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MANAGEMENT FOR THE DEVELOPMENT OF HIGH-MOUNTAIN RIVER
BASINS IN THE ANDEAN REGION */

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SUMMARY

This document consists of nine papers prepared by ECLAC under the sponsorship of the Government of Italy. The Regional Office for Latin America and the Caribbean of the United Nations Environment Programme (ROLAC/UNEP) supported the execution of the project from the outset, and the Board of the Cartagena Agreement (JUNAC) was also involved in this work. The purpose of these papers is to analyse the management policies and methods which have been used for the development of high-mountain river basins and high-mountain zones in the following Andean countries: Bolivia, Colombia, Ecuador, Peru and Venezuela.

Together, they constitute an initial serious and accurate classification and definition of the various strategies used by the governments of these five countries to improve the living standards of the high-mountain inhabitants and to conserve the natural resources which sustain them. The river basin was the main reference unit used in analysing the implementation of the strategies, although other geographical units such as microregions and political/administrative subdivisions were also taken into account.

Since most of these papers were prepared by the same author (Axel Dourojeanni) and initially conceived for presentation to various forums, they have conceptual similarities which makes it easier to read the chapters separately and to follow the way in which the topic has evolved.

This document is meant to provide the bases for the compilation of a body of theoretical work on management processes for the development of high-mountain river basins and it defines the scope of some concepts, including those relating to the development, regulation, management and protection of river basins and their relationships with integrated rural development and regional and microregional development practices.

The summaries of the case studies which appear in the last chapter of the document furnish concrete information about the management methods and the present state and potential for development of the high-mountain zones. There are also references to programmes and projects in operation in the upland watersheds of the five countries. The case studies were made by local consultants. The paper on Bolivia was sponsored by JUNAC. In addition to the papers included in this document, others have been written, mainly methodological, which deal with topics related to the management of high zone development. These papers are at present available as limited-distribution documents of ECLAC.

ECLAC hopes that this document will be useful to persons involved in the design of strategies for improving the living standard of the more than 50 million peasants living in high-mountain areas of Latin America and the Caribbean and for conserving the natural resources which sustain them. It is grateful for the generous support of the Italian government and for the contributions of the many experts who helped with the preparation of this text.

REPORT OF THE INTERNATIONAL SEMINAR ON INTEGRATED SYSTEMS FOR
THE DEVELOPMENT AND MANAGEMENT OF RIVER BASINS IN THE
ANDEAN REGION OF LATIN AMERICA

(Lima, 24-28 November 1986)

I. RECOMMENDATIONS

The Andean countries of Latin America with populated areas over 2 000 metres above sea level currently face a set of common problems manifested in the physical and socioeconomic deterioration of their resources and populations. This situation is partly due to a lack of clarity and continuity in their management mechanisms and, partly, to inadequate fiscal investment in infrastructure, research, credit, and in the encouragement of private investment. However, the contribution of these areas in terms of food, energy, minerals, water resources, wildlife, tourism and handicrafts is very important to the economies of the countries.

Although the governments of the Andean countries have tried to adapt and devise strategies for the integrated management of highlands with a view to incorporating them dynamically into the rest of the national territory, their efforts have usually given priority to profitable investments and therefore have not equitably benefited all inhabitants and users. They have lacked continuity and have been too few, given the magnitude of the task. If solutions are to be found to this problem, it is important for the countries to share their experiences through mechanisms for horizontal co-operation. The work of international agencies effectively achieves this by facilitating the interchange of information among institutions, the training of professionals, the comparative analysis of strategies and the development of co-operation mechanisms.

The Seminar congratulated the Economic Commission for Latin America and the Caribbean (ECLAC) and the Board of the Cartagena Agreement (JUNAC) for developing, from 1984, with the financial support of the Government of Italy and of the European Economic Community, a project to promote horizontal co-operation in the planning and management of water resources in high-mountain river basins in Latin America. It recommended an expansion of this project particularly as regards the formulation of strategies for the integrated development of high-mountain river basins and the creation of methodological tools to carry out these strategies.

The Seminar requested ECLAC and JUNAC to make a comparative analysis of the case studies in order to evaluate the approaches used in dealing with the problems of high-mountain river basins in the Andean region.

It also stressed the need for ECLAC and the other participating agencies to make more detailed studies of the strategic aspects, institutional, economic, political and technical, with a view to suggesting action options

to the governments where action would be possible since only preliminary consideration was given to the strategies in the case studies.

The Seminar requested ECLAC and JUNAC to take the necessary steps to pursue the preparation of a manual on development and management of river basins in the Andean region since it considered such a manual the most appropriate methodological instrument for guiding governments, institutions and experts in the integral management of the Andean river basins and high-mountain areas.

As there is no centre which specializes in the development and integral management of river basins in high-mountain regions, the seminar decided to request ECLAC, with the co-operation of international agencies such as FAO through the Latin American Technical Co-operation Network on Watershed Management, the OAS, UNEP, UNESCO and others to continue their promotion activities and their co-operation with specialists and institutions or corporations located in the Andean area at the regional or microregional level.

The Seminar expressed the view that an analysis must be made of existing education and training programmes for management or administration of river basins and renewable natural resources, and that a network should be established for the exchange and updating of information among teachers specializing in river basins. These activities could be facilitated by courses conducted with the support of ECLAC and of ILPES, with a view to establishing a school of thought and a methodological approach for the development and integral management of Andean high-mountain regions and river basins.

Lastly, the Seminar recommended to the relevant agencies that a similar meeting should be held no more than three years hence, in order to evaluate the progress made in the implementation of these recommendations and their effect on the upland Andean areas of the countries of Latin America.

II. SUMMARY OF THE DEBATES

The search for strategies to deal with the steady deterioration of the living standards of the inhabitants in the highland regions of the Andes and of the natural resources that sustain them has been a constant concern of the governments of the countries of the Andean region. So far, despite the efforts of these governments (embodied in political declarations, legislation, formulation of plans and implementation of projects --some successful and others not), attempts to solve the problems that affect the population and to reverse the process of degradation of natural resources have not been completely successful.

This situation is due mainly to two factors. Firstly, the low rate of investment in projects for the development of high-mountain zones regarded as marginal, in comparison with investments in the extraction, use or exploitation of profitable resources in areas which have greater comparative advantages. Only a few river basins, such as those which had been developed

by major investments (such as in hydroelectricity plants or in the establishment of cities) or which because of their strategic geopolitical location receive major investments. Government projects or actions based on social and environmental rather than on economic and financial considerations are usually of limited scope or sporadic, despite political statements to the contrary. Secondly, there is a lack of appropriate management systems for governmental action in these many different areas with different characteristics and of difficult access, whose resources are usually difficult to exploit and conserve, with a population that has its own culture and customs, and where technology must be adapted to each place.

Management techniques should increase public and user participation, extend the scope and continuity of State action aimed at benefiting population and users and promote the better use and conservation of the resources, achieve greater intersectoral co-ordination and, generally speaking, provide a more efficient and equitable service for the whole of the population living in the high-mountain zones, for their benefit and for the benefit of the country itself.

The meeting dealt mainly with the search for means of improving the management administration and the corresponding planning and implementation tools.

Before discussing this issue directly, criteria were adopted to define some of the main characteristics and needs of the Andean high-mountain areas (see annex II) and the various strategies and management techniques used by the governments of the region in the high-mountain areas were analysed and evaluated.

The participants had two different basic frames of reference for the discussion. The first, of a general nature, consisted of two ECLAC studies: "Strategy for the development and management of the Andean region: A proposal for action at the river basin level" (LC/G.1433); and "Methodological proposal for systematizing integrated river basin development in high-mountain zones of the Andean region". The second, of a specific nature, consisted of the strategy evaluation and analysis studies, programmes and projects used or proposed for the development and management of high-mountain river basins and zones in the Andean region during the period 1980-1985, with projections up to 1990, for Colombia, Ecuador, Peru and Venezuela.

The Seminar had originally been called "International seminar on integrated systems for the development and management of watersheds in the Andean region of Latin America". While it was under way, however, it was thought more appropriate to use the term Development and management of river basins (Desarrollo y gestión de cuencas) instead of the term "watershed management" in order to more effectively summarize the Seminar's objectives. The term "watershed management" was therefore used to refer to the management of natural resources in a technical/hydrological sense, while the term development and management of river basins referred to the administrative and operational activities that promote integrated development. In practice integrated development and management of river basins would include the physical management (of the natural resources) of one or more watershed.

By associating development and management with river basin development, it is possible to broaden the view of a river basin as an exclusively physical/hydrological unit, and to see it as a management and co-ordination unit which can be used to co-ordinate programmes and projects in an integral manner with the participation of the local inhabitants.

During the debates the participants pointed to the need for more detailed analysis of the management techniques used by the governments of Latin America and the Caribbean in promoting the integrated development of high-mountain regions. Apparently, most of the existing information refers to sectoral and not integrated or multisectoral methods of action. ECLAC's methodological proposal indicated three management systems for the integrated or multisectoral development of river basins or microregions in the high-mountain region: the creation of multisectoral co-ordinating committees; the organization of special projects, such as projects for integrated rural development, microregional development and the integrated development of river basins; and the creation of local, autonomous or semi-autonomous corporations at the regional or river basin level. The details of their functioning should be studied to identify the positive aspects of each method. It should be pointed out, however, that all of these institutions, with the exception of some corporations in Colombia, have been sporadic and have been operational for different periods of time.

In order to promote integrated development, integrated plans for the development of high-mountain areas prepared by various national or regional planning offices have also been used theoretically with the aim of facilitating co-ordination among the different sectors operating in the same area in a high-mountain region. There have also been pilot integrated programmes or projects for the development of high-mountain areas which, again in theory, serve as models or prototypes for larger-scale activity. These initiatives have achieved their objective only to the extent that they have been linked to an existing management mechanism. Strategies based on the formulation of a plan are incomplete, since a plan is not in itself a solution but only a tool in the service of a management mechanism, which should be established and in operation before the plan is elaborated. Similarly, the large-scale application of a pilot project requires the creation of a management system capable of incorporating what has been learnt into the regional or national plan. Ideally, this management system should already exist or should be created before the pilot project is undertaken.

The elements which should be incorporated in management activity for the development of river basins emerged from the papers presented at the Seminar. The main goal of management should be to improve the quality of life of the users and inhabitants and promote the protection and conservation of their natural resource base. This entails compliance with certain criteria, including: the organized public and user participation in development; respect for and reestablishment of Andean criteria with respect to the aspirations of local communities and populations; creation or consolidation of diversified yet complementary production systems; and evaluation categorizing of rural poverty, in order to reach most marginal and unequal areas; use of classification criteria (for example, of soils and land use) based on the Andean situation; and co-ordination of the activities of all the

users of the basin, be they big investors, small landowners or mountain peasants.

Any proposed strategy for the development of high-mountain regions should clearly establish the management systems to be used in its implementation, the operational and physical area in which it would be carried out, the direct and indirect participants in the development of the area specified, and the criteria for decision-taking on the development of each specific region.

The disadvantages and advantages of the various management strategies used by the countries of the Andean region in the high-mountain areas, were analysed, in particular those designed to improve the living standards of their inhabitants and conserve their resource base.

Two extreme positions were debated with respect to State action. The first was top-down action with emphasis on integrated macrodevelopment based on the use of the installed capacity of the central State bodies and their provincial or regional offices. This means allocation of resources on a national basis and compliance with technical and administrative regulations, so that the plans and tasks assigned by the central government are carried out in the regions, provinces and municipalities. The success of this approach requires a high level of efficiency and administrative continuity at all levels, national, regional and local. In order to comply with the regulations and carry out the plans, the regions and microregions must have sufficient resources and be sufficiently equipped and independent to adapt the regulations and instructions of the central offices to their local situations.

A major restriction on this approach is the lack of continuity in central government support of regional governments in development processes and regional governments of local governments, owing to budgetary dependence and to the many political and administrative changes and reorganizations which occur. The constant changes in policy and authority, national, regional and local, so typical of the Andean countries, weakens local government bodies and prevents their consolidation.

The second approach was to upgrade the authority of local management units such as high-mountain peasant communities, townships and other local organizations so that, regardless of changes in government policy, they could govern themselves, co-ordinate their own development and co-operate with other users of the river basin or microregion to which they belong. This method has been used by several countries, at least on an experimental basis. The problem is that the State must in any event help each of these units to become more independent, and the problems of discontinuity and the small scale of State aid again arises, because State support must be maintained over a long period for the local bodies to become self-sufficient and acquire increased authority and qualified personnel.

Lastly, the Seminar considered the theoretical participatory-operational proposal submitted by ECLAC in document LC/G.1433. This strategy proposed the decentralized organization of the State based on the creation of independent or semi-independent corporations capable of generating their own

financial resources (along the lines of Colombia's autonomous corporations) and on the active participation of usually marginalized sectors. This latter point entails: training the mountain peasants or the poorer users to promote their own development (organized in communities, townships and other participatory units); restoring and adapting technologies suited to the situation; establishing diversified but complementary production systems; studying the physical environment, the land, altitude and history; and, above all, the capacity to ensure interchange among all the participants --from mountain peasant to big business-- in the development of each of the basic areas. A prime objective of this proposal is to organize State action in such a way that, acting through a regional authority, it could furnish the usually marginalized inhabitants of the upland watersheds in the Andean region with the elements needed to achieve self-sufficiency in their own development, reducing their present isolation, stagnation and dependence, and enabling them to sit around a table with other, richer users. It was further suggested that the most appropriate means of achieving this objective is to establish bargaining committees or local boards (sponsored by townships or other existing organizational units) in each management area; these committees would deal with matters both internal and external to the basin, thus linking internal development with outward-looking development. This arrangement will work only if harmonization and co-operation among the participants in the basin's integrated development and management is helped and directed. The bargaining committee must have, at least initially, the support of a technical team provided by the regional authority which would help to strengthen the community or township participation systems. As this is a theoretical proposal, it is only fair to say that it would be worth comparing with past experiences of governments which have taken a similar approach.

The operational areas were studied in order to see how the Andean territory is distributed among the national State organs such as regional bodies, local authorities and national institutes, foundations, projects, corporations and programmes operating in the high-mountain regions. (See annex I, where the concepts used are defined.) It was recognized that the information in the hands of the national organs about the Andean situation is usually outdated and insufficient or distorted, owing to their tendency to impose sectoral initiatives for the execution of specific programmes or projects from the outside. Unless the national organs ensure the participation of the recipients of their programmes by creating local bodies, lack of co-ordination among the recipients can be expected. Intervention without public and user participation in defined areas such as river basins or microregions is incompatible with the aim of achieving integrated management for the development of high-mountain areas.

When the State carries out sectoral programmes or projects, each executing agency subdivides the territory into areas compatible only with its own particular management system, fragmenting the territory, preventing co-ordination among projects from different sectors and confusing the recipients of the aid. Hence the importance of a common definition of a physical management unit such as a high-mountain river basin or microregion. The definition of such areas makes it possible, particularly, in high-mountain regions, to establish mutual relationships between the users of these areas and the environment they exploit, with a view to improving their

standard of living and their relationships with the outside world. In the Andean high-mountain region the river basin is the ideal natural unit for the co-ordination of initiatives with public and user participation. If this was not possible, however, these units could be related to a microregion. By using the river basin or related microregion as the physical management unit, it is possible to determine the nature of the relationships in each area among the operational management units (landowners, townships, peasant communities, mining companies and farm co-operatives) and also to incorporate the protection and conservation of the resources.

In its discussion of the relationship of environment, conservation and protection and watershed management with the economic and social concept of "integrated river basin development and management" the existence of two lines of thinking become apparent which are not incompatible but which should be harmonized by means of discussion and agreement among the experts and through a school of thought that could systematize these concepts into a common approach.

These lines of thinking have different starting points and evolutions. One is based on conservationist and protectionist criteria and has the main goal of preventing erosion by water and controlling flooding and water quality by means of good management of the basin's natural resources. This approach leads first to multiple use of the water by basin and then to concepts of integrated use and management. The developmental and management approach starts from macronational planning, moves on to regional and area planning and culminates in planning and management proposals for integrated rural development; this approach can be taken on the basis of river basins but it is not essential, for the concepts of "microregion", "community", etc., can also be used. Owing to this divergency, there was no consensus in the papers on using the Andean river basin as the reference unit. Some proposals referred to the Andean high-mountain region in general without mentioning smaller and more specific areas, so that it was not clear to what unit of land the proposed policies were to be applied. In other papers, the river basin, microregion, township or peasant community was the starting point of the analysis.

