and achieve sustainable community development are defined at the micro-watershed level.

The critical factors that lead to environmental imbalances are identified and addressed through a regional analysis, which focuses on the subdivisions of a watershed, i.e. sub-watersheds and micro-watersheds. Those sectors with the greatest potential for development are optimized. During this process, natural resource management policies that are appropriate at the regional level (the watershed) are developed from intervention strategies that are specially formulated for the subregion (the sub-watershed). These are adjusted and implemented through activities designed with the participation of the population of the micro-region (micro-watershed).

The WM methodological framework has evolved from a regional scheme based on centralized planning to a sustainable local development approach that includes the participation of communities and the private sector. Thirty years of interventions and experiences have validated the conceptual and methodological base, and there is now a technical and operational framework suitable for formulating and executing successful WM programmes and projects.

EXPERIENCES FROM COUNTRY PROJECTS (1990 TO 2000)

The new development approach based on private initiative expanded significantly during the 1990s. Under this model, local populations solve their own problems, and solutions are suggested through a top-down approach. Projects are concerned with creating opportunities for participation and the promotion of joint action by government bodies and non-governmental organizations (NGOs). Communities view rural development projects as opportunities for developing and using their own local capabilities.

Between 1990 and 2000 management focused mainly on sub-watersheds and micro-watersheds, following an integrated natural resources management approach and promoting public and private sector participation, with emphasis on watershed inhabitants and users. The prevailing approach considers the watershed as a system. It promotes harmonious watershed development through the interaction and interdependence of watershed components. Development and management are geared

[3] Soil erosion, salinity, reduced land fertility, etc.

towards the integrated management of territorial watershed units starting with smaller areas and expanding to larger ones, i.e. micro-watershed to sub-watershed. Watersheds in mountainous areas and catchments are priorities.

The trend is to support environmental sustainability and to plan and execute participatory actions that take into account the interests of each stakeholder while attempting to be fair in meeting different needs and achieving sustainable development. It then becomes possible to foster integrated WM through joint actions in natural resources use, which contribute to economic growth while conserving, preserving and protecting the resources. Box 3 lists the main characteristics of a successful WM programme.

Box 3: Characteristics of a successful WM programme

It acts on a watershed that is of national or local relevance.

It follows an action plan that is supported by the government.

It takes account of stakeholder support through commissions.

It is flexible enough to carry out a participatory planning process.

The information it generates is also used outside the affected watershed areas.

It has the capacity to assess and report achievements, benefit from external evaluations and carry out necessary amendments.

Source: FAO, 1994.

The concept of strategic planning as a development management tool is important, as are long- and medium-term objectives and the actions to be implemented in the short term in order to achieve these. Examples of strategic planning for various countries of the region are illustrated in the following.

- In ***Ecuador,*** pilot activities in the Andean Region emphasize the protection of natural resources and the mitigation of impacts on regulatory works that protect the country's most important hydroelectric system in Paute River watershed. It gets financial assistance from banks[4] and technical support from an established network.[5] A National Commission for Watershed Management and Conservation has been set up to give priority to watersheds.
- In ***Peru,*** relevant legislation was passed, making WM issues of national interest. The Ministry of Agriculture provides budgetary support to a national project that sets priority interventions in Andean mountain watersheds and areas with high levels of poverty. This is helping to institutionalize activities at the watershed level. Newly created autonomous watershed authorities have started managing the water resources of major irrigation projects at Lambayaque, Jequetepeque (Santa, China) Piura and Titicaca (with Bolivia).
- In ***Bolivia,*** (see case study in chapter 4) the concept of sustainable development is applied to the design and implementation of projects such as the Piraí River Flood Channelling and Control Service (SEARPI) and PROMIC[6] in Cochabamba. Shared watershed projects are also being implemented at Titicaca (with Peru), Bemejo (with Argentina) and Pilcomayo (with Argentina and Paraguay).
- In ***Chile,*** improvements have been made to the legal framework for: i) conserving/managing native forests, biological diversity and the environment; ii) afforestation; and iii) rural development. Incentives are provided for activities aimed at rehabilitating degraded land and combating desertification.

[4] The Inter-American Development Bank.
[5] REDLACH.
[6] Programa Manejo Integral De Cuencas (Integrated Watershed Management). See www.promic-bolivia.org

- In ***Argentina***, an institutional WM framework has been set up in San Luis Province, and specific projects are being implemented (albeit in a disorganized manner). At the national level, special committees are implementing watershed projects on a broader scale.
- In ***Venezuela***, watershed projects are being designed and implemented in, for example, the Brono, Yaracuy and Tocuyo river watersheds.

A comparative analysis of the programmes and projects put forward at the first (1990) and second (1994) REDLACH congresses, as well as in national reports on the status of WM (2000), shows that countries have made substantial progress in WM and are consolidating their experiences and the results obtained.

THE TREND TOWARDS FORMULATING NATIONAL PLANS

The Expert Consultation on National Watershed Management Programmes in Latin America and the Caribbean, held in Santo Domingo in 1996, emphasized the importance of having national WM plans or programmes. National plans serve as medium- and long-term reference frameworks that provide guidelines to different WM stakeholders. The current situation regarding national plans is shown in Table 1.

Table 1: National watershed management plans

Country	Type of plan				
	National Watershed Plan	National water resources plan	National priority watershed plan	Sectoral plans: Forests, soils, environment	National watershed plan in process
Argentina		X		X	
Bolivia	X				
Brazil		X			
Chile			X	X	
Colombia		X		X	
Costa Rica			X		X
Cuba					
Ecuador		X	X		
El Salvador					
Guatemala			X		X
Honduras			X	X	
Mexico					
Nicaragua					
Panama				X	
Paraguay				X	
Peru			X		
Dominican Republic					
Uruguay			X		
Venezuela	X	X			

Two countries in the region have national watershed programmes, and seven have national priority watershed plans. Five countries have prepared national water resource plans, and six have national sectoral plans on issues related to WM. Two countries are currently preparing national watershed plans, and several have expressed the intention of doing so in the near future.

DEVELOPMENT OF SPECIFIC FUNDING SOURCES

Several countries have developed and are using various national funding sources, which allocate funds according to the sort and scope of proposals made. They take into account the goals of the institutions

that participate directly or indirectly in WM. This reduces the dependence on foreign funding sources, for which competition exists with other sectors of the economy.[7]

The following are some such *national funding sources* for WM programmes:

- allocations from the budgets of all the institutions and agencies that carry out natural resources management activities: if each agency's priority activities are matched up to geographical locations, there can be no, or only minimal, need for foreign funding;
- funds raised through the application of, among others, polluter-pays, beneficiary-pays and user-pays principles, such as for hydroenergy generation (Colombia) and irrigation (Peru);
- charging fees for the use of water and other natural resources within and outside watersheds, such as the Peruvian and Ecuadorian water self-management systems;
- valuation of and payment for the intangible social, economic and environmental benefits derived from WM programmes, such as Costa Rica's payment system for environmental services;
- allocation of specific government funds from national budgets, foreign debt exchange and transfers from other sectors of the economy, among other sources;
- creation of national mixed funds with contributions from the public and private sectors, such as at the Lake Titicaca watershed in Bolivia, the Cajamarca Foundation and mining funds in Peru, and the trust funds of private foundations in Chile.

In Colombia national funding alternatives for watershed management and conservation include *transfer from the electricity sector.* In order to reduce sedimentation and protect investments in hydroelectric reservoir infrastructure, electricity generating companies have to direct 2 percent of their gross sales to electrification projects, and 2 percent to reforestation programmes in watershed areas that supply and have an impact on reservoirs. Nearly 15 000 ha have been reforested under this scheme. Recently, the system has been modified so that hydroelectric power companies with a capacity of more than 10 000 kW now transfer 6 percent of their gross sales according to the following scheme, which was fixed by the Energy Regulation Commission:

- ***Royalties for natural resource exploitation:*** Following the 1991 Constitution, Law 141 of 1994 provided for the creation of the National Royalties Fund (FNR). The National Royalties Commission regulated the State's right to draw royalties from the exploitation of non-renewable natural resources, and laid down settlement and distribution rules, among others. Later, this law was modified and added to Law 344 of 1996.
- ***CARs' own resources:*** These are scheduled investments in Regional Autonomous Corporations' (CARs') action plans that must be approved annually by each CAR's Board of Directors.
- ***Resources from municipality and department investment plans:*** These are generally insufficient to cover watershed issues, which can instead be included in development plans, as CAR project counterparts or as independent projects.