Given this situation, it was thought important to agree on criteria for the definition of specific physical areas, particularly in view of the need to formulate strategies for physical and operational units which are clearly defined and accepted by all agencies (regionalization process) to ensure co-ordination of the programmes and projects carried out in these areas. In order to achieve this regionalization, it is necessary to accept at least that the natural physical boundaries (river basins, valleys, hillsides, ecoregions, rivers) should be harmonized and brought into line with the operational boundaries (administrative, political or institutional), in order to establish a single management or bargaining area. It was also pointed out that the high-mountain areas, in addition to being occupied by peasant or Indian communities inhabiting specific areas, also contain townships, associations, enterprises and other groupings which are neither peasant nor Indian and live in the basin or use it under different forms of tenancy of the resources (land, minerals, water, wildlife, forests). These include urban dwellers, mining companies, universities, hydroelectric power companies and other users who must be taken into account in matters of participation.

The views of the representatives of the local people, businesses, universities and other organizational units must therefore be taken into consideration in management decisions. This point is often overlooked owing to excessive concentration on rural and Indian affairs and on poverty, with the result that these groups are singled out and treated separately, without being given the possibility of participating in the integrated development of the land they inhabit. This approach disregards the fact that urban settlements, companies and other social, business or institutional units are part of this environment and they all play an important role both in development and in the use and management of the natural resources.

The State, having divided the territory into microregions, can co-ordinate the actions of different bodies in a single river basin or area or carry out integrated projects for one or several watersheds. In both cases it can clearly identify the local inhabitants and users, thus facilitating their participation in a bargaining committee or other similar body.

With regard to the concept of development and management of river basins, many analyses were offered of the concepts of society and participation. The need was stressed for study of the structure of Andean society peculiar to each country and region before introducing a programme of integrated river basin development and management. There was likewise consensus among the participants on the fundamental need for the participation of the rural and urban inhabitants of the Andean region and of enterprises in the management processes. There should be no management for development purposes without such participation.

The Seminar agreed that it would be useful to propose means of facilitating action by the State and the users of the river basins in bargaining or management areas in order to foster integrated management for purposes of river basin development. The fundamental task, if the integrated development and management of high-mountain zones is not to amount merely to pilot projects, is to determine the measures and resources needed to reach every corner of a country with appropriate initiatives. This means regionalization and microregionalization, training of leaders and specialized personnel, identification and evaluation of each area, and the performance of other tasks to facilitate the introduction of a comprehensive national institutional and participatory system. The work carried out so far had been either on too small a scale or only fragmentary, and therefore coverage has been inadequate.

The need to organize the State to carry out the proposed strategy highlighted the importance of initially training government technicians and then using them to train the inhabitants and users of the high-mountain river basins. Technicians working in high-mountain zones must have interdisciplinary professional training, for they have to work in management areas defined by river basin boundaries or other operational units, and they must be able to work within the framework of integrated programmes and serve as the link between experts, users and politicians. Their training must cover technical, administrative, social and economic matters. For this purpose, the region's universities would have to create special postgraduate programmes in integrated natural resource management and integrated river basin development.

The participants emphasized the importance of the ECLAC proposal for the establishment of a management support system for the development of high-mountain river basins in the Andean region. The proposal was for the preparation of an operational manual on the formulation, selection and implementation of strategies, programmes and projects in high-mountain areas based on the collection and processing of information about actual experience and its incorporation into a computerized system that would provide rapid and easy access to multiple options for action.

The Seminar took note of the report and of the preliminary version of the forestry and agriculture manual, which is based on more than 20 years actual work co-ordinated by the Forestry and Agriculture Service of the Cajamarca Technical University. The collection of this information was sponsored by the Board of the Cartagena Agreement and the European Economic Community. It was thought that the manual would be of great use to all the institutions interested in the development of the high-mountain areas of the Andes and that it would also be of use in extending the pilot experience to the national level.

Manuals were also received from the National Programme of Soil and Water Conservation in watersheds prepared by the Department of Water, Soil and Irrigation of the Ministry of Agriculture of Peru under an agreement with the International Development Agency. These manuals and the respective report would also be useful for natural resource management in the high-mountain zones. The meeting was informed about many other river basin development and management projects and initiatives which are being carried out in Latin America and the Caribbean and which were used as background material in the drafting of the basic documents presented to the meeting.

The basic documents presented to the Seminar included the case studies of the high-mountain river basins in Colombia, Ecuador, Peru and Venezuela (see the list of documents in annex IV). The high mountains of the Andean region have people and products which are decisive for the future development of each of the countries studied. However, State action has usually been concentrated on the extraction of resources, especially hydropower and minerals, and on some highly profitable products such as coffee, to the benefit of a few privileged sectors and urban centres. Relatively very little has been done to benefit the peasant inhabitants of the high-mountain areas of the basins or to improve the protection and conservation of their resource base.

Economic and financial considerations have taken precedence over environmental, social and legal criteria in determining investment in these places. The case studies confirm a close relationship between the efficiency of the administration and management machinery of the bodies responsible for assisting with the development of the high-mountain areas and their sources of financing. The management methods differ according to the source of their financial support (for example, public funds, investment loans, or levying of special taxes). Sources of financing play a decisive role not only in the selection of the management method but also in determining the period over which the works can be carried out and the extent of their social and environmental impact.

Projects designed for the management and conservation of renewable natural resources do not take sufficient account of production factors, and this often makes them impracticable or unacceptable, for the local inhabitants do not identify with protectionist measures. Production plans, in contrast, although they sometimes do not specify what conservation measures are included, achieve wider acceptance by both investors and the local people.

The essential comprehensiveness or multisectoral approach of initiatives to improve the standard of living of the inhabitants of the high-mountain areas entails two major constraints on government activity: the need to deal with several options at the same time, which renders economic justification difficult, and the lack of compatibility between the integrated or multisectoral projects and the normal sectoral organization of the State.

The economic and financial inputs to sustain the management systems must come from special resources allocated for this purpose (as in Colombia where 2% of energy sales by hydroelectric power stations is used for the benefit of the inhabitants of the basins from which the resource was obtained), from loans for investment projects, from public funds, or from resources provided by the inhabitants and the users of the basins --local manpower, for example.

The four case studies show that the high mountains of the Andes have a very good production potential, even though more precise data to quantify this potential are not available. The State must generate more investment projects with full knowledge of the available alternatives and options; knowledge of this potential is essential to justify the allocation of State resources to integrated development and management.

The Seminar emphasized the need to continue to compare the strategies carried out by the governments of the Andean countries in the past 10 years for development and management for the benefit of the high-mountain inhabitants and resources, especially with a view to the sharing of experience.

Annex I

DEFINITION OF TERMS

Operational management unit: A geographical unit delimited by the radius of action of an enterprise, company, community or individual that in some way uses the renewable or non-renewable resources of the basin. An operational unit is defined and represented by the inhabitants or users of an area: an owner or tenant of a plot; a group of owners or association of tenants; the representatives of a peasant community; the board of a farm co-operative; the board of a mining enterprise; the board of a hydroelectric power company; or the board of an irrigation district.

Physical management unit: A geographical unit delimited by natural boundaries such as a river basin, a hillside, an ecosystem, etc. In these units, the use of the resources must be integrated and co-ordinated. The activities to be carried out under co-ordination are those which affect the state of the natural resources: building a dam or road, regulating a forest or wildlife, or cultivating a field. The river basin is the physical management unit adopted by the Seminar.

Management and bargaining area: A geographical and operational area produced by the combination of one or more physical management units and one or more operational management units. If a river basin is chosen as the physical management unit, the management and bargaining area will be established and run by the representatives of each of the operational management units operating in the basin.

Bargaining committee: A body drawing its membership from each management area. The members of a bargaining committee are the representatives of the operational management units combined in a common physical management unit. A bargaining committee may be formed under the auspices of a township or other kind of organization representing the users and inhabitants of the basin.

Bargaining criteria: Guidelines proposed for agreements between the representatives of operational management units. These criteria may include the desire to improve the standard of living of the inhabitants, to preserve the natural resources or to conserve the local cultural heritage, as well as other criteria related to the common interest in the physical management unit.

Annex II

CRITERIA FOR DETERMINING THE MAIN CHARACTERISTICS AND
NEEDS OF THE HIGH-MOUNTAIN AREAS OF THE ANDEAN REGION

- The high-mountain areas cannot be treated as homogeneous or continuous. Although poverty and environmental damage are obvious facts in all the situations, the poverty is unequal in most of the high-mountain zones, to judge by various indicators of living standards, natural potential and economic activity. The degree of inequality must be evaluated so that priority can be given to specific initiatives designed to reduce the differences between these management areas, each of which requires individual treatment.

- The analysis of the conditions in the high-mountain areas must be made at the level of management or bargaining area, using evaluation techniques suited to the situation in each zone. Large-scale approximations and the use of imported forms contribute little to the search for concrete solutions, which are the only ones which ultimately produce results.

- The development and administration of the management and bargaining areas of the high-mountain zones is not a process tied exclusively to the agricultural sector or environmental conservation. The high-mountain areas of the Andean region are a complex in which agriculture and industry, city and countryside, energy and technology are all present. In fact, industrial development of a high-mountain river basin is impossible without diversification of activities. This diversification begins in the family which embraces at one and at the same time agriculture, livestock-raising, handicrafts, trade, gathering, services and paid labour and continues in other broader economic areas, such as the community, the district and the province.

- In practice, the development of management areas takes place in two directions: from the inside outwards and from the outside inwards. The first process is associated with the traditional development of the family and the community and with the support which they receive to improve their living conditions. The second is connected with intervention by external actors in the river basin or district to extract or exploit certain resources such as hydroelectricity and mineral, forestry and fishery products. The study of the development process of high-mountain river basins must take both directions into account. In the case of development from the inside outwards, priority is given to the concern of the high-mountain dweller to achieve security, self-sufficiency or survival by diversifying his activities, co-operating with other individuals, working land at several altitudes simultaneously, and using local technology. In the case of intervention from the outside inwards, private, regional or national interests predominate. This usually generates very powerful conflicts between the river basin authorities and central, regional, or national interests, but it can also be the source of greatest support for the integrated development of a river basin or microregion.

- The development of each management area in the high-mountain zones can only be achieved by means of joint action and co-operation among the participants in the process. Whether these participants are passive or active, they must be clearly identified and brought together in a bargaining committee. They may be representatives of the population at large, such as representatives of peasant communities or of townships, representatives of the private sector such as landowners or traders, representatives of the State technical sector, or representatives of political groups, local authorities, armed forces, teachers, religious orders, charity organizations or foreign missions.

- The possibility of agreement among the participants in the development of each management and bargaining area depends on the extent to which they know what agreement is needed, why it is needed, by what means it is to be given effect, and how and when this should be done. If there is to be agreement in this respect, the participants in the process must be helped to understand the relevant interests, rights and positions of each participant and to consider the largest possible number of options for action and interaction and the procedures and resources needed for implementation of what is agreed. This help amounts to the organization and training of technicians to work with each management area or with groups of units.

- If the development of each management area is to be achieved, be it a river basin or other unit, there must be an action plan for every country and region designed to facilitate, strengthen and co-ordinate the effort of each basic unit. This action plan must be clear and practicable and not consist merely of a list of intentions or general guidelines. In other words, it must be formulated rigorously and specify and assign priority to its objectives, indicating how, when and where they are to be attained, and it must deal both with the existing constraints and with suitable means for overcoming them.

Annex III

ORGANIZATION OF WORK

As part of the activities of the project on planning and management of water resources in high-mountain river basins in Latin America and the Caribbean, financed by the Italian government and with the collaboration of the Board of the Cartagena Agreement (JUNAC), the International Seminar on Integrated Systems for the Development and Management of Watersheds in the Andean Region of Latin America was held from 24 to 28 November 1986 in Lima.

The Seminar was attended by experts in river basin management from Bolivia, Colombia, Ecuador, Peru and Venezuela. In addition to the representatives of the sponsors, the meeting was attended by representatives of the Turrialba Tropical Agronomy Research and Training Centre and of the Inter-American Development Bank.

The meeting adopted the following agenda:

1. Opening of the Seminar
2. Election of Officers
3. Adoption of the provisional agenda
4. Statement on ECLAC and JUNAC activities and projects relating to integrated systems for the development and management of the high-mountain river basins in the Andean region of Latin America
5. Presentation of the country papers on evaluation of the situation and the policies and strategies used by the countries of the Andean region in integrated river basin development and management
6. JUNAC statement on the identification and description of production systems in the Andean region
7. Statements by experts and national officials responsible for the formulation and implementation of programmes and projects on river basin development and management in the countries of the Andean region
8. Statements by officials of international organizations and foundations which carry out activities related to the development and management of high-mountain river basins
9. Analysis of the problems and the need to systematize and exchange knowledge about integrated systems for the development and management of high-mountain river basins in the Andean region of Latin America
10. Debate and adoption of the recommendations and conclusions of the working groups
11. Closure of the Seminar.

The inaugural meeting was addressed by: representing JUNAC, Carlos Aguirre, Chief of the Technology Policy Department; representing ECLAC, Michael Nelson, Director of the Division of Natural Resources and Energy; and, representing the Italian government, Quintilio Crovetto, officer responsible for technical co-operation, Italian Embassy in Lima.

The Seminar was chaired by Axel Dourojeanni, Chief of the Water Resources Unit of ECLAC's Division of Natural Resources and Energy.

Annex IV

LIST OF DOCUMENTS SUBMITTED TO THE SEMINAR

Basic documents

Programme

Provisional agenda (IC/L.398(Sem.36/1)).

Annotated provisional agenda (IC/L.399(Sem.36/2)).

Strategy for the development and management of the Andean region: a proposal for action at the river basin level (IC/G.1433).

Proposed methodology for systematizing the integrated development of high-mountain river basins in the Andean region (prepared by A. Dourojeanni and T. Santa María), November 1986.

Reference documents

Eliseo Colque Gutiérrez, Algunas experiencias del oriente boliviano en el desarrollo y manejo de cuencas hidrográficas. Centre for Economic and Social Studies (CERES), Bolivia.

Autonomous Regional Corporation of the Cauca Valley (CVC), La CVC: algunos aspectos históricos, Cali.

Autonomous Regional Corporation of Rionegro-Nare (CORNARE), Consideraciones finales del Seminario hacia una política de desarrollo regional, Rionegro, Antioquía, 6 to 10 October 1986.

Lorenzo Chang Navarro, Conservación de suelos y manejo de las cuencas hidrográficas, Ministry of Agriculture of Peru, National River Basin Soil and Water Conservation Programme, Lima, July 1985.

Pierre de Zutter, Perspectivas del ecodesarrollo andino, Lima, 1986.

National Development Foundation, Resumen de la evaluación y diagnóstico de las estrategias, programas y proyectos utilizados o formulados para el desarrollo y manejo de cuencas y/o zonas altoandinas del Perú durante 1980-1985 y su proyección hacia 1990, Lima, November 1986.

Alcides Gómez, Darío Fajardo M. y Soledad Ruiz N., La situación agroalimentaria y las políticas para el campesinado en Colombia, 1960-1986, Bogotá, November 1986.

Water Resources Institute of Ecuador, La planificación de los recursos hidráulicos en el Ecuador, Quito, November 1986.

Board of the Cartagena Agreement (JUNAC) and European Economic Community (EEC), Manual Silvoagropecuario, Cajamarca, 1985.

Board of the Cartagena Agreement (JUNAC) and Inter-American Indian Institute, Relato general del encuentro campesino de desarrollo rural para dirigentes del área andina, Cochabamba, 6 to 12 October 1986.

Ministry of Agriculture of Peru, Estrategias de promoción en las comunidades y caseríos andinos para la conservación de suelos en el Perú, National River Basin Soil and Water Conservation Programme, Lima, December 1985.

Ministry of Agriculture of Peru, Impacto de la conservación de suelos y aguas en la sierra peruana, National River Basin Soil and Water Conservation Programme, Lima, April 1986.

Ministry of Agriculture of Peru, Manual técnico de conservación de suelos, National River Basin Soil and Water Conservation Programme, Lima, September 1985.

THE STATE AND STRATEGIES FOR RIVER BASIN MANAGEMENT
IN THE ANDEAN REGION */

1. High-mountain river basins in the Andean region

The development and management of high-mountain river basins is a complex subject. It concerns isolated and steep areas with hundreds of different areas, each of which has its own individual characteristics. Every microregion calls for individual and integrated treatment. In every region it is necessary to understand the organization and participation of the user in his own development, preserve and adapt technologies appropriate to the environment, deal with systems of production which are diversified yet complementary, study the physical environment --the land, altitude and history-- and above all to be capable of promoting transactions or concerted actions among all the participants in the development process in each of the basic areas. Since the high altitude mountain river basins are part of a complex macrosystem made up of many different systems and subsystems with their own characteristics and with differing degrees of internal and external complementarity, the challenge consists in developing the potential of each of these systems and subsystems. The objective is to provide the inhabitants of the high altitude river basins of Latin America with what they need to be self-supporting in their own development, thereby reducing their isolation, stagnation and dependence.

Ways must be found to assist hundreds of environments, while respecting the individual characteristics of each of them, and at the same time establishing links among these environments and between them and the outside world, i.e., to combine development from within through systems of assistance and services for promoting self-management with development from outside in the form of the intervention of regional, national or international interests.

The solutions to be proposed, will have to transcend the traditional rhetoric which merely states the problems and indicates what has to be done without worrying whether the recommendations are practicable or not. If practical results are to be achieved, technical experts must share their knowledge with the users and other participants in the development of river basins, devising easy-to-use and flexible mechanisms for identification of the problems, and they must determine the users' common objectives and the constraints to their attainment, and find ways to overcome these obstacles through the exchange of experience. This means devising ways to encourage self-management in each river basin or development area.

*/ Prepared by the ECLAC Secretariat and originally issued under the title "Strategy for the development and management of the Andean region: a proposal for action at the watershed level" (LC/G.1433). This paper was presented by A. Dourojeanni and Mario Lenzi to the seminar/workshop on integrated watershed management, Tropical Agronomy Research and Training Centre (CATIE), Turrialba, 20 to 23 August 1986.

This task is less arduous at present, for there exist computerized systems (including the use of microcomputers) which facilitate access to much of the positive experience which can be retrieved and organized systematically. The simplest approach is to employ these systems to provide the user with a set of alternative solutions from among which he can choose the ones most suited to his needs, and also to propose ways of combining these solutions and putting them into practice. This mechanism can be useful provided that it reaches its potential users and they have the opportunity and the will to co-operate with each other.

The high-mountain environment is neither homogeneous nor continuous and therefore ready-made formulas or evaluation systems designed a priori do not work. There are, however, some criteria on which researchers agree and which must be taken into consideration in dealing with the development needs of these zones. In considering these criteria, the reader should try to distance himself from the preconceived approaches of the outsider. Otherwise he may view as obstacles factors which are considered favourable and useful by the river basin's inhabitants, or indeed take the basin only as a means of obtaining certain benefits, thus missing the opportunity to assist it in its development.

2. Conceptual guidelines for the integrated management of the Andean region

Observation of the macrosystems in which the Andean people carry out their activities reveals an imbalance in the flows of materials, energy and information, measured by income and expenditure in these zones (Colomés, 1982).*/ These ecoregions make significant contributions to the national economies in terms of food, energy, minerals, water, tourism and manpower. On the other hand the economic return to them in terms of public investment in infrastructure, research, loans and promotion of private investment is notably inadequate.

It is a well known fact that in recent years the Andean countries have not given priority to their high regions in their economic policy (ECLAC, 1982). The effects of this neglect have been clearly established in many studies on Andean poverty.

Policies subsidizing urban areas at the expense of the countryside have set the tone. The urban dweller will accept (or pay) artificially high prices for some imported foodstuffs then insist on paying such low prices for domestic goods that profits are insufficient to meet the needs of the peasant population.

In addition to the poverty and environmental degradation in which the peasant lives, the slow rate of development of this ecoregion has also been influenced by permanent and temporary migration, the marginalization of the peasant and the almost total failure to recognize his natural forms of organization and management (ECLAC/UNEP, 1983).

*/ The bibliographical references are listed at the end of this document.

Estimates of ECLAC and the Board of the Cartagena Agreement (JUNAC) agree that about 60% of the rural population of the high-mountain zones in the Andes lives in a state of poverty, whereas in the urban areas the approximate proportion is 25%. Available indicators show that neither urban-industrial development, nor agricultural restructuring, nor the machinery for transfer of public and private services has succeeded in reducing the numbers of rural poor, and that these numbers are probably increasing in Bolivia, Ecuador and Peru.

At a time like the present, beyond formulas for overcoming the immediate manifestations of a much deeper crisis, there is a visible and persistent attempt to redefine the minimum rules of the game and, most important of all, a desire to integrate the inhabited high-mountain zones in the nation's life. If it is held that these regions are one of the central factors of national integration, then it is vital to secure their internal development and integration.

The problem of the Andean region (and the general problem of Latin American countries with high-mountain river basins) lies in the difficulty of finding means to raise the productivity of fragile inhabited ecosystems without damaging the environment, especially the renewable natural resources. In order to achieve this goal it is conceivable, from a more general standpoint, to apply redistributive policies and to democratize the economy, politics and society with a view to integrating the various levels of productivity; and from a more specific standpoint, there is the possibility of a series of technical and operational actions (Sánchez, 1986, and "La Molina" National Agrarian University, 1986). It will also be necessary to devise means of using the water, land, vegetation, wildlife, energy and mineral resources without destroying them and without relocating large numbers of people. In short, it is necessary to know how to manage the relationship between man and his environment so that both can continue to exist.

The incorporation of the environmental dimension is facilitated by the use of a river basin as the natural and basic geographical unit, the most suitable framework for regional and microregional planning, for it integrates man with his surroundings. In this setting, with its natural boundaries, it is relatively easier to come to agreements and introduce projects for the integrated planning of biophysical, social, economic and administrative resources, both multidisciplinary and interinstitutional. The choice of the river basins as the planning unit does not run counter to their integration in social and economic sectors at higher regional or national levels. Using river basin boundaries makes it possible to introduce a regionalization which makes political and administrative boundaries compatible with physical boundaries.

The water resource is the unifying factor in this ecosystem, for its management and use are linked to the management and use of other renewable resources and to man; a region's security and development depend to a large extent on water.

The planning of river basin development and management must take into account both the structure of the river basin itself (sub-basins and larger

basins) and the macrosystem as a whole (regions and the nation). From the spatial perspective, which is that of the whole macrosystem, the river basin must be studied with respect both to its interior flows and to its links with flows in neighbouring basins. These two aspects, considered jointly, define the mode and degree of the river basin's integration in the regional and national systems and the internal integration of its various component parts. These regionalization exercises, embodied in national water resources plans, have been carried out in Colombia, Ecuador, El Salvador, Mexico, Peru and Venezuela (ECLAC, 1986).

3. Criteria, guidelines, reconciling interests and management methods

The region's most interesting experiments in the management of inhabited high-mountain river basins are found in Colombia, Ecuador, Peru and (to a lesser extent) Venezuela. Broadly speaking, these countries have carried out policies consistent with the criteria of protection, multiple-use and integrated management.

Protection criteria ruled in the 1950s when reforestation began to be introduced as a means of protecting the soil and the sources and riparian areas of watercourses, backed up by monitoring and surveillance measures and by the promulgation of rules and regulations on protecting forest areas. On the basis of this protection model, some public enterprises and other entities began to reforest critical watersheds for the purposes of regulation and increased water production for aqueducts and energy development (COLCIENCIAS/CVC/DNP/OPSA, 1986). The Cauca Valley Corporation in Colombia began reforestation in the Calima, Anchicaya, Nima and Cali watersheds. The Government of Venezuela introduced its countrywide Conservation Infrastructure Programme with a subprogramme on conservation management of high-mountain watersheds. Its most important contribution was the emphasis on watersheds, the type of institution created and the systematic training of State personnel (Venezuela, 1978).

By the mid-1960s the river basin was beginning to be considered as a multiple-use biogeographical unit. This trend --supported by OAS with analyses, studies and projects-- took the form in Colombia of more detailed analytical studies sponsored by the Ministry of Agriculture, the now extinct Regional Corporation for the Development of the Magdalena Valleys (CVM), the National Institute for Natural Resources and the Environment (INDERENA), the Autonomous Regional Corporation of the Cauca Valley (CVC), the Autonomous Regional Corporation of the Sabana de Bogotá and the Ubaté and Chiquinquirá Valleys (CAR) and the Meseta de Bucaramanga Protection Corporation (CDMB), which served as the basis for the formulation of what may be considered the first river basin management plans. These studies focused on analysis of the biophysical conditions and characteristics; some social aspects were barely touched upon, and protection continued to be promoted. Difficulties were usually encountered in moving from analysis to the actual management of the natural resources of the river basins.

Earlier experience had made it clear, especially in Colombia, that river basin regulation and management became a complex task when the move was made

from studies to implementation, which is affected by a number of factors, not only biophysical but also political, social, economic and administrative, all very closely interrelated. Thus a third criterion was imposed --that of integrated management for river basin development.

From 1978 an important change was made in this field, especially by the CVC. It had been concentrating its activities on some 28 watersheds which form part of the Upper Cauca, Upper Anchicaya, Upper Daga and Upper Calima, and it had worked in three stages: making contact with the community and monitoring and surveillance of the renewable natural resources; analysis and formulation of the regulation and integrated management plan; and implementation of the plan with community participation and the technical and financial support of the sector's public and private bodies. Again since 1978, CAR has carried out regulation and integrated management plans in the watersheds of Lago de Tota, the Néusa dam and the Checúa river. INDERENA, with the participation of other bodies involved in regional and national development, carried out the Upper Magdalena river basin project (PROCAM). The trend has been towards the concept of man in his environment, including his social relations and his activities, as factors of fundamental importance in the definition of river basins.

4. Management and administration methods in the high-mountain river basins of Latin America

The analysis combining two traditional approaches known in English-speaking countries as "watershed development" (the integrated development of the resources of relatively large basins, applicable in the high-mountain river basins of Latin America because they are inhabited and exploited on a large scale) and "watershed management", which implies managing the natural resources of a relatively small basin so as to preserve them and control the water produced.

In terms of development, the policy is based on the concepts of regional development applied to microregions, with a large component of conservation or administration of the natural resources, in particular water. Accordingly, the application of regional development techniques to river basin development and management focuses firstly on delimitation of the area in which the policy is to be carried out (in this paper, the high-mountain river basin) and on special treatment of the topics of conservation and administration of natural resources, especially water, depending on the area. This process has been defined as "... man's administration of this whole area in order to develop and protect its natural resources with a view to obtaining the maximum sustained production in the short, medium and long terms" (Dourojeanni and Oberti, 1978).

The watershed is defined in hydrological terms as the area drained by a river or, in the words of Colombia's Watershed Regulation Law: "A properly delimited physical-geographical area in which the surface and ground waters feed a natural drainage network by means of one or several permanent or intermittent watercourses which in turn join a larger watercourse which discharges or can discharge into a main river, into a natural or artificial reservoir, or directly into the sea". This definition covers both a system

influencing a fairly small area (microbasin) and a sub-basin (a larger system which still feeds another) and a large water system (river basin). These three hydrographic networks are closely interrelated and there is no absolute definition of size to distinguish a large basin from a small one.

There is very little historical information about the management of these high-mountain watersheds in Latin America. The inhabitants have usually controlled and managed these areas intuitively while seeking to develop them (Manrique, 1985). In family or communal work, for example, the inhabitants of the Andes usually manage land, including the water resources, at several different levels of altitude at the same time, and their activities resemble the integrated river basin management of modern times. In cases of outside intervention in high-mountain river basins, this integrated management process was sometimes profoundly altered, either by consolidation of the management or its partial or total destruction.

The actions which have come closest to the concept of integrated management of high-mountain river basins are those which combine external interests (such as the execution of multiple-use water projects, especially for electricity generation) with internal interests (such as increased productivity) by means of technical assistance and the granting of loans. In contrast, actions of a subsectoral nature designed to exploit the renewable and non-renewable resources have not taken the integrated approach to river basin management and have not brought together these external and internal interests. A very good case in point is that of a mining company which contaminates the water resources and air of a river basin, cuts down its forests to generate energy and alters the community's patterns of organization.

Between these two extremes there are many situations resulting from various attempts to reconcile the interests of the different participants in the management of the river basin, participants who act formally or informally, passively or actively, internally or externally, on behalf of State technicians, the private sector, the users, or political, church, technical, academic or military groupings. The conflicts of interest can be just as various as the participants in the process.

Take as participants, for example, the technical advisory group, the political authority group, the organized private group, the organized popular group, the social and religious group or the scientific research group. Each has its own particular concept of development, which indeed depends on its internal or external view of the river basin. In any given river basin a politician, a technician and a user would have three different views of its development and management; and the technician's view may differ depending on whether he lives within the river basin or is simply there temporarily to construct a specific installation. To these different approaches and the consequent conflicts of interest are added the different national, regional and local approaches. The initial task of reconciliation is to establish common points of interest for all the agents (improvement of roads, for example) and on this basis to achieve mutual co-operation (ECLAC, 1985).

The modalities of management in the high zones can be classified according to whether they have State participation and are sectoral or

multisectoral in scope, whether they operate from within or from outside the river basin, and whether they are passive or active. The lower level of management would operate without State participation and passively, i.e., without organization of the users either within or outside the basin. The higher level would include joint and active participation by the organized users and the organized State on a multisectoral basis combining internal and external interests (see table 1).

5. The State's intentions and results

It is interesting to compare the State's intentions and its results in the management of river basins, microregions and districts, especially with an eye to the impact on the local inhabitants. For the inhabitants of a high-mountain river basin, the words "development", "administration", "regulation" or "management", which are so widely used in official reports, acquire significance only when they take some tangible form: improved food security, better housing, health, clothing, roads or transport, higher selling prices for their products, or better access to education. In other words, when the quality of life is improved and there is greater stability, increased self-sufficiency, fairer conditions and higher productivity.

In contrast, it means little to the local inhabitants that officialdom is analysing its problems, formulating a plan, or studying the physical, social or economic environment, enacting laws, regulations or decrees for their benefit, creating some institution on paper, organizing seminars on their problems, or writing scientific texts.

The inhabitants may consider the following items non-tangible and having no influence on their resources:

- The statement of the problems of the inhabited high-mountain zones: the deep-rooted wrongs, the colonial legacy, the inefficiency of this or that administrative or political system, the shortage of foreign exchange, the foreign debt, dependence, backwardness, poverty, social injustice and low productivity. These declarations do not change the local situation. More specific statements, referring to an individual river basin, are certainly more practical but they still lack tangibility for the inhabitants. Various river basin studies, for example, contain lists of quantified biophysical problems such as erosion, flooding, sedimentation or plunder of renewable natural resources, or socioeconomic problems such as the illiteracy rate, degree of malnutrition, unemployment level, migration, and other traditional indicators which do not necessarily lead to concrete solutions.

Table 1

MANAGEMENT FOR THE DEVELOPMENT OF HIGH-MOUNTAIN RIVER BASINS

A. Without State participation

Location of management	Sectors participating in management	<u>Degree of participation of agents</u>	
		Passive	Active
1. From inside the river basin	1. All sectors 2. Only some sectors	Neither organized management at the river basin level nor awareness of the need for its management	With organized management at the river basin level and awareness of the need for its multisectoral or at least sectoral management
2. From outside the river basin	3. Only one sector Example: irrigation associations	Example: groups of owners, unorganized local population	Example: private independent development corporation, at the river basin level

B. With State participation

Location of management	Sectors participating in management	<u>Degree of participation of agents</u>	
		Passive	Active
1. From inside the river basin	1. All sectors	Neither sectoral nor multisectoral implementation authority in the river basin	With sectoral or multisectoral implementation authority in the river basin
2. From outside the river basin	2. Only some sectors	Example: national or local river basin committees	Example: State, private or joint river basin development corporations
3. Joint inside/outside	3. Only one sector Example: technical water administrator		

- The definition of goals for overcoming the problems (economic development, environmental protection, independence, decentralization, order of priorities, regionalization, integration in the nation, improvement of living standards, eradication of precarious living conditions, and combatting hunger). These same goals, for example for a specific area such as the Saldaña river basin in Colombia, can translate into: planning the river basin, protecting the river basin, developing and conserving the water potential, improving levels of training and employment, consolidating economic, farming, livestock, forestry, fishery, agroindustrial, handicraft and tourist activities, improving the trade balance, contributing to the gross domestic product, improving the use of manpower, achieving better integration of the population, and promoting institutional co-ordination machinery (Colombia, n.d.). Such statements of goals may be made at the national, regional or local level; they may have been formulated with or without users participation; they may indicate the time and place in which the goals are to be achieved and the executing agencies; yet for the river basin's inhabitants they may still remain intangible goals.