A number of foreign funding institutions (banks, technical cooperation agencies, multilateral/bilateral bodies, government entities and NGOs) are interested in natural resource management and sustainable development. They cooperate in preparing and executing watershed programmes and projects. There are also various cooperation modalities (refundable, non-refundable, contingent recovery or technical assistance) and beneficiaries (governments, NGOs or local authorities).

Table 2 gives examples of international institutions for technical cooperation and funding that provide support for the preparation and execution of WM activities. The table also lists their operational and funding modalities, the kind of cooperation they offer, and their beneficiaries.

Costa Rica is the regional leader in terms of environmental service valuation, with important experience in the valuation of forests as carbon sinks. The National Forest Fund (NFF) carries out awareness raising campaigns related to charging private and public users of environmental services

[7] Resulting from the current situation in the region.

that forests provide as protectors of priority watershed water resources. To this end, contracts for the collection of such payments are being issued. Various ongoing projects are valuating water for a similar scheme. Universities and research centres have undertaken scientific research to quantify and valuate environmental services, and thus internalize environmental costs. In 1999, an inter-institutional commission was created by executive decree with the aim of defining the criteria by which institutions calculate tariffs. However, given the limitations of existing studies to valuate environmental services, the commission has so far set only two parameters: catchments and protection. Catchment value is defined as the water retention capacity of the forest, which favours water infiltration and percolation into the soil, while protection value is understood to be the investment made by the State and municipal governments to manage and maintain protected areas, and thus to protect the resource.

Table 2: International institutions for technical cooperation and funding

Profile	Modality	Institution	Funding	Beneficiary
Banks	Multilateral	BIRF, IDB, FONPLATA etc.	Refundable Non-refundable Contingency recovery Technical cooperation	Government agencies
Technical cooperation	Multilateral	FAO, UNDP, UNEP JICA, OAS, FIDA, EU, etc.	Refundable Non-refundable Contingency recovery Technical cooperation	Government agencies
Technical cooperation	Bilateral	JICA (Japan), CID (Canada), IICI (Spain), USAID (USA), GTZ (Germany), COSUDE (Switzerland), SNV (Netherlands)	Non-refundable Technical cooperation	Government agencies and, in some cases, individuals or NGOs
NGOs and international foundations	Bilateral	WWF, Rockefeller, Ford, The Nature Conservancy, etc.	Non-refundable	NGOs

The commission's recommendations have not yet been made official; however, they served as the basis for research undertaken by public water utilities, the results of which will be submitted to the relevant authorities so that they can include environmental services in their tariffs. At present, the public utility of Heredia Province in Costa Rica already does this; an inter-institutional commission has been set up to approve, monitor and follow-up on programmes managing the resources derived from environmental services. The Electric Service Management Board, JASEC[8] has also done this. These actions are carried out in accordance with forestry and biodiversity legislation.

ENHANCED UNIVERSITY AND TECHNICAL TRAINING COURSES

Formal and informal training for technical and professional personnel is a key element in the preparation and implementation of projects. It is also essential that local leaders be trained to manage natural resources through community organizations. This helps beneficiaries and local authorities to view projects as their own, and not as external interventions that have been imposed by government authorities without being based on the community's needs. Table 3 lists the types of professional and technical training courses mentioned in the country reports. The number and variety of WM courses increased dramatically between 1990 and 2000, and seven countries now offer postgraduate degrees in the subject, with another two offering graduate degrees. Almost every country offers postgraduate and graduate courses in WM within other careers.

[8] Province of Costa Rica.

Table 3: Watershed management training courses

Country	Post- graduate degrees	Graduate degrees	Post- graduate courses	Courses for other careers	International courses
Argentina	X	X			
Bolivia	X			X	
Brazil			X	X	
Chile			X	X	X
Colombia	X	X		X	
Costa Rica	X			X	
Cuba			X	X	
Ecuador			X	X	
El Salvador				X	
Guatemala			X	X	
Honduras	X			X	
Mexico	X	X		X	
Nicaragua					
Panama				X	
Paraguay			X	X	
Peru	X		X	X	
Dominican Republic					
Uruguay			X	X	
Venezuela			X	X	

THE EFFECTIVE FUNCTIONING OF REDLACH

REDLACH has been facilitating and promoting information exchange and technical cooperation among countries in the region for more than 20 years. The network has promoted the interchange of knowledge and experiences in WM, consolidated WM concepts and encouraged the use of watersheds as physical management units. It has strengthened the bonds among related professionals and promoted joint activities with technical cooperation agencies and multilateral financing organizations.

Box 4: REDLACH events

International Workshop on Watershed Management in Mountain Areas. Santo Domingo, Dominican Republic, 2000.

Seminar-Workshop on Sustainable Development in Mountain Areas. Querétaro, Mexico, 1999.

Third International Symposium on Sustainable Development in Mountain Areas, Workshop on Watershed Management in Mountain Areas. Quito, Ecuador, 1998.

Expert Consultation on Latin American Southern Cone Watershed Management, Economic and Social Aspects. Blumenau, Brazil, 1996.

Specialist Consultation on National Watershed Management Programmes in Latin America and the Caribbean. Santo Domingo, Dominican Republic, 1996.

International Workshop on Watershed Management in Mountain Areas. La Paz, Bolivia, 1995.

Second Latin American Congress on Watershed Management. Merida, Venezuela, 1994.

Expert Consultation on Watershed Management in Arid Zones. Mendoza, Argentina, 1994.

Latin American Workshop on Watershed Management Extension. Acarigua, Venezuela, 1993.

International Workshop on Watershed Management Programmes and Projects Assessment in Relation to Forestry Action Programme in Tropical Areas. Tegucigalpa, Honduras, 1991.

Second Latin American Congress on Watershed Management. Merida, Venezuela, 1994.

First Latin American Congress on Watershed Management. Concepción, Chile, 1990.

All of REDLACH's 19 member countries have programmes, projects and validated experiences in WM. In addition, a conceptual framework was officially approved for all the countries present at the First Latin American Congress on Watershed Management (Concepción, Chile, 1990), and updated at the Second Latin American Congress on Watershed Management (Merida, Venezuela, 1994).

Activities related to horizontal technical cooperation and information sharing among countries have been carried out since 1990. Box 4 shows some of the events organized within the REDLACH framework. Technical results from these events have been widely distributed within the countries, and have furthered the standardization of WM concepts and practices in the region.

2. Existing gaps in watershed management programmes and projects

POLITICAL–LEGAL FRAMEWORK

Although significant progress has been made throughout the region in relation to WM regulatory aspects, most countries still have scattered legal frameworks addressing natural resource issues. This results from taking a sectoral approach to development, in which different sectors and subsectors are managed individually according to the views and considerations of their respective responsible bodies, some of which deal with many natural resources management aspects. Although there are rules that govern the availability of water resources, the many laws, decrees, regulations and ordinances presiding over their multiple uses are neither effectively applied nor properly observed. Such scattered regulations offer a mix of possibilities, but many countries apply them inconsistently and not to whole watersheds.

Formulating a regulatory legal framework for integrated natural resources management that focuses on prevention rather than remedial actions and that is consistent with the existing framework is a real challenge. It is important first to adapt and harmonize existing regulations through amendments or legislative reforms that ease and encourage inter-institutional coordination with the full participation of the private sector. The second step is to design a technical legislative framework for developing or enhancing institutional WM capabilities that would serve as the basis for future:

- inter-institutional agreement and conciliation bodies;
- watershed management planning and coordination mechanisms;
- the use of watersheds as management units.

Most of the countries surveyed have no specific government policies for WM, which is instead partially addressed in environmental, forestry or water policies. This makes it difficult to plan medium- and long-term interventions and to consolidate the intersectoral and inter-institutional relations required to achieve sustainable development of WM. Programmes and projects to implement national policies and strategies must provide short-term results that meet the needs of watershed inhabitants and users while complying with the objectives and priorities of government authorities. In the medium and long terms they have to meet the needs of the whole population, including those of future generations, and become fully consolidated as state policy that extends beyond the time frame of the government in office.