- The formulation of action policies in support of the goals, such as the 15 policies set out in the APRA plan for the Peruvian sierra (policies on taxation, foreign exchange, differentials, loans and finance, farm support prices, individual crop promotion and production, direct marketing, imports programming, State investments, business management and training, use of appropriate technologies, co-ordination with the State, forecasting of natural disasters, agroindustry and consumption).

- The announcement of global development strategies, also set at several levels: priority areas, step-by-step progress, working from the periphery towards the centre, differentiation, co-ordination by geographical, technical and operational (microregions) and organizational area, planning by river basin, creation of independent corporations, etc. The strategies may also operate at the national, regional or local level and contain more or less detail depending on the level of work. In the case of the Saldaña river basin in Colombia, the strategies are divided into three groups: i) strategies connected with the provision of social services (construction of aqueducts, sewerage and water treatment installations, extension of the management of the natural resources and community participation) and with the co-ordination of health, education and housing services; ii) strategies concerned with the land: water administration soil conservation, ecological research and forestry inventories; and iii) economic development strategies: development of integrated production units, promotion of technological innovation, crop diversification, encouragement of crop rotation and cultivation of annual crops in association with forestry plantations.

- The promulgation of laws, decrees or regulations which support or facilitate the implementation of previously stated policies and strategies. In fact, all the Andean countries have a large collection of laws on the integrated management of high-mountain river basins in the Andes dealing with water resources, soil conservation, wildlife management, forestry management, promotion of development and other matters. In most cases, however, the main approach is sectoral or subsectoral, with the notable exception of Decree 2857 of 13 October 1981 of the Ministry of Agriculture of Colombia, which regulates part of Decree Law 2811 of 1974 on river basins.

This decree defines the concept of river basin, its limits and the conditions of its use and refers in detail to: the purposes and priorities of regulation; the regulation plan in its various aspects and phases, including analysis, formulation, means of implementation and monitoring; the execution of the plan; the administration of the watersheds; the financing of the plans; expropriation and other compulsory measures; and prohibitions and penalties.

- The preparation of action programmes or projects is also something non-tangible for the local inhabitants, unless they are carried out. Table 2 gives some examples of programmes and projects which are being formulated.

The main point in the analysis of the relationship between the State's intentions and its results from the standpoint of what is tangible for the inhabitants of a river basin or other high-mountain area, is to establish what means are available to the government and how it can take effective action to realize its intentions.

The State can act for the benefit of the inhabitants of a basin by means of an established bureaucratic system (ministries, national corporations, regional offices), by establishing an independent corporation or special body, or by relying on the structures of sectoral or multisectoral projects or programmes. State action is more positive for the inhabitants the more it encourages their self-reliance: for example, with programmes for training, co-operation, organization and loans and, to a lesser extent, by transferring funds, establishing services without charge, granting exemption from payments, and other similar measures. State action can be negative for the river basin's inhabitants when it allows direct intervention in it or intervenes directly itself without taking into consideration the local needs, thus condoning the damage, the exploitation or extraction of minerals and energy and forestry and other products without securing any improvement in the living conditions of the local inhabitants and without conserving the resources.

Broadly speaking, an independent corporation or any other decentralized or semi-decentralized body succeeds when it facilitates direct interaction between the users and the State. This may also include the allocation of funds or other resources for initiating the planned actions. Unfortunately, these independent or semi-independent systems have not become widely established in the region for various reasons, including the failure to develop the river basins through increased investment, the lack of legislation, the existence of centralized systems such as regional offices or of provincial or district boundaries which do not coincide with those of the river basin, failure to allocate specific funds for each river basin, isolation of the watersheds, shortage of trained personnel, conflicts between the interests of national enterprises and those of the river basin, and traditional uses of a river basin's resources, mainly the water, which do not contribute to its development.

Table 2

PROGRAMMES AND PROJECTS ON MANAGEMENT, INVESTMENT AND CONSERVATION
IN HIGH ANDEAN RIVER BASINS

Bolivia

AMBANA: LAND AND MEN

1. To combat erosion (reforestation, interceptor channels, reconstruction of terraces)
2. To improve plot soils (to prevent soil degradation by improving structure, drainage, fertilization, organic matter)
3. To improve animal fodder and reproduction (so that in turn the animals contribute organic matter) by means of vaccination, control of reproduction, fattening, construction of shelters
4. To improve natural grazing by admixture of grasses and legumes
5. To improve livestock management through use of enclosures and allocation of plots for cultivation of fodder with silo or stack storage
6. To introduce or improve native species such as tarwi and quinoa
7. To improve seeds, disinfection, chemical fertilizers (technological package)
8. To control runoff and erosion
9. To improve the infrastructure and irrigation techniques
10. To improve farm output by restoring fertility
11. To improve vegetable production on plots

Also planned:

12. Transformation of the social outlook of the inhabitants of the valley or river basin with a view to greater participation
13. Various kinds of training and assistance for organized inhabitants (extension, loans)

Source: IFEA/Bolivian National Committee of the MAB programme (1982).

ColombiaREGULATION AND DEVELOPMENT PLAN FOR THE
AGUACATAL RIVER BASIN

1. Restructuring of land use
2. Soil conservation and control of erosion in unstable areas, torrents and water quality
3. Natural regeneration of vegetation
4. Reforestation for environmental protection
5. Commercial reforestation
6. Controlled livestock raising
7. Controlled crops
8. Monitoring and surveillance of natural resources
9. Control of mining and quarrying
10. Regulation and control of human settlements on hillsides
11. Improvement of home living conditions and social welfare
12. Services (basic services such as drinking water and education, and social, community, institutional and other services. Priority is given to drinking water and removal of human wastes and waste water, and to education services, followed by electrification, health posts, community halls, sports fields, and commercial services co-operatives)
13. Leisure activities in the outdoors
14. Reorganization of economic structures
15. Special studies (all kinds of studies on avalanche activity close to towns, studies on coal mining in the river basin)
16. Training and technical assistance

Source: CVC (1979).

Table 2 (cont.)

Peru

FORESTRY AND AGRICULTURE SERVICE (SESA) OF CAJAMARCA TECHNICAL UNIVERSITY	PROJECT ON REHABILITATION AND RESTORATION OF DEPRESSED AREAS OF THE CENTRE-SOUTH SIERRA
<ol style="list-style-type: none"> 1. Land use and conservation 2. Andean crops 3. Establishment of meadows 4. Establishment of forestry nurseries 5. Establishment of forestry plantations 6. Establishment and management of market gardens 7. Seed banks 8. Establishment and management of fruit farms 9. Establishment of nurseries and flower farms 10. Small animal farms 11. Fish-farming 12. Beekeeping 13. Production and use of mycorrhysal fungi 14. Production and use of nitrificient bacteria 15. Cultivation of weaving materials 16. Bioagriculture 17. Integrated water use (runoff) 18. Integrated production systems 19. Integrated economic cycle 20. Construction of biodigestors and use of biogas and fertilizer 21. Construction and use of solar driers 22. Construction and use of solar heaters 23. Construction and use of storage facilities for tuber seeds 24. Other production infrastructures 25. Ceramic handicrafts 26. Wickerwork workshop 27. Carpentry workshop 28. Natural dyes for sheep's wool, textiles and garments 29. Precious metals workshops 30. Fur and hide workshop 31. Basic health services 32. Schools and workshops 33. Basic rural housing 34. Drinking water, latrines 35. Community halls 36. Wayside inns or stores 37. Diversion channels 38. Infiltration channels 39. Sewers 40. Terracing 41. Water channelling 42. Torrent control 	<ol style="list-style-type: none"> 1. Irrigation works to consolidate the production structure of microregions. 2. Basic production support infrastructure (access roads, etc.) 3. Installation of production-support seed factories to produce genetic and certified seeds mainly of native crops 4. Development of handicrafts, fish-farming, raising of small animals (rabbit-farming, poultry-farming, beekeeping, etc.) and small agroindustries 5. Development of social and community infrastructure (health, sanitation, education, community services) 6. Design and introduction of an integrated support system for rural producers (research, technical assistance, credit, marketing) 7. Modernization of existing ploughing and other farming equipment promoting the use in suitable areas of appropriate mechanized equipment 8. Restoration and extension of traditional social and economic techniques of the Andean region (food and medicinal plants, irrigation systems, local forms of leadership) 9. Development of an integrated training and instruction programme for farm producers and the population at large 10. Social research to evaluate: i) the possibility of devising a system of wayside inns to facilitate vertical trade between producers and communities living at different altitudes; ii) the potential of groups for reciprocal exchange of labour and assistance (Ayni) to convert them into associative minienterprises and joint recipients of loans; and iii) the potential of these Ayni groups to solve the problems of small-scale farming 11. Preparation of a plan for utilization of the network of weekly Andean fairs, with a view to reorganizing and improving rural-urban marketing and producer prices, and the supply of production inputs and support

Table 2 (Concl.)

12. Design and execution of reforestation programmes, mainly for communities with comparative disadvantages in terms of agricultural development, with the reintroduction of native species and varieties (Kisuar, Q'euna, Lloque)
13. Systematization, regulation, zoning, deeding and inscribing in the public registers the landholding systems of peasant communities

Source: UNC/JUNAC/ECLAC (1985).

Source: Guerra (1986).

Peru

PROJECT ON REGULATION OF WATER AND LAND RESOURCES
IN THE RIO MALA BASIN

1. Forestry plan (seedling production, establishment of planted areas)
2. Agricultural plan (improvement of alfalfa fields and natural pasture, hedging of natural ravines, construction of milking sheds, installation of semi-industrial cheese-making plant)
3. Farming plan. Design of crop certificate, improvement of seeds, technological package (fertilizers, technicians, etc.), reconstruction of terraces.
Supplementary plans
4. Water management plan for drinking water, irrigation, tapping installations, aqueducts, etc.
5. Soil fertility maintenance plan
6. Extension and training plan
7. Incentives plan

Source: Peru (1984).

NATIONAL INSTITUTE FOR DEVELOPMENT OF
MICROREGIONAL PROJECTS IN THE SIERRA

1. Establishment of wire, wire-netting and wooden-fence enclosures
2. Improvement and restoration of natural grazing land
3. Field cultivation of unirrigated legumes
4. Field cultivation of grasses and tubers
5. Promotion of stack and silo storage
6. Animal health and preventive health programmes
7. Dissemination of animal fattening and finishing techniques and shearing techniques (camelidae)
8. Design of crop certificates (seed rotation, native crops, forestry plantations, etc.)
9. Establishment of home-industry network for food processing and preserving
10. Promotion of primary processing of foodstuffs
11. Dissemination of design, production and operation technology for small energy-producing units
12. Wildlife management for human consumption
13. Wildlife management for production of goods
14. Wildlife management for tourism
15. Planning of new tracks and road maintenance
16. Planning of alternative means of transport
17. Medium- and long-term lending programmes with preferential interest rates
18. Selective extension programme for management of various resources (fodder fields, livestock, crops, soil conservation, product processing, etc.)
19. Programme on distribution of strategic and other inputs

Source: Peru (1983).

The Latin American experience indicates that State action in the high-mountain river basins by means of provision of such services as health, education and social organization is less effective than its action through projects. Nor does the extraction of minerals or water for irrigation or hydroelectric power in several Andean countries mean that something will be left for the local inhabitants, for there are no laws making it mandatory for a percentage of the profits to be allocated to the river basin's development and management. (Noteworthy exceptions are Laws 56/81 and 60/83 which create and maintain the Rionegro-Nare Autonomous Regional Corporation in Colombia, which is financed mainly by contributions from the electricity sector.) This is the problem of the inhabitants of the Upper Colca in Arequipa. Here, as Manrique (1985, p. 223) puts it "... the Majes project seeks to use the waters of the Colca river to irrigate the Majes pampas. However, after a short period during which the project generated jobs for the villagers, the work ceased leaving a balance of 166 hectares of farming land in the valley expropriated for road construction, acute inflation --caused by the presence in the area of high-earning workers-- and resource degradation, such as the terraces destroyed at Yanque and the problems of Maca, which is collapsing. The peasants' expectations of access to irrigation water from the canal or of obtaining irrigated plots at Majes have been disappointed yet again; they were not given access to the water even during the drought in the region in the early 1980s, and the number of beneficiaries in the Colca area was set in 1982 at 120 peasants. The price of the plots (US\$25 000 to be paid over 20 years) destroyed once and for all the possibility of peasant access to Majes land. The waters of the Colca will thus create new wealth in the irrigated areas and at the two hydroelectric stations now planned. The Colca peasants have been snubbed yet again and they will have to continue their struggle to indicate claims which, obviously, will not be granted to them as concessions but only by conquest of their historically disregarded rights". Something more positive is apparently emerging from State intervention through investment projects at the national level, such as the plan for improved irrigation in the Peruvian sierra and other sectoral projects. Unfortunately, this kind of isolated and intermittent programme does not produce the same results as integrated development of a river basin and encouragement of the organized and negotiated participation of its inhabitants.

This points to the need to strengthen managerial systems both of the river basin or other basic development unit whose size facilitates the identification of areas of common interest and also of the procedures for implementation of action agreements with the inhabitants and users or between them. Negotiations between these agents must also be facilitated, with a view to establishing systems for the use and conservation of the resources available in the river basin. If these resources are exploited by others or for others (for example, for the purpose of obtaining water or generating energy for distant cities), the river basin's inhabitants should have recourse to a legal procedure for obtaining at least a percentage of the profits accruing from use of their environment. These and other similar measures will reduce the gap between the State's intentions and its results and between the inhabitants of the watersheds and the rest of the country.

6. Bargaining among participants in integrated river basin management in the high-mountain zones of the Andean region

Almost all the publications on management of high-mountain river basins stress the vital need for the users and inhabitants of these units to participate in their development. It seems that only Colombia has an official procedure for organizing and facilitating integrated, equitable and institutionalized participation by the inhabitants of river basins throughout the country. This procedure is to apply the decree law on watershed management and create autonomous development corporations.

In the other countries there are many studies of specific river basins, some taking integrated approaches and others sectoral. They are, however, primarily concerned with the execution of a given programme or project and not with institutionalized and continuous action to promote participation. The existence of these programmes does not always mean that the river basin's inhabitants participate in implementation decisions.

In other cases, the existing participation systems are more apparent than real. There are, for example, several community assistance programmes in which the idea of formulating and implementing projects does not originate in face-to-face discussion around a table by the users, technicians and politicians but from a petition or request from the organized users to the government authorities seeking or demanding assistance. It is also common for projects to result from the unexpected arrival of a technical group which has decided to include the watershed in its national programme and construct a given work, without any prior discussion as to whether this work has priority for the inhabitants or is going to bring them any benefit.

Often too there are problems of State co-ordination in formulating integrated river basin development plans: duplication of studies, preparation of projects from a sectoral standpoint, or merely lack of co-ordination in jobs related to the integrated administration of the basin's water. With a view to avoiding such situations, Brazil enacted Interministerial Decree No. 90 of 29 March 1978 which created the Special Committee on Integrated Study of River Basins (CEEIBH), with special committees for the main basins (San Francisco, Paranpanema, Guaiba, Iguaz, Jar and Paraiba del Sur).

The fact that State action in river basins is not negotiated certainly makes it difficult to co-ordinate actions with its inhabitants and creates a number of conflicts between the views and wishes of politicians, technicians and the various users.

In institutionalizing a bargaining committee, it is important to consider, inter alia, the following points: type of representative that should participate on the bargaining committee; organization, functions and sphere of competence of a permanent technical secretariat to assist the negotiations by submitting studies and action options, implementing decisions, drafting agreements, setting an order of priority for actions, and supervising and monitoring what is agreed; permanent sources of financing for the permanent secretariat and to facilitate the implementation of decisions; the legal basis for the operation of the bargaining committee; and a

procedural manual on negotiating in different situations, to facilitate agreement among the various participants.

A probable composition of the bargaining committee is given in figure 1, and the steps in the process of achieving agreement among the participants in table 3.

7. Bases for the creation of a support system

One of the obstacles encountered by technicians and users when they try to put into practice river basin development and management initiatives is the lack of information about methods of carrying out concrete actions. This can be largely overcome if they are aware of undertakings which have produced good results in Latin America and other parts of the world. In order to do this, it is first necessary to determine what type of information will be helpful to the system's users. Secondly, it is necessary to design a computerized system for accessing the information containing hundreds of solutions from which those most suited to each situation as agreed at the bargaining table can be rapidly selected. This means the rapid and efficient systematization of data from many different sources and places not only to furnish information about what to do and how to do it but also to establish links between the various action options. As a first stage the system will provide the user with a set of solutions (for example, investment programmes and projects such as those set out in table 2) and it will then receive some specific data on the problem (for example, relative complexity of the project, demand for manpower, sector to be developed) so that the computer can preselect the most suitable solutions. As a second stage, the system should provide a description of the project and indicate any other similar projects and where information about the actual execution of such projects can be obtained. Lastly, the system should provide a summary of the procedure for step-by-step implementation of the project and indicate where more information can be found.

The information must be assembled and presented in the form of a manual or handbook using common codes, classifiers and describers so that the information can be classified, retrieved and rapidly integrated in the system. This codification is also necessary as a means of facilitating the exchange of information among users and participants in each river basin and between river basins and countries.

Lastly, the manual or handbook must be presented and distributed to its potential users, who must be instructed in its use and trained to form a co-operation network with a view to increasing and keeping up to date the information contained in the system. In designing the manual ECLAC thought that four groups of information are needed: a first group giving guidance on the formulation of integrated river basin development and management plans and on how to choose among options; a second group presenting the modalities of river basin organization and administration, covering political, legal, financial, educational, participatory and other matters; a third group presenting a large number of investment alternatives in the form of programmes and projects, describing them and explaining how to carry them out; and lastly a fourth group which classifies and explains the production

Figure 1

**BARGAINING COMMITTEE IN A RIVER BASIN:
POSSIBLE PARTICIPANTS**

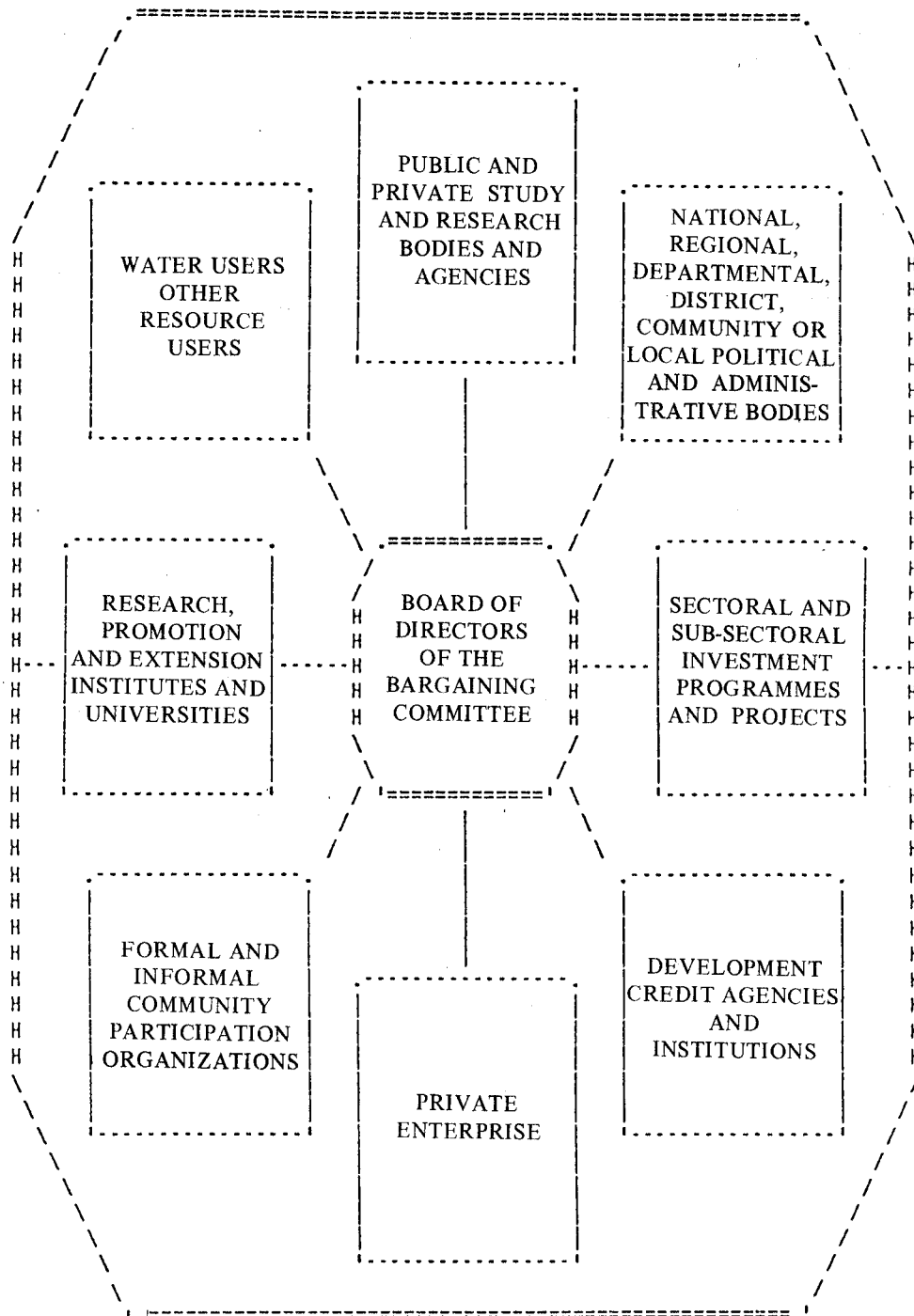


Table 3

STEPS IN NEGOTIATING AGREEMENTS
IN A RIVER BASIN

- Step 1 To identify the agents involved in the river basin's development, use and management whose activities affect the environment (bottom-up planning).
- Step 2 To ensure proper representation of the interests of these interdependent agents or groups.
- Step 3 To identify points of divergence and agreement among the agents with a view to establishing possible areas of agreement.
- Step 4 To submit technical and operational solutions which evaluate the possible areas of agreement among the participants.
- Step 5 To delimit the geographical or physical and institutional or administrative scope of the solutions or areas of agreement in order to establish which agents are involved.
- Step 6 To forecast the effect of the adoption of the proposed solutions with a view to determining the agents' degree of commitment.
- Step 7 To evaluate the proposed solutions, in quantitative terms as far as possible, specifying the direct and indirect costs and benefits for each of them. To allocate these costs and benefits to the agents on a provisional basis.
- Step 8 To identify possible compensatory action by the State or collective organs to overcome any discrepancies in the allocation of costs to the agents when their agreements benefit society as a whole.
- Step 9 To carry out the negotiations on the basis of a clear understanding on the part of those who sign the agreements of the commitments which they are thus undertaking and of any possible compensatory commitments.
- Step 10 To ensure that the various agents respect their commitments by means of legal regulations, supervision and technical assistance, where necessary. To maintain a system of supervision.

Source: Based on West (1984).

and conservation systems. Each group consists of four modules. The first should deal with the various aspects of knowledge of the situation (inventories, evaluation, analysis, or studies); the second should classify and describe the solutions; the third should explain the general procedures or methods for putting these solutions into practice; and the fourth should classify and describe specific techniques or tasks which are common to several procedures.

The effort to put this system into practice is being co-ordinated by ECLAC and the Board of the Cartagena Agreement (JUNAC). The countries of the Andean region, through their public and private bodies, are collaborating actively in this process and contributing their experience, and they will be responsible for carrying it out. The following are some of the bodies which have indicated their wish to participate:

Argentina: National Institute of Water Science and Technology;

Bolivia: Institute of Hydraulics and Hydrology; Cochabamba Regional Development Corporation;

Chile: National Forestry Corporation;

Colombia: National Planning Department; National Institute for Development of Natural Resources and the Environment; Agricultural Institute of Colombia; Hydrology, Meteorology and Land Improvement Institute of Colombia;

Ecuador: Water Resources Institute of Ecuador; Ministry of Agriculture and Livestock;

Peru: National Development Institute; National Council on Science and Technology; "La Molina" National Agrarian University; Ministry of Agriculture;

Venezuela: Ministry of the Environment and Renewable Natural Resources; Inter-American Centre for Integrated Water and Land Development (CIDIAT).

It is to be hoped that this joint effort will result in the establishment of a system incorporating the advances made both at the regional level and in each country. The first group includes FAO's Latin American river basin management network, which is concerned mainly with protection and conservation; the various proposals for the creation of organizations for the development of the high sierras (such as the idea of establishing an international association of experts in hill farming at Turrialba) (CATIE and Rockefeller Foundation, 1980) and other similar proposals. Progress has also been made in each country: for example, in the establishment of river basin management bureaus, the organization of courses on river basin management and the holding of conferences and seminars, which would be able to make use of an information system such as the one proposed.

POLICIES FOR THE MANAGEMENT OF THE DEVELOPMENT OF RIVER BASINS
AND MICROREGIONS IN THE HIGH ANDES */

I. GOALS FOR THE DEVELOPMENT AND MANAGEMENT OF
HIGH-MOUNTAIN ZONES

In the past, the development of high-mountain watersheds and microregions or zones in the Andean countries generally gave priority to areas of easy access and those offering comparative advantages for big investments. This criterion meant that the marginal high-mountain zones were virtually left to their fate, although they support between 30 and 50 million inhabitants in Latin America and the Caribbean, most of them peasants and Indians.

In addition to perpetuating a very low standard of living for the local inhabitants, this neglect meant preference for the exploitation of certain resources such as minerals and hydroelectricity, and disregard of the potential of others which, even in the present conditions, account for a large proportion of supplies of food, timber, meat, camelidae wool, water, land, fodder and wildlife; there are other resources as well which are not only underused but are being openly destroyed by environmental degradation.

Attention is given to marginalized high zones mainly when they become problem zones, for poverty and the misuse of the resources of these places have resulted in situations undesirable for the zones themselves and damaging to the interest of the more developed regions. For this reason, the objectives set for marginalized high zones have represented a desire to control problems rather than to develop the zones as such. Accordingly, instead of encouragement of the growth and improvement of the high zones, the talk is of the need to control migration of peasants and Indians to the intermediate or metropolitan urban areas in order to prevent any increase in their peripheral marginality, to control erosion because it affects the dams and other hydroelectric installations supplying power to distant urban centres, and to prevent the emergence of violent organized groups. This focusing of attention on problems also encourages the study of the situation from the scientific standpoint, and these studies often result in a long series of observations of little practical value. Some socially aware groups do formulate projects to assist the mountain peasants; they are awarded grants or subsidies, and attempts are made to help the people and to preserve the natural resources in a humanitarian and conservationist spirit. In any event, little is done to develop the potential of the zones and to propose solutions.

Study of specific cases shows how little action has been taken considering the value of the people and the resources of the high zones, the importance of studying these people and their forms of organization and

*/ This paper was written by Axel Dourojeanni and Tomás Santa María and submitted under symbol LC/R.605 to the International Workshop on Institutional Aspects of the Integrated Management of Demonstration Basins (30 November to 4 December 1987).

properly evaluating their manner of participation, as well as their production systems and the means of realizing their potential, the vital importance of conserving the natural resources, and lastly, the need to improve the standard of living of these people and incorporate them in the development process for the benefit both of the region and of the country to which they belong.

If these values were made clear, changes could be made both in the conservationist and protectionist criteria for care of the resources and in the paternalist approach towards helping the peasant, adopted either in an altruistic spirit or to protect one's own interests and prevent the migration of peasants to the town from damaging one's investments. It would thus be possible to arrive at a participation-production approach for the benefit of all the users and inhabitants of the high zones.

The goals of the different groups of users are potentially compatible with each other. An initiative designed to benefit the mountain dweller can prove advantageous for big investments, for example when the peasants are helped with a programme to improve farm output in conjunction with a soil conservation programme which results in reduced sedimentation in a reservoir used by a hydroelectric power company. There are also programmes designed exclusively to control sedimentation which disregard the needs of the inhabitants of the high zones and concentrate solely on the construction of dams to retain the sediment and stabilize hillsides, without involving or benefitting the local people. In the first kind of programme there is an interaction of interests which benefits both the poor local inhabitant and the big company; in the second case the effect is unilateral and benefits only the big company.

The reconciliation of the interests of the various users and inhabitants of the high-mountain zones, whether resident in them or not, for common or equitable profit, requires the participation and agreement of persons or groups of persons having interests in a given area of action, the definition and delimitation of the area within which participation and agreement are possible, and the identification of points which could be negotiated among the participants and the means of coming to agreements.

It is a question of improving the standard of living of the peasants or Indians of the mountain zones, who live at present in worse conditions than the rest of the population, and helping them to conserve, protect and restore the resource base, in order to increase their participation and output capacity. At the same time, the living standards of all the inhabitants of the high-mountain river basins would be improved by involving all the users, and not just those most socially and economically deprived, in the development of these microregions. What is needed is a system to secure agreement among the parties with a view to improved output and resource conservation in both marginalized and developed areas.

Improvement of the living standards of all the inhabitants and users of the high-mountain zones based on participatory agreement at the river basin or microregion level would have an impact on regional and national development and help to attain the global objectives of food security, job

creation, increased exports and generation of foreign exchange, and interaction and social peace.

For the purposes of achieving these goals, a system of bottom-up participatory agreement is advocated which would facilitate and promote negotiations that would produce mutual benefits. It would be necessary to begin by helping the most disadvantaged to acquire self-respect so that they can participate in negotiations at the level of the river basin or microregion to which they belong, thus improving their own knowledge and promoting their interests and avoiding representation by a paternalist system.

Any strategy devised with these goals in mind will have to take into account such factors as:

a) The people and their interests (inhabitants, groups of inhabitants, individual users, organized users) which can be classified according to their motivations and interests, standard of living, location within or outside the high zones, knowledge, capacity for participation and organization, development stage and potential, investment capacity, and political, economic and social power.

b) The area containing the people and the resource base in the high-mountain zones, an area whose boundaries for the purposes of management and use should be harmonized with physical boundaries such as watershed divides and with political/administrative boundaries. The harmonization of these boundaries means the creation of regions comprising one or more watersheds. The area in its broadest sense covers the whole resource potential.

c) All the constraints to the attainment of the development goals and the aspirations of the people in these areas. The constraints may be endogenous (physical or natural, economic, organizational, social or cultural) or exogenous (causes, situations or agents external to the area, such as the financial system and the method of allocating farm loans, legal, constitutional or political factors, and factors of resource allocation or economic policy).

d) Solutions which are available or which are proposed as means of overcoming the constraints. These solutions may be public, private or joint. What is needed is solutions designed to satisfy on a fair basis the interests of the inhabitants and users of the area and which facilitate the conservation and protection of the resources. The solutions may originate from each group present in the basin (a peasant community, for example), from an agreement between two or more groups (between a community and a mining company), or from external factors (government inputs).

e) The set of existing or potential strategies for putting the proposed solutions into practice. These should include the organization of the participating groups, of State, private or mixed groups, and advisory or supervisory groups, and the design of methodologies and institutional structures with a view to obtaining the necessary resources and achieving the goals. The strategies should include an order of priority for the activities.

for various planning periods. This applies to each group of people and all the groups of people involved in the process.

II. MAN'S INTERESTS AND MOTIVATIONS IN THE DEVELOPMENT OF HIGH-MOUNTAIN ZONES

Man as a subject of development is the main component of a development strategy for the high-mountain zones. Three forms of association have been identified:

1) The mountain peasants: groups consisting of peasant and Indian communities, precarious occupiers of land without title, small low-income landowners, migratory peasants and, in general terms, local people with or without formal organization who occupy marginal or high zones in unfavourable conditions. For them the priority goal is to improve their standard of living, their production systems and the systems of resource protection and conservation.

2) Other inhabitants and users of high zones: relatively large intermediate centres of population, groups of businessmen, traders, teachers and academics, medium-sized and large landowners, civil servants or private employees, religious groups, charitable groups, civil, military and church authorities, missions, heads of programmes and projects, and in general terms all other permanent or temporary residents of the zones who are not classified as mountain peasants.

3) Non-residents intervening in the area to some extent either directly or indirectly: representatives of big companies (hydroelectric or mining, for example), directors of national programmes investing in projects in the high zones with or without direct benefits for the residents (for example, resource-protection projects, scientific studies), regional or national authorities responsible for public policies affecting the high watersheds and high-mountain zones in general.