THE MULTISECTORAL AND INTER-INSTITUTIONAL APPROACH

The conceptual and methodological framework validated at the Second Latin American Watershed Management Congress (1994) considers WM to be “an integrated group of actions on the natural environment, and on social, economic, institutional and legal structures”. However, there are as yet no clear procedures that could lead to the integrated use of watershed natural resources in a way that attains the “objectives required by the society”.

Such procedures should be compatible with overall natural resource use and take into account the close connections among water, soil and plant resources. They should also entail the management of surface, ground and atmospheric water resources for different human, agricultural, industrial, energy, recreational and tourist uses. The management of soil resources should consider the soil’s potential and avoid erosion and depletion, while the management of plant resources and the conservation of native forest and natural pastures should also be included as essential concerns.

Projects usually stipulate such guidelines, but these are very rarely put into practice. The main reason for this is that programmes and projects are driven by government agencies with specific responsibilities in the water, forestry and agriculture sectors. Historically, these sectors have been characterized by a lack of communication among the responsible agencies, and often by competition for the same funding sources.

In most Latin American and Caribbean countries, the institutional structure consists of several different organizations with responsibilities for specific natural resources. This creates institutional diversity, which leads to the overlapping of competencies and regulations, as well as to legal and operational gaps. It also leaves room for severe conflicts over natural resource use and duplicity of tasks among organizations and regulators. Table 4 gives examples of institutions that deal with WM in some countries of the region. Natural resource management in Latin American countries emphasizes watershed planning that aims to generate inter-institutional consensus and conciliation, through planning and coordinating mechanisms and the assignment of specific natural resources management tasks to the different institutions. Systems of inter-institutional coordination and multisectoral participation help to ensure that competent executive bodies, local authorities and local communities all interact and that the interests of each sector are taken into account.

Table 4: Watershed management institutions

Country/item	National	Regional
Argentina:		
- National Directorate of Sustainable Development (SDS y PA)		
- Water Resources Department, Ministry of Economy		
- Inter-jurisdictional watershed authorities		
Chile:		
- Ministry of Agriculture		
- National Forestry Corporation		
- Ministry of Public Works		
- National Commission for the Environment		
- National Commission for Irrigation		
Honduras:		
- Honduras Corporation of Forestry Development (COHDEFOR)		
- National Service of Aqueducts and Sewer System (SANAA)		
- National Electricity Company (ENEE)		
- Department of Natural Resources and Environment (SERNA)		
Mexico:		
- National Water Commission (CNA)		
- Department of Environment, Natural Resources and Fishing (SEMARNAP)		
- General Directorate for Soils Restoration and Conservation (DGRCS)		
- National Ecology Institute (INE)		

Source: Report of the International Workshop, Santo Domingo, 2000.

The bodies, mechanisms or institutions established to coordinate activities require a suitable legal framework and positioning within the government structure so that they can coordinate efficiently with the related institutions. Coordinating institutions are in charge of managing but not implementing; they formulate usage rules but are not themselves users, and they promote joint criteria, consensus and harmonization of the activities carried out by the communities and agencies directly involved with natural resources and watersheds. Different types of watershed organization (authorities, committees, commissions, corporations, boards) are set up according to the situation in the country concerned, for example:

- Argentina: inter-jurisdictional watershed authorities;
- Colombia: regional autonomous corporations;
- Peru: autonomous watershed authorities.

PARTICIPATORY MECHANISMS FOR STAKEHOLDERS

One of the key elements of successful watershed programmes and projects is the organized participation of various stakeholders, such as producers and their families, local technicians, rural schools, NGOs, entrepreneurs, trade unions, cooperatives and municipal authorities. When there is such participation, actions are perceived as community efforts rather than external initiatives, and organizations are more likely to join the community to achieve their own objectives.

Although there are several different ways of communicating, reaching consensus, participating and articulating actions with local institutions, not every programme is capable of achieving organized, lasting or sustainable participation over time. Diagnosis, planning and participatory assessment based on the population's perceived needs and proposals represent the paradigm for sustainable development projects, in which an appropriate active interlocutor manages activities that further the sustainable development process in the medium and long terms.

Technology transfer should take into account the characteristics of the target population, the different scenarios and particular situation within each community, gender and cultural issues, and socio-economic and agro-ecological aspects. Self-management processes should strengthen the decision-making power of the individuals participating in the development process so that they are able to negotiate and reach agreements with the different actors involved. To this end, it is necessary to raise awareness and self-confidence among leaders and institutional managers and technicians.

A major challenge is to strengthen and consolidate management ability, and to devise viable proposals for facilitating the transfer of projects to local organizations and providing them with decision-making autonomy. As local actors develop managerial and organizational abilities, they should gradually assume the roles of technical advisers, service providers and financial managers. Thus, these will become formal sustainable development entities.

SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACTS

It has been demonstrated that land users are unlikely to support programmes and projects that are aimed exclusively at controlling erosion or conserving natural resources. This is mainly because land users do not consider conservation techniques sufficiently important to justify investing in labour, and there is a scarcity of resources at the local and farm levels. Projects and programmes become more feasible when they set out both to improve agricultural, cattle and forestry production systems on farms and to implement activities that rehabilitate degraded lands and conserve natural resources. The success of WM programmes is directly related to sustainable improvements to production and a better quality of life for communities.

One of the most important challenges is to outline actions that improve food security and the quality of life for watershed inhabitants. Although producers living in conditions of extreme poverty are capable of devising survival strategies, the social, ecological and human costs of these strategies are high. In order to guarantee the quantity, variety and quality of food that families need, to enhance the population's awareness and to attain a proper balance between production systems and natural resource conservation, valid strategies must be outlined for small and medium-sized producers and for the community as a whole.

The relations among environmental factors, such as climate, soil, water, vegetation and wildlife, are an important determining factor in regional development based on inhabitants' needs. However, the use of such basic resources as water, soil and vegetation is severely restricted by the fragility of many ecosystems. As a result, the inhabitants of large rural and urban areas often face serious risks from the deterioration and improper use of their natural environment. This can have catastrophic effects on human health (polluted water, severe chronic diseases), floods, riverbank and infrastructure works, sedimentation, soil erosion, and migration.

WM and environmental impact assessment (EIA) methodologies can be used to control water pollution and the progressive degradation of natural resources, as well as the subsequent loss of productivity, progressive soil erosion, eutrophication, deforestation and the deterioration of natural ecosystems. Appropriate practices make it possible to minimize sanitation risks and drinking-water shortages, reduce flood damage, reverse the progressive reduction of economically productive areas, and mitigate rural migration processes from degraded sectors to large urban centres. The great challenge for future WM programmes and projects is to incorporate:

- social impact goals aimed at improving inhabitants' quality of life;
- economic impact goals aimed at increasing farm production and productivity, providing employment and attracting foreign currency to the region;
- environmental impact goals aimed at mitigating environmental damage as part of the programme's existing social goals.

ASSESSMENT AND MONITORING

In order to justify future investment in watershed activities, it is necessary to develop a proper assessment and monitoring system that provides follow-up on the biophysical and socio-economic aspects, and that starts with a baseline at the outset of activities, followed by control and evaluation in the short, medium and long terms. It is also necessary to adapt applied research to each ecosystem, with the help of multidisciplinary teams, universities, specialized institutions and NGOs.

An effective assessment and monitoring system makes it possible to evaluate social, economic and environmental aspects and to quantify the cost–benefit ratio of WM programmes and projects. Most countries have weak monitoring and assessment mechanisms, together with a lack of procedures for assessing the results obtained.

A biophysical monitoring system can entail analysing different land treatments by means of Geographic Information Systems (GIS) and the field measurement of representative soil and water sampling sites at hydro-meteorological stations that allow continuous recording. Digital aero photography surveys make it possible to assess changes in the productive use of land, forest areas and grasslands. Regarding the physical parameters of soil, it is possible to determine humidity, apparent density, structural stability and infiltration. Water parameters can be assessed through hydrological models that are based on watershed rain and flow data, and through measuring the levels of surface water pollution, agrochemical residues and sediment.