When discussing the inhabitants and users of the high-mountain zones in connection with a specific area such as a watershed or microregion, the first two of the above groups are usually described as endogenous to the area, while the third is exogenous. This distinction is important in the analysis of the motives and interests of each group in development, their individual need for the resources of the watershed or microregion, the power and knowledge which they can bring to bear in satisfying their needs and interests, and the visible (formal) or invisible (informal) interrelationships between the groups.

Each group operating within a microregion has its own motivations and interests which do not necessarily coincide at any given time or place. Groups of mountain peasants, for example, may be interested in preserving their ancestral way of life and ensuring survival by protecting the meager resources which they possess. This is the rationale which determines their individual or group conduct in the watershed. Other peasant groups may be motivated to change their way of life and its standard and quality and manage their affairs so as to obtain increased output and improved health, housing

and education services, and generally to adopt a more modern way of life. These motivations have direct and indirect effects both within and outside the watershed on output, conservation of natural resources, and income distribution.

The other groups are usually motivated by economic, political or operational interests. This is true, for example, of a company marketing dairy products, whose interest will be to promote dairy cattle to supply its central processing plant. A university will want to apply its social or scientific principles, and a mining company to provide its workers with food; all of this determines the type of development in the watershed, the relations established with mountain peasants, and the manner of use and conservation of the available resources.

Outside groups with interests in the watershed are also there for specific purposes. A large number of the actions taken in the high-mountain zones are in self-defence to mitigate the damage caused to big investment installations by the activities of the poorest inhabitants, although it is argued in political debate that any intervention in these marginalized areas is for the exclusive benefit of the most disadvantaged sectors. One reason for intervention might be, for example, migration to the urban areas, for the cost of the impact of the migrants will always be greater at their destination than the cost of projects to keep them in their place of origin. In other cases it is a question of preventing the sedimentation of reservoirs, and this results in soil conservation programmes which, although they do indeed benefit the mountain peasants, are designed mainly to prolong the life of a reservoir or protect an access road.

The main purpose of outside intervention in the watersheds or microregions is to extract resources and meet requirements for such items as food, drinking water and energy, and also to obtain manpower. Clearly, there are also non-commercial interventions, such as those prompted by a scientific, academic, spiritual or social interest: for example, to preserve a species, make anthropological observations of the ways of life in the high zones, or carry out evangelical religious campaigns. There are purposes of a political-social nature designed to improve the quality of life of the lower-income inhabitants and ensure their survival, helping them to realize their aspirations by means of increased output or conservation of the resources which guarantee their subsistence.

Action based on considerations of overall equity seeks to reconcile the interests of the marginalized sectors with those of other groups, production with conservation, and the development of the watersheds or microregions with the development of the region, the ultimate objective of which is the overall development of the country itself.

The needs of each group, which are satisfied partly with the resources available in the watershed or microregion, imply other causes of conflict and possible agreement among the inhabitants and the users. Water is one of the obvious needs. In the high-mountain zones water has given rise to the most serious conflicts between the users and inhabitants of a watershed, but it has also resulted in social cohesion to improve the use of the water and control its harmful effects, such as floods. Other needs are the basic inputs

required by the inhabitants and users of the watershed, needs expressed in the common interest in the natural resources for the production and use of foodstuffs, raw materials, minerals, energy and living accommodation, and they depend on the standard of living of the different groups: some groups will consume more than others.

All these resource needs go to form the interests of the different groups operating in the watershed and they must be studied in order to determine when they are in conflict and when they are complementary or neutral.

The power and knowledge possessed by each group in its activities in the watershed are other factors which must be known if they are to be interrelated so as to satisfy the groups' needs in an equitable manner and conserve the natural resource base.

The mountain peasants have little power to influence decisions on direct or indirect action for the development of their watershed and they have even less power outside the area or the land which they directly occupy.

Outside groups exercising power in the watershed are usually represented by public sector bodies and their authorities and by big investors and businessmen who decide to exploit one of the watershed's resources. The public bodies may take initiatives which either benefit or harm the inhabitants of the watershed. A negative example would be a decision to increase taxes in the region or not to allocate financial resources or assistance for its development. On the positive side there is the equitable distribution of regional funds, direct aid for the development of depressed areas, or the policy of setting priorities for regional development. The same thing happens in the case of investors and businessmen: an investment may be beneficial for everyone or for only some of the inhabitants of the place or it can be generally negative. The most negative example is the extraction of resources by companies which establish themselves in enclaves. However, most of these actions have a double effect. A mining company may generate jobs in the place and at the same time cause serious contamination of the water of the basin's only river.

It is essential to determine the set of possible interrelationships between the three large groups and within each of them, with a view to identifying possible agreements between them. This objective is easier to attain within an area delimited by river basin or microregion in which there exist natural relationships between its inhabitants and users because they use a common communication route or the water of the same river or belong to similar social groups or communities.

For example, the commonest relationships between peasant communities located within a single watershed are concerned with the use of water, property lines, the marketing of goods at fairs, dependence on a single means of transport and a single access road, or participation in a religious festival.

Relations between the other groups stem from similar motives and from other motives connected with economic, political, social and religious

factors. These relationships are usually less explicit and less apparent than the relationships between peasant communities, unless there is an authority or corporation for the river basin.

III. MANAGEMENT POLICIES AND PRIORITIES IN THE DEVELOPMENT OF HIGH-MOUNTAIN ZONES

The policies which have guided the management of high-mountain zones in Latin America and the Caribbean, and the success achieved, have varied in accordance with the extent to which the different motives, interests, needs and interrelationships described above have been taken into account.

Policies and priorities in management activities in high-mountain zones have been classified into three groups:

i) Those designed to benefit primarily or exclusively the high-mountain peasants. These programmes are designed to develop marginal peasant communities or groups --without necessarily incorporating them in the integrated development and management of the river basin or microregion-- and to preserve the fragile upland ecosystems. The factors taken into account include improved use and conservation of the natural resources.

The programmes are based on the provision of support or assistance to these groups. In some cases this aid has been multidisciplinary, engaging the participation of the peasants, who have contributed their knowledge and experience to the programmes. In other cases, the aid has been fragmentary, for purposes of irrigation, reforestation, drinking water supply, soil conservation, or improvement of certain crops. Social support activities have also been developed: training of the peasant woman, training of leaders, agrarian reform, organization of co-operatives, loans and subsidies, laws to protect the peasant community, issue of title deeds, literacy and improved marketing. As a rule, these activities have not sought to include in the peasant communities in bargaining groups with greater decision-taking scope and which include the most representative users of a watershed, microregion or region. This trend has resulted in paternalist treatment of the groups with least resources and the most fragile ecosystems.

ii) Those aimed at certain privileged groups located inside or outside the river basin. These favour the groups responsible for the exploitation of the most profitable resources: irrigation zones, and mining, energy, livestock and forestry resources; or the purpose may be to control the damage which may be caused by the people living in the vicinity of big investment projects, as in the case of erosion control in a watershed for the benefit of a hydroelectric power company. The mountain peasants are not necessarily regarded as the priority targets in these initiatives, although they may in the end benefit from the projects and obtain jobs in them.

This type of programme can help the poorest groups when the effects of their lifestyles and methods of land occupation become problems and damage the interests of the more privileged groups. This happens, for example, when attempts are made among the poorest groups to reduce migrations or erosion or

to help them to increase their deliveries of agricultural and livestock products to urban or mining centres. Concern for the poorest groups arises in these situations when the result of the action means a direct benefit for the more profitable sectors. This kind of situation occurs in the big mining consortiums and in electricity, forestry and livestock companies and in other systems of large-scale exploitation. This situation is usually that of an enclave within the river basin or microregion.

iii) Those designed to satisfy the needs of all the inhabitants and users of a river basin or microregion, including both the mountain peasants and the other groups living or operating in the area. These policies are aimed at the integrated development and management of river basins or microregions. It is an ideal theoretical aim which can be achieved only by means of negotiation between the participating groups.

These policies are supposed in theory to benefit all the inhabitants and users of the place and, at the same time, to cater to regional and national interests. They take different forms in practice. One is intervention from outside, where the usual intent is to ensure co-ordinated action in the river basin or microregion by establishing national river basin or microregion commissions, with a view to planning the development of these zones in order that public bodies can operate in them in a co-ordinated manner. It usually proves impossible to establish a national authority capable of ensuring interinstitutional co-ordination among all the sectors and securing the participation of the users and inhabitants in the development activities.

Another form of intervention operates from within: regional corporations or offices are created and set up in the river basin; they may be independent or semi-independent and may or may not include the participation of the local inhabitants and users. A case in point is the Cauca Valley Corporation (CVC) in Colombia, which is continuing to obtain excellent results in many areas of development; however, its preoccupation with improving the living conditions of the mountain peasants through implementation of watershed regulation programmes is of fairly recent date. The proportion of investment for this latter purpose was always low, amounting to barely 10% of investments in large projects.

Lastly, there are forms of intervention which promote greater participation by inhabitants and users. This participation follows a spiral path: it begins from the bottom, from the groups with least resources such as mountain peasants, villagers or smallholders, and gradually draws in the groups with larger resources such as investors, businessmen, etc., at the level of a river basin or microregion. The idea is to involve in the formulation of the strategies both the poorest sectors --with their own knowledge, experience and interests and their need to improve their living conditions and output-- and the sectors with larger resources. The poorest groups are thus able to sit at a bargaining table with some negotiating capacity. The examples which come closest to this model are the Integrated Rural Development Programmes (DRI) in Colombia and the Special Project of the Development Programme for Economically and Socially Underdeveloped Microregions sponsored by the National Planning Institute of Peru.

The main feature of this method is that it encourages participation by all the inhabitants and users of a defined area, and this makes it easier to reconcile differing interests. The difficulty of using this method with the groups with least resources often stems from lack of knowledge, organization and legal status on the part of these groups which prevents them from participating in bargaining committees on an equal footing with formal representatives of the other groups living in or using the same area.

When it chooses some of these methods of action, the State establishes, consciously or unconsciously, the structure and the kind of organization which will carry out its policies --national co-ordinating committees, national technical assistance programmes, independent corporations, microregional development programmes, hydroelectric power companies, mining companies, etc. These entities merely represent the final result of a long chain of formal and informal factors, such as personalities and the interests which motivate intervention in the high zones, priorities with respect to the possible beneficiaries, resident in the zones or otherwise, the approaches and methods to be used for the achievement of the purposes in question, and the policies, laws and regulations which provide the protective framework for the activities. The purpose of this paper is to determine the place of the mountain peasant and of his resource base within this chain of options and actions, with a view to establishing and improving his relative position. It is certainly not the analysis of programmes and projects or of institutions operating in the high-mountain zones to improve the peasant's prospects. The starting point must be the motivations, interests, needs and acquired knowledge which translate into strategy options, for this reveals the real bargaining powers in the negotiations in which each group participates with a view to achieving integrated development.

IV. THE DELIMITATION OF AREAS FOR THE DEVELOPMENT OF HIGH-MOUNTAIN ZONES

In view of the economic, social, cultural, ethnic and ecological heterogeneity of the high-mountain zones, it is not possible to take a uniform approach throughout the region, and specific solutions must be proposed for each of the many existing situations. For this purpose it is necessary to delimit smaller areas which have some degree of homogeneity, in this case sufficient homogeneity for the achievement of agreements between the inhabitants and users of the area and between them and the exterior. The limits of these areas merely indicate a basic level of agreement and do not rule out the possibility of expansion when a basic level is sufficiently well organized to deal with higher levels. These basic areas must meet another important requirement: compatibility of the operational and administrative boundaries of management (operational management units) with the physical or natural resource-administration boundaries (physical administration units).

In the approach in which political and administrative criteria predominate --such as those of homogeneity and regional complementarity, existing State or provincial boundaries, road access, existence of large urban centres, historical and cultural tradition and economic

specialization-- political and administrative boundaries are usually used countrywide and the existing political demarcation is followed. When these political and administrative criteria prevail, it is difficult to incorporate biophysical or environmental consideration, although this is usually highlighted as one of the goals to be attained. This occurred, for example, in the proposal of February 1983 for regional subdivision of Peru which, although taking into account such factors as river basin boundaries, stated that it was essential to adapt the regions to the present political divisions since "the dislocation which would otherwise result would generate more difficult problems than would the introduction of purely academic and theoretical regional subdivisions".

When biophysical and environmental criteria predominate in the regionalization approach, more weight is given to climatic, demographic, orographic, water, production and environmental factors. The result is subdivision on the basis of river basins, valleys, plateaus, levels of altitude, and inhabited and climatic zones. These criteria are usually followed by government bodies responsible for the management and conservation of natural resources such as water, forests, soil and wildlife. For example, there is the identification of river basins made by the Office of Watershed Management of Venezuela's Ministry of Environment and Renewable Natural Resources, and the homogeneous irrigation zones established in Peru.

Subdivision into microregions reconciles these two extreme approaches and achieves the physical and economic integration of production activities with the resource potential and the needs of the people and of production: it promotes the rational use of the natural resources in harmony with the ecological systems, organizing the human settlements by facilitating people's access to goods and services, restores the productivity of the ecosystems, and guarantees national sovereignty and security.

Moreover, this approach is consistent with other arguments that emerge from meetings to the effect that regional planning and development based on natural limits such as high-mountain river basins, assimilated to the existing political and administrative limits, should be taken as the basis for the co-ordination of investment programmes and projects, with a view to facilitating relationships among the groups operating in the river basins and securing proper environmental management and conservation.

V. CONSTRAINTS TO APPLICATION OF A PARTICIPATORY MANAGEMENT SYSTEM AT THE RIVER BASIN OR MICROREGION LEVEL

The main constraints are classified and described in order to determine their causes and effects and possible solutions, to evaluate their shape, magnitude and importance, and to establish an order of priority for the series of actions which are needed to overcome them. They can be grouped into areas or sets in which the solutions require the same method of administration or action in a specific sector; they can also be classified in terms of the geographical area in which they occur or of their direct or indirect impact on the potential beneficiaries. The obstacles will be physical and technical or managerial and administrative depending on the sphere of activity.

Before turning to the identification and description of the constraints to attainment of the goals, it is important to determine the attainment strategy. It is maintained in this paper that a management strategy for the development of high zones should include: the participation of the peasants in a bargaining committee, bringing to it their knowledge and concerns, together with the other groups of users and inhabitants of the area or microregion; the possibility of furnishing technical assistance to all the groups, identifying possible agreements among them to facilitate their participation; microregional subdivision to harmonize the physical and operational boundaries; and integration and organization of the State administration for the implementation of this strategy.

The first group of constraints on the application of a management strategy in the high-mountain zones of the Andean region stems from the very heterogeneity and complexity of the Andean situation and from the state of knowledge about it. This situation has received partial study in its thematic or sectoral aspects, with the areas treated as if they were homogeneous. Each of the microregions requires specific and integrated treatment, not only in what is said but also in what is done, for each of them has its own specific characteristics.

In each microregion it is important to recognize and understand the organization and participation of the user, restore and adapt technologies suited to the situation, deal with different but complementary production systems, and acquire knowledge of the physical environment --the land, altitude and weather. Since the river basins or microregions form a complex macrosystem consisting of many different systems and subsystems with their own characteristics and with differing degrees of internal and external complementarity, the challenge is to establish the potential of each of these systems. Knowledge of the Andean situation clears the way for reduction of the isolation, stagnation and dependency of its marginalized inhabitants and for their integration in the processes of development.

A way must be found to ascertain the actual situation of hundreds of these areas by means of controlled analyses designed to help their inhabitants while respecting their individual characteristics and establishing links within each area and between an area and the exterior. This Andean situation, as can be seen from the analysis of motivations and interests, takes several different forms, all of which must be studied and analysed. These studies have not yet been made. Some people are only interested in finding out how much energy or minerals can be extracted or how much sediment the river carries down. What is important for others is how much soil is being lost and by how much output is thereby reduced. The analyses usually focus on only one aspect or are too generic in nature, so that they are of little use for an understanding of the dynamics of the high zones.

Another kind of constraint stems from the manner in which the public sector goes about the development and management of these zones. When it tries to apply a participatory strategy at the river basin or microregion level, working from the bottom upwards and giving priority to the poorest groups, the State management is sometimes impeded by mistaken motives which

prompt the public sector to tailor its activities in the high-mountain zones to an objective which is not based on a concern for the people and their resources and the area in which they live, or to act on a piecemeal or sectoral basis or to satisfy the concerns of outside groups; the effect of this for the inhabitants and users is intervention instead of participation. Furthermore, the lack of institutional co-ordination of the public sector in its activities in the high-mountain zones confuses the potential recipients of the aid.