A socio-economic monitoring system can be fed by continuous surveys of statistically meaningful samples of beneficiaries, along with follow-up on the technical and productive capacities of representative producers. Social data regarding producers and their families, basic needs, housing, health, education, land tenure, soil use, crops, staff, livestock, income, overheads, capital, investments and economic activities during the period can also be fed into the system.

The design and implementation of an assessment and monitoring system for watershed programmes and projects is important as it facilitates the validation of work practices and methodologies and the production of a database that unifies criteria and promotes information sharing among countries.

NATIONAL WATERSHED MANAGEMENT NETWORKS

REDLACH promotes the creation of National Watershed Management Networks with a view to consolidating each country's inter-institutional and multisectoral participation in watershed programmes and projects through the following mechanisms:

- dissemination and exchange of information on REDLACH activities and on the progress made in WM activities in each country;

- technical collaboration with public and private organizations linked to WM, and networking among institutions involved in watershed resource activities;
- unification of criteria among the different organizations working in watersheds (prior to the formulation of strategies or the execution of national programmes);
- establishment of a framework to coordinate technical, legal and financial activities and guide sustainable development based on equity and efficacy;
- politically feasible alternatives based on the available resources, which can be taken into consideration during the decision-making process.

Five of the countries surveyed have formal networks, which are at different levels of activity and have different coordination capacities.

Bolivia: The Bolivian Network for Integral Watershed Management (REBOLMIC) was set up in 1995 with the participation of the National Department of Natural Resources and Environment through the National Directorate of Watershed and Natural Risks, as well as of various government bodies and NGOs. It was officially recognized by a Ministerial Resolution, which gave birth to the REBOLMIC coordinating body, constituted by technical public and private institutions (PROMIC, SEARPI, DICOMAS, CORDECH, PLAFOR, MREC) and led by the Vice-Ministry of Renewable Natural Resources, with the aim of joining efforts and optimizing human and financial resources.

Costa Rica: The national watershed network was created in 1999 by executive decree with the aim of increasing the country's WM capacity. In 2001, the network prepared a preliminary proposal on WM policies, guidelines and actions, which is being discussed and reviewed prior to seeking the official approval of the relevant authorities.

Ecuador: The Permanent National Commission for Watershed Management and Protection (CONAPCHID) was created by decree in 1982. It aims to coordinate the various State bodies for watershed use, development, recovery, protection and conservation.

Honduras: In 1993, the General Environmental Law created the National Watershed Network under the Department of Natural Resources and Environment. It is defined as the national organization, and is supported by regional and local bodies to coordinate and manage actions and to exchange information regarding the integrated management of natural resources and watersheds.

Peru: A Ministerial Resolution approved the establishment of the National Watershed Management Network (REDNAMAC) in 1993. This is coordinated by the General Directorate for Water and Soils of the National Institute of Natural Resources, which is the body in charge of coordinating, promoting and disseminating actions related to WM, with the participation of public and private entities.

One of REDLACH's ongoing activities is to establish and strengthen national networks, which serve as instruments to consolidate information sharing and unify criteria from the different actors involved in WM within and among the countries of the region.

3. Lessons learned and priority actions

This chapter presents the major lessons learned and the priority actions suggested from experiences between 1990 and 2002. Findings are based on national reports, other regional studies on WM, consultations with specialists from the region, and the results of WM projects implemented in the region.

CONCEPTUAL AND METHODOLOGICAL FRAMEWORK FOR WATERSHED MANAGEMENT

The conceptual and methodological framework for WM has evolved positively. WM began as a conservationist approach to solving sectoral biophysical problems. It then expanded to become a multipurpose management system, incorporating social elements, that evolved into the present integrated and participatory management approach. WM programmes and projects ought to include preservation and conservation actions related to resource use. They must also strive to obtain the participation of all the watershed stakeholders in order to harmonize different sectors' interests and bring about social, economic and environmental results that lead to a sustainable development process.

POLITICAL, LEGAL AND INSTITUTIONAL FRAMEWORKS

When there is no adequate political-legal framework for WM programme and project continuity is limited and the achievement of medium- and long-term results is hindered. Most of the countries surveyed lack national policies or action plans for WM, and those that do have guidelines and strategies on this issue have not been able to implement them effectively. Existing legal frameworks are mostly sectoral, aiming at water, forestry, agricultural or other aspects, and current laws are often not adequately enforced owing to insufficient political will or an absence of regulations.

- ***Action:*** Promote an environment of sensitization, discussion and consensus that facilitates the design and implementation of mechanisms for harmonizing the skills of several institutions and ensuring the continuity of WM activities.

Procedures for the inter-institutional and multisectoral implementation of projects must be consolidated. Although this principle is understood at the discussion level, and is usually considered when project documents are being formulated, it is not applied effectively when projects are being implemented.

- ***Action:*** Strengthen the operational aspects of inter-institutional and multisectoral participation within REDLACH's future technical cooperation and information exchange framework.

INFORMATION AND DATA GENERATION AND EXCHANGE – TECHNICAL COOPERATION

Information and databases must be generated from the results of programmes and projects in order to foster cooperation and promote future investment at the national and regional levels. This facilitates the country-to-country transfer of successful experiences and methodologies that have been validated in similar biophysical and socio-economic environments, as well as optimizing the possibilities for information exchange through REDLACH.

- ***Action:*** Systematize the experiences and results of projects and programmes, and maintain an up-to-date database on new WM initiatives.

REDLACH has proven to be an effective mechanism for information exchange and technical cooperation among countries. But it has not been fully used because many countries do not yet have national networks or have ones that do not function adequately.

- ***Action:*** Create or strengthen and consolidate national technical cooperation networks on WM in order to increase dissemination of the conceptual and methodological framework within countries and promote country-to-country and project-to-project cooperation.

WATERSHED MANAGEMENT ORGANIZATIONS, PLANS, PROGRAMMES AND PROJECTS

Establishing specific WM organizations facilitates the participation of all related sectors, and provides a more integrated vision to development. The organizations or authorities involved must include the public and private sectors and be committed to integrated WM in order to facilitate actions related to natural resource use, conservation and protection. Organizations must also have a legal basis, decision-making power and autonomy, coordinating capacity, skilled human resources and access to the required financial resources.

- ***Action:*** Promote country-to-country cooperation based on the experiences of countries with watershed authorities or organizations in order to determine whether these can be adapted and implemented within the diverse institutional frameworks of the region.

National WM plans facilitate consensus and coordination among competent institutions. A national plan should identify and prioritize the country's watersheds and consider the interrelationships of the many factors that must be considered in WM. It should harmonize the actions to be fostered by each of the institutions concerned and align WM strategies with the country's other short-, medium- and long-term development policies.

- ***Action:*** Follow-up on the activities initiated at the Expert Consultation on National Watershed Management Programmes in Latin America and the Caribbean held in Santo Domingo, Dominican Republic in 1996.

Future WM programmes and projects must consider both the issue of addressing large regions and the specific approach of dealing with small areas. WM strategies that are based on successive scales of intervention have been effective. If a region is studied according to a territorial approach that uses watershed natural divisions (sub- and micro-watersheds as planning and implementation units),[9] it is easier to identify and deal efficiently with specific critical factors[10] as well as to prioritize critical areas and potential sites, design realistic and replicable actions, and optimize those sectors that have high development potential.

Through this process, natural resources management policies defined at a regional level (watershed), through strategies formulated at a subregional level (sub-watershed) and participatory actions designed at a micro-region level (micro-watershed) are easily applied and implemented.

- ***Action:*** Promote the implementation of pilot demonstration watersheds as methodological models for the region that are based on the experiences of several countries and form the basis for future training activities.

[9] With the level of detail and information increasing as the unit decreases in size.
[10] That could cause environmental problems.

TRAINING OF HUMAN RESOURCES

Formal and informal training of human resources constitutes an important factor for successful WM projects and programmes. Training at different levels facilitates technical and professional specialization in integrated WM. Training should be based on a broad and integrated vision, which provides basic knowledge about the various disciplines involved in efficient management, as well as the diverse interrelationships among watershed resources and their functioning as a system. Before a WM programme or project is implemented, field technicians should be trained so that all project team members use the same criteria and have the same level of knowledge, particularly when they come from different institutions and have diverse professional profiles. Training plans for producers must be designed to fit the needs identified by beneficiaries, giving priority to their requests and including natural resources conservation principles and the WM approach in each course or activity.

- ***Action:*** Survey and harmonize criteria and implement a regional-level distance-training programme based on the current courses and careers available in the different countries.

ASSESSMENT AND MONITORING OF PARTICIPATION AND THE SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACTS

Assessment and monitoring of results must be part of any project design as it helps to justify future investments in WM. It is essential to disseminate the experiences and results obtained from WM projects and programmes among professionals, technicians and project beneficiaries, and to validate natural resources management practices with the participation of producers, universities, institutes and NGOs.

- ***Action:*** Incorporate follow-up and evaluation as integral parts of the implementation of future WM projects and programmes. Evaluation can be based on comparisons with the baseline (situation before the project), control mechanisms and applied research, and makes it possible to assess the social, economic and environmental results obtained during and after project implementation.

Local actors' active participation is crucial to the success of watershed programmes and projects. Throughout a project's life cycle – before, during and after its implementation – it is crucial to acquire the participation of community representatives and the region's productive sectors; NGOs, associations, cooperatives, social organizations and regional or municipal authorities also play a major role. Interdisciplinary participation in the project team is also required so as to cover all aspects of integrated WM, which can include (depending on the characteristics of the region) agronomy, forestry and civil engineering, hydrology, geography, sociology, communications, etc. Participation can be encouraged and promoted by means of consultation and sensitization campaigns. Projects must identify problems, address potential solutions, and disseminate information regarding activities and progress through talks, publications and field visits with authorities and groups of producers from other areas, who can thereby learn about the work carried out by the project.

- ***Action:*** Ensure that future WM programmes and projects include participation mechanisms for their conceptualization, formulation, execution, monitoring and later follow-up.

Achieving social, economic and environmental impacts is another key to successful WM programmes and projects. Producers who depend on small landholdings, subsistence economies and family labour usually have restricted capital and little access to information. It is difficult for them to adopt conservation practices, and they are often affected by losses in productivity. This vicious cycle not only erodes natural resources, but also demeans producers and their families by causing them progressively to lose the capacity to earn a living and maintain a decent quality of life. Sooner or later, whole families, or their younger members, start a process of rural migration, removing themselves

from their traditional cultural and labour environment to search for opportunities[11] in urban areas. Together with natural resource conservation and increased production, WM programmes and projects must also aim to improve the quality of life of watershed inhabitants.

- ***Action:*** Ensure that future WM programmes and projects aim also at improving people's quality of life and increasing farm productivity in order to generate employment and economic benefits, while recovering or mitigating environmental damage.

FUNDING

The use of funds derived from watershed resources can help to justify future WM investments. Successful experiences of national funding under different resource allocation modalities include: i) a combination of institutional budgets and funds for specific activities; ii) the application and adjustment of tariffs; iii) valuation of and payments for intangible benefits; and iv) the creation of public and private mixed funds. Alternating and complementing multiple national and international funding sources throughout the different stages of a project, with a view to reducing the preparation time and optimizing the available funding sources, can be very effective.

- ***Action:*** Promote coordination and co-funding among the different institutions involved in WM, and promote joint technical cooperation and multilateral funding proposals.

[11] Which are scarce, and difficult to find.

4. Bolivia case study

This case study provides only a general description of the activities, results and lessons learned during implementation of the Participatory Integrated Management Project on the Upland Watershed of Piraí River, Santa Cruz, Bolivia (GCP/INT/542/ITA), which lasted from late 1992 until early 2002. The paper is based on various reports and studies conducted during the project, as well as the findings of a visit to the area of the project in April 2003.

THE PROJECT

Inter-regional Project on Participatory Conservation and Development of Upland Areas

Project GCP/INT/542/ITA was initiated as a result of bilateral and international organizations' (FAO, the United Nations Environment Programme [UNEP], etc.) interest in testing new methods and approaches for the sustainable development of mountains and integrated participatory WM. The objectives of the regional project were to:

- develop five pilot watershed experiences in different regions of the world: Bolivia, Burundi, Nepal, Pakistan and Tunisia;
- incorporate the lessons learned during these field experiences into local planning systems and national strategies and policies;
- disseminate information at the global level about the methods, techniques and tools that were validated in the field.

Participatory Integrated Management Project of Upland Watershed of Piraí River

The Piraí River Flood Channelling and Control Service (SEARPI)/FAO project was carried out in the Piraí River upland watershed of the rugged mountains that separate the Mesothermic valleys from the Amazonian lowlands of Bolivia. The area covers 97 000 ha, with altitudes ranging from 1 200 to 2 400 m above sea level. Its steep slopes, geology and rainfall pattern make the area especially prone to erosion. Average annual rainfall ranges from 800 to 1 000 mm (FAO/Italy Cooperation Programme, 2000). The criteria used in selecting this area include:

- the huge disparities in resource management and socio-economic growth between upstream and downstream zones;
- Piraí River upland watershed represents the eastern spurs of Bolivia's Andes mountain range;
- the presence of SEARPI (the public institution selected as the project's national counterpart), which was interested in implementing initiatives that involve the watershed population in enhanced natural resource management. (Prior to the project, SEARPI activities had usually focused on engineering interventions to avoid flooding of the lowland watershed.)

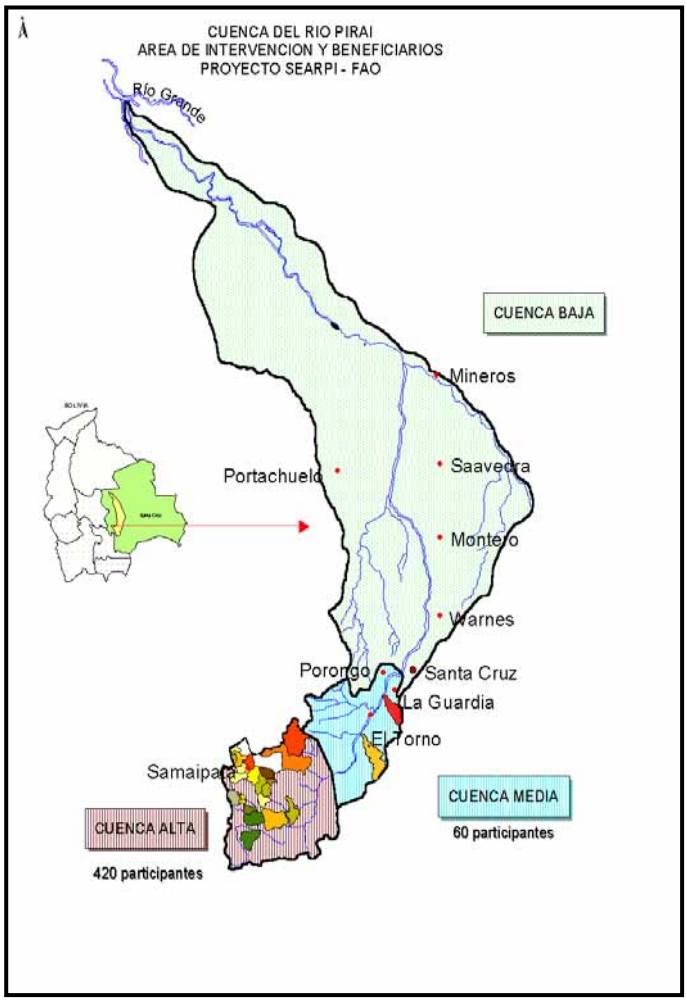
Goals of the Participatory Integrated Management Project on the Upland Watershed of Piraí River

The general purpose of the project was to achieve integrated WM with the participation of the population and rural communities. The following immediate goals were listed in the project paper:

- Initiate and consolidate a participatory process for the integrated management of selected watersheds of the Piraí River.
- Incorporate the concept of participatory integrated WM into local planning and national policies/strategies for sustainable development.

- Help identify methods, tools and techniques for participatory integrated WM at the national, regional and interregional levels.