To assist the people of the Andes for the almost exclusive purpose of preventing the damage which they cause or as an act of charity with interventionist rather than participatory assistance is to waste the opportunities for acquiring new knowledge and using the existing knowledge and capacities of the local inhabitants. The capacity to achieve the output potential and demonstrate the importance of conservation of the renewable natural resources of the high-mountain zones is then lost. Furthermore, actions motivated exclusively by the desire to exploit the natural resources of the high-mountain zones without taking into consideration their inhabitants is even worse because it simply disregards them.

The Rionegro-Nare Autonomous Regional Corporation (CORNARE) in Colombia has tried to overcome this problem by allocating 2% of the proceeds of the sale of the energy produced in the river basin for the benefits of its poorest inhabitants. This is one of the few cases in which the people of an upper river basin receive a percentage of the profits. The situation is somewhat similar in the Cauca River Basin under the watershed regulation programmes of the Cauca Valley Corporation (CVC). In the other cases the big investments represent only a relative benefit in terms of the possibility of temporary employment in the construction of hydraulic installations or roads, or of permanent work for a mining company. This does not necessarily mean any improvement in the standard of living of a river basin's inhabitants, for the effect of the building of these works may be harmful, bringing inflation, unemployment and cultural change not desired by the local people.

The present dispersal of efforts and the lack of co-ordination among State institutions must also be overcome: they do not exchange information with each other; they each divide the territory into operational units to suit their own particular purposes; they intervene in areas without any knowledge of the effort being made by other institutions in the same place; they create national co-ordination commissions without satisfying the necessary prior conditions for these commissions to be effective; they interfere with each other in programme execution and the budget battle; and they produce a proliferation of similar studies. All this generates inefficiency and discontinuity in the aid which they provide.

Effective co-ordination of the institutional system for integrated management must be based on knowledge of the situation requiring improvement, for it is then possible to create the conditions for interinstitutional organization, integration and co-ordination. Initiatives such as those undertaken as part of the microregionalization system make it easier to establish the most suitable form of organization and co-ordination procedures because this system defines common areas and action goals.

Lastly, the State is limited in what it does by the need to work simultaneously in a large number of watersheds and microregions and it does not have a sufficiently large and integrated system for its purpose. To begin with, it is difficult to find sufficient professionals and technicians with multidisciplinary training and with a feeling for the catalytic and participatory action needed for the operation of this system. They must be capable of relating to the mountain peasant and at the same time to the authorities of the public and private sectors, acting as the link in the interaction between the two systems. They must be sufficiently well trained that they not only know various technical and social subjects relevant to the high-mountain zones but are also willing to learn and study peasant thinking and techniques. In other words, they must be capable of reconciling their professional technical-operational matrix with that of the peasant and be able to guide and harmonize the activities and interests of each community or organized peasant group with those of the other groups in the river basin. Lastly, they must be able to co-ordinate their knowledge and their activities within the watershed with the regional and national representatives responsible for programmes and projects in the area.

The conditions with which professionals must cope in this work are extremely severe: difficult access to the high-mountain zones, lack of accommodation, shortage of transport, and low wages. It is therefore very difficult to obtain the necessary personnel for the execution of a large-scale programme. The inputs are not there: financial resources, multidisciplinary teams, training courses, guidelines, studies of the Andean potential, research on the production systems, access roads, and geographical division of the country into river basins or microregions.

This paper refers only to the general constraints to development. However, at a deeper level there is a number of obstacles to the implementation of the participatory strategy at the river basin or microregion level. The point is that, in seeking to encourage agreements among dissimilar groups, such as the representatives of a mountain peasant community, the owners or managers of a mining company or the representatives of a large irrigation or hydroelectricity project which takes its water from the area, it can be difficult to secure the co-ordination essential to agreement. It is also difficult when there are in the watershed many different bodies, projects, public and private institutions, and missions which are also operating at the regional or national level.

VI. PROGRESS IN MANAGEMENT FOR THE DEVELOPMENT OF HIGH-MOUNTAIN ZONES

The latest moves in management for the development of high-mountain zones in Latin America have typically adopted multisectoral or integrated approaches. In some cases a management approach is taken without any attention necessarily being given to precise areas, and in other cases these areas are defined as river basins or microregions. Despite the desire for a multisectoral or integrated approach --which recognizes the need to secure co-ordination among sectors and the participation of the inhabitants and users to improve their living standards and the use and conservation of the high-mountain zones-- partial or sectoral approaches have usually been adopted in practice without any co-ordination and with little participation. The programmes have therefore benefited only a few privileged groups or a few sectors, or else they have facilitated the exploitation of only a few profitable resources.

Table 1 sets out a classification of the different methods used in these approaches. The classification first takes into account the policies of national scope introduced by governments and which have a widespread impact in the high-mountain zones. The high-mountain zone, such as the Peruvian sierra, has been taken either as a single homogeneous area or with an indication of possible separate management areas such as the region, microregion or river basin. General policies and laws have been formulated to guide the development of these zones. There are also countrywide approaches with multisectoral plans for the high-mountain zones. As a rule, action is limited to statement of policies, enactment of laws and regulations, explanation of strategies or plans to promote the development of the high-mountain zones, including in some cases environmental considerations, and introduction of a regional system such as the political programmes proposed by the Izquierda Unida (UI) in Peru (Iguiniz, 1986) which sets out a strategy for the Peruvian sierra and farming, and by the Partido Aprista Peruano (APRA) (López, 1986), which contains a development programme for the sierra and a policy implementation proposal.

Other countrywide approaches are merely sectoral in scope. They do not necessarily indicate specific areas of action for each sector. As in the previous case, these approaches are usually confined to the formulation of policies, promulgation of laws and regulations, analytical studies, and national programmes for the management of selected resources. The programmes are usually run by institutes and ministries. Noteworthy advances in this area include Colombia's river basin regulation law (Decree 2857 of 1981) on regulation of the environmental aspects of river basins and financing of the regulation plans.

Table 1

MANAGEMENT POLICIES AND METHODS FOR DEVELOPMENT IN
HIGH-MOUNTAIN ZONES

A. Countrywide management policies and methods for high-mountain zones	A.1 Multisectoral countrywide approaches	Laws, policies, regulations, national programmes to promote the development of high-mountain zones
		Laws, multisectoral development policies
	A.2 Sectoral countrywide approaches	Laws, policies and regulations for sectoral development (irrigation, wildlife, forests)
		Countrywide watershed regulation laws
B. Regional, micro-regional or watershed management policies and methods for high-mountain zones		Countrywide water laws
	B.1 Development approaches for specific areas	Investment projects or programmes, commercial extraction, exploitation or use
	B.1.1 Entrepreneurial approach or utilization of natural resources	
	B.1.2 Social approach or improvement of quality of life	Assistance, subsidies, loans, small programmes, etc.
	B.2 Environmental approaches for specific areas	Control of harmful phenomena, erosion, landslides, pollution, protection of endangered resources (flora, fauna, etc.)
	B.2.2 Conservationist or rational use approach	Natural resource management for production and conservation

Another important piece of legislation is Peru's General Water Law (1976) which provides for the justified and rational use of this resource in harmony with social considerations and the country's development. Its general provisions establish that all water without exception is the property of the State. Finally, there is Ecuador's Decree 1111 of 1982 on river basin protection and management. Other new moves in this area are to be found in all the laws promoting the sectoral development of some aspect of the use, exploitation, protection, or conservation of upland resources, such as the laws promoting irrigation, community forestry development, camelidae management, small-scale mining and support for peasant communities.

The classification set out in table 1 includes the management policies and methods of regional, microregional or river basin scope. They offer broader recognition of the specific characteristics and complexity of each situation than do the national policies. In this case the policies afford greater freedom of action to each of these areas (decentralization) with a view to obtaining information from the local inhabitants and users. These management policies and methods are designed both to promote the development of the high-mountain zones and improve the standard of living of their inhabitants and to conserve and protect the natural resources. But in practice these policies often succeed in dealing with only some of these factors.

These policies and methods are sometimes influenced by a development approach which tends to channel river basin or microregion development towards utilization of the more profitable natural resources by means of investment programmes and projects; in other cases they incline towards a more clearly social pattern concerned with improvement of the quality of life of the inhabitants and users with least resources by means of technical or social assistance, allocation of subsidies or special credits, or implementation of small programmes and sectoral projects.

The approach may also be environmental and seek to encourage the preservation of endangered natural resources and their protection by means of control of such phenomena as erosion, landslides, floods and pollution at the watershed, hillside or ecosystem level. This policy has produced numerous initiatives in the high-mountain zones. Among the most important are the big watershed protection investments made by various institutions to control sedimentation (Dourojeanni, 1980, and FAO, 1983), the laws on protection of endangered fauna and flora, and the creation of national parks, sanctuaries and reserves in mountain zones. The policy also seeks to promote the rational management of natural resources with a view to securing sustained output over time. This conservationist attitude has also been reflected in many laws, programmes and projects such as Peru's national land and water conservation programme which is carried out in river basins and with specific communities, Colombia's soil conservation programmes in coffee-growing areas, and others.

These advances, both theoretical and practical, are occurring to different extents in each country of Latin America. Many of the theoretical proposals have not so far been carried out effectively. The most difficult point is that there is a considerable lack of co-ordination among all these approaches within one and the same country. The partial achievements of each approach have not yet been analysed and compared, and thus advantage has not

been taken of the opportunity to create and develop a school of thinking concerning management systems for high-mountain zone development and to help the governments to combine their efforts better.

Nor has the practical experience in management for the development of river basins or microregions yet been evaluated, so that it is difficult to make a judgement on the progress made in sectoral and multisectoral action. The large number of programmes and projects already executed constitutes a valuable source of information which should be analysed systematically through study of documents and reports and by direct evaluation.

Direct or field evaluation is very important because the reports on what has been achieved in the integrated management of high-mountain river basins or microregions, which are based exclusively on what the documents say, sometimes give the impression that a great advance has been made when in reality the situation has changed very little for the inhabitants and resources of the high-mountain zones. When Abraham Lowenthal was interviewed about his experience in Peru and was asked what had been his biggest mistakes, he answered: "The fundamental error has been to take an over-centralized view from Lima, to have trusted too much in documents and plans which speak of the conditions and the projects in the mountains and forests, instead of going to see all this in practice. This is a fault that I share with many students of Peru --including nationals-- but that is no excuse" (Passara, 1986).

In practice, all management solutions suffer from a number of shortcomings: lack of co-ordination and effective direction of the efforts; failure to identify and assign priorities to the constraints and solutions; adoption of global approaches which disregard the heterogeneity of the Andean situation or of partial or sectoral approaches designed to solve only some of the problems; and failure to evaluate theoretical advances with respect to practical action. However, there have been some positive developments which could be used and applied in other places. The difficulty is that a solution is a good one only to the extent that it is consistent with the objectives pursued and can be adjusted to the characteristics of the place in which it is put into effect. The most important thing, therefore, is to have a list of options, with a description of their most important features, rather than a subjective opinion of an assessor.

VII. POSSIBLE SOLUTIONS

The goal is to furnish solutions which will improve the quality of life of the inhabitants of the high-mountain zones and foster the restoration, protection and conservation of their natural resources. This does not mean benefiting only the poorest inhabitants but all the inhabitants and users, and on a fair basis. All can benefit, and there is no need to take a paternalist attitude towards those who are currently most disadvantaged. The aim therefore is to develop the high-mountain zones with an eye to output and not just to conservation and protection, establishing agreements among all the users and inhabitants of the river basins or microregions.

The strategy is to strengthen and integrate the approaches and methods used in high-mountain zones management in Latin America with a view to achievement of the proposed objectives. It is not intended to disregard the advances made in this field; on the contrary, the aim is to secure on the basis of recognition of past inputs and achievements, the systematic organization of the various management approaches to the integrated development of river basins, watersheds, microregions and high-mountain zones in the Andes.

The criteria and solutions on which there is apparent consensus in the Andean countries include the need to change attitudes to the situation in the high-mountain zones of the Andean region. In order to achieve this change it is essential to acquire deeper knowledge of the high-mountain zones' potential and to make full use of it by integrating the potential of known resources such as minerals and water with the potential of resources which are at present unknown or undervalued. If this is to be done, there is no alternative than to collect the abundant available information on a broader and more purposeful basis than at present. And there must be further research, in conjunction with the local inhabitants, into production and conservation possibilities in order to develop the vast mineral, tourist, wildlife, forestry and many other resources which, given shared and rational exploitation, could improve the living standards of local and non-local inhabitants and users.

A second step would be to improve the bottom-up coherence and co-ordination of the institutional system. This will entail precise delimitation of the river basins, watersheds or microregions and establishment of a bargaining committee in each of them. By working upwards from these specific areas at tangible problems it will be possible to achieve real co-ordination for institutional activities at the national level, but not in the reverse direction. Co-ordination solutions can only be found by grappling with concrete problems and reconciling the conflicting interests of the persons who live in or use the area. These persons must therefore be allowed to participate, negotiate and reach agreements with the representatives of regional and national interests. The opposite method has never worked --the method of trying to integrate State actions in the high-mountain zones by creating big river basin commissions at the national level.

Thirdly, the effort will have to be multiplied, and this implies systematic instruction and training of technical teams capable of advising each river basin or microregion. This training must equip the student with the means to appreciate the knowledge and reasoning of the inhabitants of the river basins or microregions, for only on the basis of this knowledge will he be able to explain his own ideas.

This exercise amounts to comparing the professional's body of technical knowledge with that of the mountain peasant. Such a comparison can lead to the adoption of measures that will improve local activities.

The next stages in the delivery of solutions are perhaps more complex and they relate to: the need to create and set in motion the machinery for participation of the formal and informal representatives of the marginalized

and non-marginalized inhabitants; the need to invite all the groups present in the river basin to take part in the bargaining committee, bringing together managers, of power companies for example, with the leaders of peasant communities and local villages; and the possibility of proposing and starting negotiations which will bring common benefits to groups which today do not know how they can obtain mutual benefits and are instead in conflict with each other.

The encouragement of participation with the assistance of State technical personnel is the key to achievement of the proposed goals both of equity --for the mountain peasants and other users-- and of resource conservation. As a first stage, it may be possible already to begin negotiations in many of the programmes established in some countries, including the participation of the users and inhabitants of the area. Such negotiations will increase in number only if an accepted microregional system is established and the goals of assistance programmes and projects are reconciled with the goals of the local inhabitants. All this requires continuing State support and the power to assist the negotiations. In fact, all the Andean countries have experience in promoting participation in Andean projects and in the process of microregionalization. The elements are there, but the most important thing is to secure a political consensus on the reinforcement and harmonization of what is being done, without destroying or disregarding existing programmes, as is presently occurring.

DEVELOPMENT AND MANAGEMENT OF UPLAND WATERSHEDS AND
HIGH-MOUNTAIN ZONES IN LATIN AMERICA */

I. PRELIMINARY CONSIDERATIONS

The Andean region of South America, Central America and the Caribbean contains a vast area of mountains with alternating high peaks, steep hillsides and narrow valleys; small rivers and streams form a large number of watersheds with a scattered population which makes heavy demands on the region's fragile renewable natural resources.

These inhabitants, most of them mountain peasants (see tables 1 and 2), generally live in conditions of extreme poverty aggravated by the increasingly serious deterioration of the ecosystem which they exploit and by the marginal treatment of their problems in socioeconomic development plans. This situation --still not assessed in its true gravity-- has a direct impact on the local population, on farm, livestock and forestry production, and on the protection of the renewable natural resources; it also has an impact on water supply systems, on the urban areas which receive the migrants, and on the overall stability of the more developed sectors.

This problem has grown worse in recent years, and there are vast mountain areas which have been completely stripped of their resources.

The number of these areas is increasing as the peasants and Indians are compelled to move on over great distances to find new land, occupying places which are increasingly less suitable and further removed from their natural environment, or are compelled to abandon their land and migrate to the big cities. This situation creates conflicts connected with sedimentation of the reservoirs, overcrowding in shanty towns, and other technical, political and social problems.

If these serious problems are to be solved, a practical and objective approach must be taken to them, with stronger administration for the benefit of the river basins and high-mountain zones in general. In this paper, river basin management is defined as the actions which people perform for practical, technical and social purposes to develop and protect the natural resources of the area with a view to securing optimum and sustained output (Dourojeanni and Oberti, 1978).