Map 1: SEARPI project area and beneficiaries



1992–1998 Upland Watershed, (Samaipata municipality): Progressive incorporation of 18 rural communities.

Approximate total surface: 140 000 ha.

1998–2002: Palmira Midland Watershed – Sub-watershed (Municipality of El Torno).
Five rural communities.
Sub-watershed surface: 5 000 ha.

1999–2002: San Carlos Midland Watershed – Sub-watershed (La Guardia Municipality).
Three rural communities.
Sub-watershed surface: 3 000 ha.

Direct beneficiaries:
Approximately 500 families. Students and teachers also benefit from the environment education programme.

APPROACH AND STRATEGY

The project design was based on a participatory process. Only general outlines of activities and desired outputs were formulated so as to allow flexibility and space for amendment during the participatory and interactive design, implementation, follow-up, assessment and adaptation phases.

Various actors were involved in the process: the rural population, stakeholders, producers' associations, basic territorial organizations, unions, municipalities and NGOs. They took part in planning and assessment workshops, which heightened sensitivity towards local development issues and the degradation of watershed natural resources, as well as providing a basis for preparing/adjusting annual plans. The implementation strategy was developed through a process of learning, reflection and action. The following is a summary of the main steps in that process:

- ***Balance between local rural development and natural resource conservation*:** The project's main objective was to: i) solve the population's most urgent needs; ii) establish a long-term, sustainable natural resources management system; and iii) improve livelihoods.

- ***Reinforce relations between communities and local institutions*:** The project promoted the involvement of populations, grassroots organizations and local institutions (municipalities, government bodies and NGOs) through a process of participation and consensus building.
- ***Replication and dissemination of successful experiences**:* Pilot/demonstration activities were first carried out in selected project micro-watersheds and communities, and were then replicated and disseminated in the upland watershed and areas of the midland watershed.
- ***Research:*** Studies and research were conducted on specific themes.[12] Methods, tools and techniques to promote community participation were identified and improved.
- ***Follow-up and assessment:*** The follow-up and assessment phases generated a significant amount of information about the implementation process, activities, goals and aims, training events, participant numbers, the technical quality of activities, revolving funds, the evolution of incentive systems, etc. All of these provided useful feedback to guide field activities and operating strategies.

RESULTS REGARDING THE PARTICIPATORY PROCESS

Human resource development

The project aimed to develop community human resources through the following activities:

- training the rural population in technical, organizational and administrative aspects;
- training community leaders[13] in rural communication and community promotion; and
- developing an environment education programme for teachers, students and families.

Enhanced production systems and income-generating activities

The project aimed to reinforce the micro-capitalization process by establishing a local micro-credit system to promote sustainable natural resource management, and by implementing income-generating and income-diversifying initiatives.

Local revolving credit funds (FRCCs) were highly beneficial to the project communities that managed them[14] and established their own payment rules, guarantees, terms and interest rates. Besides providing technical assistance and incentives (inputs, materials, farming equipment, etc.), FRCCs were crucial in facilitating the implementation of techniques to enhance production systems (see Box *5*).

Box 5: Enhancing production systems

It is evident that people have greater respect for honey-producing trees in areas where apiculture has been introduced. Likewise, the adoption of family fish farming has contributed to the conservation of natural vegetation and improved water supply for provide fish ponds. These practices, together with the introduction of soil conservation techniques such as legume soil cover in fruit orchards are good examples of activities that have led to natural resource conservation through productive activities.

Source: Tripartite assessment mission report, 1999.

Micro-credit also made it possible to implement a series of income-generating and diversifying activities, the most successful in terms of cost–benefit ratios being apiculture, vegetable production, fish farming, natural dye production, medicinal plant sales, and handicrafts. Increased income-generating activities led to the establishment of two producers' associations: the Beekeepers'

[12] Natural resources, socio-economic activities, communications, the population's perceptions, etc.
[13] Both men and women.
[14] Basic territorial organizations and producers' associations.

Association of Piraí River Upland Watershed (ASACAPI) and the Ecological Producers' Association (ASOPEC), which benefited from project funds at the outset and which continue to expand.

Sustainable management of watersheds and natural resources

Improving production systems and generating income had positive impacts on sustainable resource conservation and development. The conservation/production approach reduced the pressure on natural forests and fallow and the risk of erosion, while enhancing water retention and infiltration, bringing about a significant change in people's perception of the environment and natural resources management (Box 6).

Box 6: Change in people's perception of the environment and natural resources management

In Bella Vista, where the project has been running for approximately nine years and has started to implement reforestation programmes, there is a remarkable change in people's perception of and attitude towards the environment and natural resources management. Most respondents in this community perceive an evident change in the natural surroundings, and are responding to this by reducing land clearance and which "chaqueo"(slash-and-burn) practices, while increasing conservation practices such as contour planting (terrace management), beekeeping and the reforestation of deforested terrain.

Source: Case study on perceptions and change of attitude, 2003.

Owing to limited financial resources, the project conducted only small-scale activities in reforestation, erosion control and other public works to reduce sediment transport and flood risk in the lower watershed. It also supported small-scale social and productive infrastructure works, such as grain mills, community woodworking, silos, family and community water reservoirs, micro-irrigation systems, rainwater collection systems, water source protection and the supply of tap water to the communities.

Fighting poverty and social/gender inequality

While the project document made particular reference to the need to involve the very poor and women in the participatory integrated WM process, the follow-up and assessment reports indicated that most participants were middle class, in spite of the attempts made to reach marginal groups. These efforts did not increase participant numbers substantially, for the following main reasons:

- Improved production systems did not benefit low-income individuals, who are mainly landless sharecroppers, unskilled labourers, widows and others at the subsistence level.
- The very poor do not have the necessary resources to apply for community revolving credit funds, which require a minimum contribution and guarantees.
- A significant proportion of the very poor are handicapped, and other marginalized individuals are not motivated to participate actively in project activities.

However, since 1999, much progress has been made in enhancing rural women's participation. In spite of constraints and cultural problems, women became much involved in a number of productive activities[15] in 2001. By 2002, 124 women had become members of ASOPEC and had established their own trading store at Samaipata (Ecotienda El Sol), as well as setting up contracts with supermarkets in Santa Cruz for the sale of organic vegetables.

[15] Such as family-level production of vegetables, production/trade of organic vegetables, extraction/trade of natural dyes, collection, drying/trade of medicinal plants, and manufacture of handicrafts.

Community participation

The use of various methods and tools[16] resulted in increased participant numbers, from 80 in 1994 to 500 in 2001. Other tools included interviews, exchange of experiences and participation in national and international training events.

The enactment of the Bolivian Law on Popular Participation (1995) further facilitated the promotion of community participation in integrated WM. The project also increased the understanding of this law in its areas of activity.

Expansion and dissemination of experiences

Towards the end of the project, priority was given to consolidating demonstration activities, plots and farms, and to accelerating the project's participatory expansion strategy.

Producers implemented successful demonstration activities. Holdings with five different integrated activities became demonstration farms, while communities with three or more demonstration farms became training communities operating as field schools, where producers from other communities or regions received training.

Demonstration activities and training communities continue to pass experiences on to local people and visitors. In May 2003, FAO, SEARPI and the University of Santa Cruz initiated a communication and expansion project to support the strengthening of such field schools.

RESULTS REGARDING LOCAL AND REGIONAL INSTITUTIONALIZATION

Throughout the project, strategies were developed and efforts made to sway government institutions and NGOs to adopt the participatory integrated WM approach. The strategic guidelines were: human resource training, creation of an integrated WM unit, strengthening pilot activities and creating field schools, replication, establishing a forum for the whole watershed, and assisting in the formulation of national policies and strategies.

Human resource training

Local institutions' ability to promote participation relies on the existence of trained and experienced personnel. From its onset, the project conducted a training programme for staff of the national counterpart institution (SEARPI), NGOs and municipalities.[17]

SEARPI was unable to continue, as requested, the activities initiated by the project owing to its incapacity to absorb the personnel trained by the project.[18] Most municipal unit technicians however are active in their relevant areas, despite employment instability – any change in municipal government could affect their future stability. Communicators and community trainers were trained to coordinate actions in their communities. However, although the project had designed a strategy to incorporate them into the municipalities, this was not a success owing to lack of resources and political will.

[16] Such as regular community meetings, participatory rural appraisal (PRA), participatory assessment and planning workshops and training in participatory methods.
[17] Municipal technical units for the environment and natural resources.
[18] Changes in SEARPI's political orientation and high staff turnover led to most of the personnel terminating their contracts (only two professionals were left in April 2003).

Creation of an integrated WM unit

The proposal to create an integrated WM unit under SEARPI came up against financial and institutional difficulties. While the executive directors wanted to create this unit to comply with the SEARPI Law (1983), the Board of Directors did not approve it for many years. Despite strong recommendations to the government,[19] no change had taken place at project completion. SEARPI's current executive direction intends to introduce a new structure that will include the integrated WM unit.

Replication of experiences

Since 1998, project activities have been extended to two municipalities of the Piraí River midland watershed.[20] Project intervention and resources were kept to a minimum in these areas, to allow municipalities and SEARPI to contribute more significantly and adopt leading roles. Integrated WM was included in municipal development and annual plans, which allocated some resources to it. Municipal governments have shown interest in continuing the project's experiences and approach.

Creation of a forum for the whole watershed

The project's approach implies coordination among different social and institutional actors.[21] Since 1999, the project has aimed to provide opportunities for discussion among all the actors in the upper, middle and lower parts of the watershed, thereby institutionalizing its approach. It helped to establish the Association of Watershed Municipalities along the Piraí River,[22] which was officially recognized. However, over time, interest in the association started to wane as a result of lack of drive and cohesion on the part of its directors, shortage of resources and the absence of executive and technical management. In spite of this, the association's example has encouraged other municipalities to form the Grande River Watershed Association.

Support to national policies and strategies:

Through FAO's Technical Cooperation Programme (TCP), the project contributed to the formulation of national watershed policies and strategies. The National Plan on Watershed Management in Bolivia (PLAMACH-BOL of 1997) incorporates the participatory integrated WM concept. The plan, which was presented during the transition to a new national government, has not yet been implemented. Until 2002, no significant progress was made, and sector development was limited to the enactment of a new water law. From 2000 to 2001, the project helped to set up a database on WM projects in Bolivia over the last ten years.

RESULTS REGARDING DISSEMINATION

Project experiences were disseminated mainly through meetings of the Bolivian, Peruvian and Latin American (REDLACH) WM networks. The project participated in REDLACH meetings in Huarinilla (La Paz, 1996) and Querétaro (Mexico, 1999), and in Peruvian network meetings in Cajamarca (1996), Piura (1997) and Tacna (1998). It also participated in experience exchange meetings with countries from the other four regions of the inter-regional project, which were held in Rome (1993 and 1998), Tunis (1995) and Hammamet (1996). Articles, papers, videos, case studies and theses were published, as well as studies, research, methods, experiences, etc.

[19] The reviewing mission (1997) and the tripartite assessment mission (1999) recommended that the government implement this proposal.
[20] This process was initiated when the authority, municipal technicians and community leaders visited upland watershed areas in order to identify and replicate successful experiences, and test others.
[21] Public and private.
[22] Consisting of ten municipalities.

LESSONS LEARNED

The following are the lessons learned over almost ten years of project experience in Bolivia.

Project design and approach

The project's flexible design was the major factor that facilitated its implementation and contributed to its success. Flexibility makes it possible to amend plans according to local dynamics, particularly those related to rural populations. However, if the design is too flexible, it may result in a deviation from the project's main goals and expected outputs. This can be avoided if facilitators agree on the concepts and significance of participation and integrated WM as the basis of project execution.

Lesson learned: Participatory integrated WM projects must be designed with adequate flexibility and must last long enough[23] to consolidate the participatory process. To facilitate this, human resources must be creative and highly motivated and have a sense of team spirit.

Community participation in integrated WM plans

Unlike traditional integrated WM projects, which focus on technical aspects and follow a top-down approach, participatory projects require a process of continuous interaction with the population. This results in more realistic planning and a greater likelihood of success.

Lesson learned: Integrated WM projects must be participatory in order to ensure their success and sustainability. Participation must be seen as a long-lasting iterative process that changes environmental perceptions/attitudes and promotes specific actions towards population development.

PRA and other participatory methods and tools

PRA is a particularly useful tool at the outset of the participatory development planning process. However, it should remain focused on environment, natural resources and local rural development issues. PRA should be avoided if the project risks not being implemented, as it would raise false expectations among the population. Other participatory methods[24] must be used throughout the participatory integrated WM process.

Social and gender equality

It is extremely difficult to involve the very poor in the participatory integrated WM process because these groups are mainly landless individuals without power to decide about natural resource use and management. Owing to cultural factors and to their dependent position, it is also very difficult for women to participate in the participatory integrated WM process. Much time is required to achieve this.

Lesson learned: Participatory integrated WM should address the needs of the very poor either by means of a special component or through the implementation of a separate income-generation programme, which may or may not be related to natural resources use.

Lesson learned: Participatory watershed projects must consider gender issues from the outset, and start with gender analysis before any action is taken. Committing women to the participatory process is not an easy task, especially with regard to their empowerment in managing community natural resources.

[23] At least ten years.
[24] Such as participatory cost–benefit analysis, participatory follow-up and assessment and economic stratification.

Participation of local institutions

Successful participation depends on decentralization. Bolivian laws[25] have created favourable conditions for participatory integrated WM because they facilitate labour relationships with the municipalities. However, participation is negatively affected by political changes in municipal governments.

Lesson learned: Local institutions', especially municipalities', participation in the process is essential for reinforcing relations with the communities and ensuring sustainable watershed actions.

Dissemination and expansion of the participatory integrated WM approach

Initially conceived as a pilot venture covering a small territory and a few communities, the project gradually expanded its area of intervention to include most of the upland and a portion of the midland watersheds. SEARPI and the municipalities became more committed and made effective use of national personnel who had been trained by the project.

Lesson learned: Project design must include strategies for growth, expansion and dissemination in order gradually to involve all watershed actors.

Participatory integrated WM engineering works

Community participation was the main objective of the project, which lacked resources to implement large engineering hydrological works and infrastructures that require significant investments.

Lesson learned: Participatory integrated WM projects must include an engineering component for public works to regulate watershed water streams.

Relations between communities and local institutions

The involvement of local populations, grassroots organizations and local institutions[26] was promoted through participation and consensus building.

Local rural development

At the start, the project supported actions aimed at solving the most urgent needs identified by the population,[27] and viewed activities aimed at the sustainable management of watershed natural resources as being of lesser priority.

Lesson learned: Communities are far more likely to participate in activities that give top priority to meeting their most urgent needs, which are usually related to rural development, before moving on to focus on issues that are directly related to watershed natural resource management.

Reducing the risk of natural resource degradation

The last decades have seen WM projects focus on erosion control and water flow regulation, which have since become established features of WM. Actions that generate employment and income, thereby reducing the pressure on resources and contributing to micro-capitalization, are less well known.

[25] Law on Popular Participation and the Municipalities Law.
[26] Municipalities, government bodies and NGOs.
[27] Excluding health- and education-related needs.

Lesson learned: It is necessary to consider direct and indirect actions that contribute to preserving resources and improving the population's livelihoods. Community credit systems designed with people play a major role in motivating and supporting the adoption of sustainable production systems.

Research–action–reflection

Activities identified during the participatory process need to be researched, tested and analysed before full-scale implementation, taking into consideration their adaptability and acceptability, existing local knowledge and the need to conduct cost–benefit analyses of income-generating activities.[28]

Lesson learned: Participatory research helps identify local (community) opportunities and weaknesses. As a tool, it involves local people in identifying alternatives to improve production and conserve resources. If an activity is to be sustainable, the population must participate in research.

Sustainability and the institutionalization process

The institutionalization of project experiences is hampered by the fact that State institutions at all levels are political in nature and relate their commitments to the present moment, and at best to their remaining term in government. Involving basic organizations and some municipalities is more sustainable.

Lesson learned: Sustainability depends more on local actors than on government involvement, so the Bolivia project should allocate more resources to supporting grassroots organizations.[29]

Resource allocation

The total financial resources allocated to the SEARPI-FAO project were very limited (approximately $250 000 a year), but additional resources were obtained from other sources and initiatives, and it is worth mentioning that all local actors participated.

Lesson learned: Participatory WM projects must act as catalysts to motivate local actors and obtain access to alternative financial/human resources. Participatory projects cost significantly less and are more sustainable than non-participatory ones.

The cost–benefit ratio of a project

Participatory integrated WM projects must carry out a detailed survey of the basic economic, social and environmental situation at the outset, so that assessments carried out during project implementation and after project completion are based on solid data and can demonstrate results and justify investments.

[28] These tools were used in the project and helped to raise the population's awareness.
[29] This may not apply to other Latin American countries that have well-established institutions for watershed management.

5. Profile of the next generation of watershed management programmes and projects

The following recommendations for the next generation of WM projects and programmes are based on national reports and analyses of past and ongoing programmes and projects in the countries of the region. These used a variety of approaches, modalities, land areas and time frames, and were driven by diverse organizational frameworks. Although each country has its own specific conditions and needs, the programmes and projects analysed share some common features and attributes, which can serve as the basis for guidelines and valid approaches for the next generation of WM programmes and projects.

The following are the most significant of those common features:

1. ***Participatory:*** The aims and territorial scope of a project should reconcile the priorities of the relevant WM institutions with the needs of the population of the watershed to be managed. It is important to carry out consultation and sensitizing campaigns for local actors, inhabitants, beneficiaries, municipal authorities and other stakeholders. Representatives of such groups should also participate in the design, execution and assessment of programmes and projects.

2. ***Inter-institutional:*** When no competent WM authority exists, programmes and projects should consult the competent institutions, establish a work team of technicians, and harmonize their policies and priorities in ways that avoid conflicts of interest or unnecessary overlapping.

3. ***Multidisciplinary:*** WM programmes and projects involve productive, social and environmental aspects, so it is important to establish a work team comprising specialists from the different disciplines related to the features of watersheds, i.e. agronomists, forestry and civil engineers, hydrologists, geographers, sociologists, social communicators, etc.

4. ***Integrated:*** The management of watershed natural resources should follow an approach that takes account of the interrelations and integration of water, soil and plant resources, as well as production systems, social conditions and the population's principal uses of resources. WM should also aim to achieve a balance among natural resource use, conservation and protection.

5. ***Sustainable:*** As well as introducing sustainable management practices and production systems, every programme or project should also be sustainable in terms of strengthening local organizations from the design stage. In addition, once a programme or project ends, its activities should be transferred to and taken over by local actors.

6. ***Replicable:*** The methodology of successive scales of intervention, from the watershed to the sub-watershed and micro-watershed levels, implies that programme or project activities be conceived, designed and implemented in ways that can easily be adjusted and applied to other, similar micro- or sub-watersheds. The methodology should also be conceived as a management model that can be adjusted and applied to other watersheds in the country.

7. ***Aligned with government policies and priorities:*** WM programmes and projects should be regarded as valid tools for harmonizing different government policies for sector development, and should survive changes of government in order progressively to become State policy.

8. ***Social, economic and environmental impacts:*** Projects and programmes should use the integrated management of watershed natural resources to promote food security and safety and improve the population's quality of life; increase farm production and productivity, by generating employment and income for the region; and recover or mitigate environmental damage. Activities carried out in

the watershed region should contribute towards the economy, social stability and the quality of the environment.

9. ***Monitoring and assessment:*** Every watershed programme and project should include a follow-up system, the monitoring of activities during implementation, and the evaluation of results, in order to validate the methodologies and practices applied, assess the cost–benefit ratio and, thereby, justify future WM investments.

10. ***Funding from specific sources:*** Total or partial funding from internal sources, such as tariffs, payments for intangible benefits, and mixed public and private funds, reduces the need to depend on external sources and to compete with other sectors that depend on those sources.

The representatives of REDLACH member countries discussed guidelines and approaches at the Latin America Regional Workshop on Preparing the Next Generation of Watershed Management Programmes. From this discussion, the considerations for improving future WM programmes were defined, as were the necessary changes to improve future WM programmes and identify innovative approaches and appropriate strategies that justify future investments in WM activities.

References

The following national reports were commissioned by FAO and REDLACH; they have never been published officially.[30] They are collected under the reference: REDLACH. 2002. National reports on status of watershed management in countries members of the Latin American Technical Cooperation Network on Watershed Management.

NATIONAL REPORT REFERENCES

Amaya Arias, M.J. 2002. *Informe nacional de Colombia sobre la gestión relacionada con el manejo de cuencas.* Santiago: REDLACH / FAO.
Aragón, B. 2002. *Informe nacional sobre la situación de manejo de cuencas en Guatemala.* Santiago: REDLACH / FAO.
Casaza, J. 2002. *La situación del manejo de cuencas en la República Argentina*. Buenos Aires. Santiago: REDLACH / FAO.
Cruz, A.G. 2002. *Informe sobre la situación del manejo de cuencas hidrográficas en el Ecuador*. Ambato, Ecuador. Santiago: REDLACH / FAO.
De Freitas, V.H. 2002. *La situación del manejo de cuencas en Brasil.* Florianópolis-Santa Catarina, Brazil. Santiago: REDLACH / FAO.
Dirección General de Clasificación de Tierras. 2002. *Informe nacional sobre la situación del Manejo de Cuencas en Bolivia.* Santiago: REDLACH / FAO.
Francke, S. 2002. *La situación del manejo de cuencas en Chile.* Santiago de Chile. Santiago: REDLACH / FAO.
García Jovel, J.G. 2002. *La situación sobre el manejo de cuencas en Honduras*. Santiago: REDLACH / FAO.
Handal Osegueda, J.R. 2002. *La situación del manejo de cuencas en El Salvador*. Santiago: REDLACH / FAO.
Molinas Maldonado, A.S. 2002. *El manejo de cuencas hidrográficas en el Paraguay.* Santiago: REDLACH / FAO.
Remiro, M. 2002. *Situación del manejo de cuencas en Venezuela*. Santiago: REDLACH / FAO.
Riquelme, L. 2002. *La situación del manejo de cuencas en Panamá*. Santiago: REDLACH / FAO.
Rivera, N. 2002. *La situación del manejo de cuencas en Costa Rica.* Santiago: REDLACH / FAO.
Serruto, G.E. 2002. *La situación del manejo de cuencas en el Perú*. Santiago: REDLACH / FAO.
Sosa Imaz, P. 2002. *Situación del manejo de cuencas en Uruguay*. Santiago: REDLACH / FAO.

OTHER REFERENCES

Escobedo, J. 2000. *Situación y lecciones aprendidas en el Manejo de Cuencas de Bolivia. REDLAC Workshop*. Santo Domingo.
FAO. 1994. *Report on the Second Latin American Congress on Watershed Management*, Mérida, Venezuela, November 1994, by Tage Michaelsen. Rome.
FAO. 2002. *Informe final del Proyecto Interregional para la Participación y el Desarrollo de las Tierras Altas-Bolivia.* Rome.
FAO/Italy Cooperation Programme. 20000. *Conservation-by-use activities in participatory and integrated watershed management*. July 2000.
Fe D'Ostiani, L. & Warren, P. 2000. *Bolivia case study, PUCD project. Inter-Agency Forum (FAO, DFID, UNDP, WFP, IFAD) Operationalising Participatory Ways of Applying Sustainable Livelihoods Approaches*. Siena, Italy.
García Jovel, J.G. 2002. *La situación sobre el manejo de cuencas en Honduras*.

[30] They can be obtained through the FAO regional office in Santiago.

Leon, R. 2001. *Estudio sobre la percepción social y el cambio de actitud con relación al manejo y conservación de los recursos naturales. Proyecto SEARPI-FAO*. Bolivia.
Roca, R. 1999. *Efectos de la conservación de los recursos naturales en la economía familiar. Proyecto-SEARPI-FAO*. Santa Cruz, Bolivia.
Solis, B. *et al.* 2002. *Estudio de valoración económica de la oferta y demanda hídrica del bosque en la Cuenca Alta y Media del Río Piraí. Informe de Consultoría Proyecto SEARPI-FAO.* Santa Cruz, Bolivia.