River basin management is thus not merely a question of protection, although environmental protection is indeed part of its purpose, but a concept involving the integrated development of defined zones with the participation of the inhabitants and users.

*/ Originally submitted by the ECLAC Secretariat under the title "River basin management and high-mountain zone development in Latin America" with the symbol E/CEPAL/L.253, to the Regional Interagency Co-operation and Co-ordination Meeting on Environmental Regulation of River Basins organized by the United Nations Environment Programme (Mérida, 18 to 22 January 1982).

Table 1

TROPICAL AMERICA: ESTIMATED AREA, ARABLE LAND AND POPULATION
OF MOUNTAIN ZONES a/

(Percentages)

Country	Of the country's area	Of arable land <u>b/</u>	Of the country's population	Of the farm population
Colombia	40	25	15	50
Costa Rica	70	25	20	30
Ecuador	65	25	25	40
El Salvador	75	40	30	50
Guatemala	75	30	40	65
Haiti	80	70	50	65
Honduras	80	15	15	20
Jamaica	60	50	15	30
Mexico	45	20	15	45
Panama	80	10	15	30
Peru	50	25	25	50
Dominican Republic	80	15	15	30

Source: Joshua L. Posner, Cropping Systems and Soil Conservation in Tropical America.

- a/ The figures given in this table are provisional and based on information supplied by the United States International Development Agency (USAID), FAO and the World Bank, or obtained during discussions with various scientists, or estimated by the author.
- b/ Arable land includes land used for annual crops and refers to cultivated or fallow land which is part of the normal rotation system. Accordingly, arable land includes the whole area used for sugar cane, cotton and other annual crops, but excludes perennial crops such as coffee and bananas and land permanently under grass.

Table 2

TROPICAL AMERICA: CONTRIBUTION OF MOUNTAIN ZONES
TO TOTAL FARM OUTPUT IN CERTAIN YEARS

(Percentages)

Country	Contribution to total farm output ^{a/}		
	Including coffee	Excluding coffee	Years
Colombia	38	26	1976-1977
Ecuador	42	33	1973-1974
El Salvador	75	18	1976-1978
Guatemala	45	26	1974-1976
Haiti ^{b/}	50	30	1973-1975
Honduras ^{c/}	38	19	1975-1977
Peru ^{d/}	24	21	1968-1970
	22	19	1975
Dominican Republic ^{d/}	28	20	1970-1972

Source: Joshua L. Posner, Cropping Systems and Soil Conservation in Tropical America. See also for:

Colombia, a) IBRD 2535-CO 1979, tables 7.1 and 7.10;

b) IDB, 1979, table A-3:46.

Ecuador, a) El Sector Agropecuario del Ecuador, table 6:19; annex 2:101; annex 11:110.

b) IBRD 1499-EC 1977, annex 2, table 2;

c) IBRD 1382-EC 1977, table 2.4;

d) IBRD 2373-EC 1979, Vol. II, tables 7.2 and 7.47.

Guatemala, IBRD 1678-GU 1977, table 8.1.

Haiti, IBRD 2165-HA 1978, table 7.2.

Honduras, IBRD 1856-HO 1978, tables 3.5, 7.1, 8.1.

Peru, IBRD 2204-PE 1979, Vol. II, table 96; Vol. III, tables 7.16, 7.20, 7.44.

Dominican Republic,

a) Beach and Murphrey, 1973, p. 26.

b) IBRD 2064-CRB 1978, annex 1, table 4.

^{a/} Including crops, livestock and timber.

^{b/} Including only crops.

^{c/} Excluding livestock.

^{d/} Excluding timber.

The studies which would have to be made are concerned with the search for strategies and management options for development which combine technical factors and factors of institutional organization in translating the studies into reality. Management strategies for development include the various ways in which the State can assist the integrated development of the high-mountain zones. Some of these strategies consist, for example, in the zoning of these areas into watersheds or microregions, the creation of independent corporations at the river basin level, and the implementation of investment programmes and projects.

Each Latin American government has a wide range of options or strategies for the management and development of river basins; these strategies can be combined with each other in the search for the strategy best suited to each circumstance or in order to strengthen the existing strategies.

One means of achieving this goal is to collect together the various technical, political, legal, economic, financial, institutional, social and cultural solutions used in Latin America for the managing and the development of river basins and high-mountain zones, with a view to analysing their combined effect and finding ways of making them into more effective sources of new strategies. This means analysis and classification of current options or strategies by means of the horizontal integration of information about management and development of river basins located in high-mountain zones.

A prior requirement for determining the strategies which might emerge from these options and for assessing their validity is systematic analysis with a view to establishment of the goals, spaces, constraints, solutions and strategies to be used in application of the solution. Once these basic factors have been identified, it is possible to evaluate their technical, environmental, economic and social interaction and thus derive methodologies for concrete action.

This paper follows this sequence in order to test it. The ultimate purpose is to determine what is currently available in the way of strategies for river basin management, with a view to the development of Latin America's high-mountain zones and in order to benefit the mountain peasants, protect the resources of the high-mountain zones and incorporate the peasants in the integrated development of the river basin or zone where they live. The aim is to, from the beginning, incorporate and organize the river basin's users within the framework of integrated management plans, to execute investment projects with the participation of all the users and inhabitants of a previously defined area, and to obtain results in terms of increased output and protection of the river basin.

The space includes by definition the whole area of a river basin or of a microregion covering one or more river basins. The evaluation of these geosocioeconomic zones must include without fail assessment of the physical or natural and the socioeconomic aspects. Study of the relationship between these aspects is part of the evaluation in which the inhabitants and users themselves must participate together with the advisory team. The evaluation must include recommendations and proposals for improving the conditions

found, both for the peasants of marginal zones and for all the other users and inhabitants of the river basin or zone in question.

II. EVALUATION OF THE GEOGRAPHICAL AND SOCIOECONOMIC ENVIRONMENT

Most of the mountain areas of Latin America and the Caribbean have a fairly high population density; the population exploits the valleys and the slopes of the upland watersheds. These areas are found extensively in northern Argentina and throughout Bolivia, Colombia, Chile, Ecuador, Peru and Venezuela and the countries of Central America and the Caribbean, all countries with geographical and climatic differences but with a common problem: intense demographic pressure on the renewable natural resources, with the consequent deterioration of the natural environment through degradation of the soil and the natural vegetation.

Technicians can use modern techniques such as remote-sensing in the complicated work of studying the high-mountain river basins and the inhabitants must contribute their own knowledge. The evaluation must reach beyond the physical and socioeconomic characteristics of the river basin to determination of the constraints and recommendation of possible solutions. Few countries have a sufficient number of teams to make these joint evaluations with the inhabitants. One means of overcoming this obstacle would be to adopt an approach based on the bargaining committee, with the inhabitants, users and technicians preparing a prior list of the goals, constraints and solutions as each group sees them, with a view to obtaining a target-oriented evaluation. This is especially important when resources are scarce, because lengthy evaluations are expensive but they are of limited use unless the purpose of the evaluation is kept clearly in mind.

The work of preparing these approaches can make use of the experience acquired in many projects already carried out in Latin America by means of horizontal co-operation among the countries interested in improving their evaluation techniques. The first step is to collect the information contained in studies on the region's river basins and compare the methods used, in particular their content and goals, and the users concerned. It should be possible to derive from this comparison a universal working method incorporating a full range of implementation options.

III. PROBLEMS OF RIVER BASIN MANAGEMENT

River Basin management is a complex and multidisciplinary activity involving political and social decisions --which is why the inhabitants and users of the river basin are the focus of the work-- and technical and economic decisions designed to ensure rational use and conservation of the natural resources. Despite the progress made, there remain many obstacles introducing integrated or multisectoral management programmes for river basins on high-mountain zones. One of the main obstacles is the difficulty of access to the high-mountain zones and their inhabitants, with their consequent isolation, and ignorance of the actual potential of these places.

They are better known for the problems which they cause than for their intrinsic value, a factor which explains the low priority given to their development in comparison with other production options. Other factors are: the lack of knowledge of the inhabitants' needs and customs on the part of the technical personnel responsible for formulating and executing the management plans and projects which are supposed to benefit the inhabitants; the lack of knowledge about working techniques and methods which can be adapted to the conditions in these river basins; and the widespread shortage of economic and financial resources resulting from the lack of interest in these zones. The preconception remains widespread that there is nothing to be done in these places and that it is a waste of time, money and effort to try to improve the standard of living of their inhabitants, so that the approach taken to them is almost one of charity instead of recognition of their values and potential.

1. The socioeconomic problems

a) The political and legal problems

Many laws in Latin America have been enacted on the use and conservation of renewable natural resources in high-mountain zones for encouraging their rational use, but very few of these laws have furnished the means and tools required for their application. There have been attempts to govern by decree without allocating the necessary means.

From the political standpoint it can be seen that the users or inhabitants of the more profitable parts of the river basins and high-mountain zones are in a stronger position than the mostly marginalized mountain peasants. The users and inhabitants of zones with profitable resources are usually better organized and better equipped to bring pressure to bear on governments. This is true of mining companies, hydroelectric power companies and big urban centres. The high-mountain peasants, in contrast, are more dispersed and often have uncertain land tenancy, so that they do not have the same means of bringing pressure to bear. Furthermore, it is usually easier to carry out work programmes to exploit profitable and concentrated resources such as water, minerals, livestock or coffee than to assist a multitude of small remote upland watersheds where many different crops are cultivated and it is harder to justify and control investments. Legislation and policies have not helped to provide durable and fair solutions to the problems of these marginal zones. The usual practice has been to take fragmented action in the form, for example, of assistance projects scattered throughout the high-mountain zones. Attention has also been given to the high-mountain zones in order to protect investments in lower areas; for example, the watershed protection projects designed to prevent sedimentation of a reservoir. There are even a few national programmes for these zones but they usually have relatively few resources in comparison with the investments in big projects to exploit resources.

Most of the major works for exploitation of mining or hydroelectric resources have been undertaken for the almost exclusive purpose of benefiting population living outside the river basin, and the high-mountain zones, although they are inhabited, are regarded only as the source of these

resources. Although this bias has been corrected in many cases, this has been done only to protect the investments and not to benefit the high-mountain peasant and contribute to his development. Similarly, the conservation policy has been carried out as if it were an end in itself, with no thought to how the management of the resources might benefit the local population; the result is thus imposition of constraints instead of proposal of solutions to the existing problems.

Many laws disregard these kinds of problem and show no awareness of the need to take an integrated approach to them; they therefore increase the difficulties instead of facilitating their solution. For example, the regulations on study, construction works and other systems regulating water projects were drafted in many countries with only large-scale works in mind, with no mention of the small works which can be carried out in high-mountain zones with local participation. The result is limitation of the project's independence, production of more studies than necessary, and complication of local participation.

The laws promulgated by the various governments will certainly have to be reviewed if the difficulties directly affecting the management of high-mountain zones in general are to be overcome. It is a question of finding suitable legal instruments which regard the concept of management as a development tool and incorporate it as an effective means of helping the peasants and all the inhabitants of the high-mountain zones.

b) The economic and financial problems

The economic and financial problems stem in part from the political and legal ones. Insufficient budgetary resources are allocated for the development of mountain zones, and the local inhabitants and users are not given a share in the profits from the big projects located in these zones. This creates a vicious circle which is difficult to break, for the smaller the economic resources the harder it is to establish the potential of the zones and the fewer projects are devised for their benefit. Many initiatives are in fact undertaken in these zones --programmes for crop improvement, livestock, irrigation and drainage, erosion control, reforestation, and camelidae management-- but they are almost always designed and executed independently without taking account of the benefits of scale to be obtained from integrated or simultaneous implementation, with the programmes co-ordinated with each other and with the big investments.

The normal techniques of project formulation and evaluation, which usually operate from an economic-financial standpoint, prevent the harnessing of the great natural wealth of the high-mountain zones, which has still not been economically quantified, so that the opportunity of using it is lost.

When big investments for the exploitation of energy, mineral or water resources have been made or are in process in the high-mountain river basins, problems arise because the marginal sectors are not regarded as possible beneficiaries of the investments. One solution would be to incorporate the marginal groups in the economic flows generated by the profitability of the investment in big projects.

When no kind of major investment in resource utilization exists or is planned for the near future --a typical situation in the upland river basins of the Amazon, for example-- investments can only be justified in terms of their local potential, or a decision to support the marginal groups by way of subsidies or other devices using public funds. There are several difficulties in the way of both solutions. There are no suitable methodologies or manuals on economic and financial analysis that can be used in evaluating development projects in small river basins located in high-mountain areas. The methods in current use focus on only part of the subject. For example, most of them focus on agrohydrology (Aguilo Bonin, 1976), forestry and conservation (de Camino, n.d.) or use of water resources. Few try to combine these management options with a view to assessing local economies of scale; nor are there any methods for determining the impact of the management of upland river basins on other installations constructed downstream, for sedimentation control, for example (González, 1979).

Even if suitable methods were available, the data and social and economic indices on the upland river basins themselves are insufficient for evaluation of the effect of resource management on the living standards of the local inhabitants and its repercussions in other places. There would have to be tables of unit costs and expected benefits for the different production and processing systems and investment projects; the values to be assigned to community participation would have to be studied; and decisions would have to be taken on means of recovery of the investment or financing of the operating and maintenance costs of the locally installed systems. It would also be necessary to evaluate the impact of reduced peasant migration to the towns, lower amounts of sedimentation in the reservoirs, reduction of the cost of damage caused by flooding, and the profits accruing from increasing agricultural, livestock and forestry output on currently unproductive land.

On top of the constraints described above there are the normal requirements of financial bodies and government agencies; in order to compare the investment possibilities in the high-mountain and other zones, these bodies request difficult, costly, and very detailed studies, of little use for small upland river basins, for they are usually applicable only to larger and more traditional projects. The evaluation, of the profitability of, for example, an agriculture and livestock project usually meets much more resistance and ignorance than does the evaluation of an irrigation or forestry project.

The result is a much smaller number of projects for the marginal high-mountain zones; the cost of project formulation and evaluation is higher and scarce highly trained personnel must be found. This limits the scope of the work to a few experimental locations in circumstances which really call for an extensive large-scale operation covering simultaneously hundreds of places each with its own characteristics.

c) The social and cultural problems

The management needs of the inhabited high-mountain river basins have been presented to the politicians only in their conservationist and protectionist aspects or in their social-paternalist aspect. Hundreds of publications preach the importance of the conservation and protection of nature without relating this to production or offering solutions. There are also hundreds of documents on peasant poverty and the marginality of the Indian. This has persuaded the politicians that these zones require big investments for environmental conservation and paternalistic assistance to the peasants and Indians, none of which brings any immediate benefit. Many politicians --ignorant of the potential of these places and of their inhabitants-- thus allocate a symbolic amount for conservation and assistance to peasants, but they take a real interest in financing projects which seem to them more pragmatic and timely. They do not even realize that by financing, for example, big mining or hydroelectricity works in a river basin without considering all the inhabitants they are merely widening the differences and aggravating the problems for all the local inhabitants. This situation will continue until the relationships between marginal and non-marginal zones are recognized and until technical, ecological and economic evaluations are made of the benefits accruing from treating them as a whole.

The technicians have usually received over-specialized training in specific professions --such as hydraulics or construction, forestry and wildlife, agronomy or livestock-raising-- which makes it difficult for them to find integrated solutions and take human aspects into consideration. It is only in recent years that more comprehensive training has been provided with respect to integrated rural development and integrated management of renewable natural resources, together with other kinds of interdisciplinary training to equip the personnel to run integrative or transdisciplinary projects.

There must be much more training work in this field. The task is a difficult one owing to the lack of essential texts, research and conceptual approaches suited to these zones. This is not to overlook the efforts made by the Inter-American Centre for Integrated Water and Land and Development (CIDIAT), the International Training Centre for Environmental Sciences (CIFCA), the Latin American Institute for Economic and Social Planning (ILPES), the United Nations Environment Programme (UNEP) and many other bodies.

Even greater problems are the isolation of the users and the shortage of extension workers who can participate in a process of mutual learning with the local people and motivate them to seek improvement of their living standards and conservation of their resources. Those responsible for this work must speak the local language or dialect (in the real and figurative senses) and also be capable of adapting to the customs and places where they live. All this requires preparation and time in addition to a sense of vocation which is usually very little appreciated and poorly paid by governments; costly efforts are thus wasted on personnel training, for new technicians wishing to do this work become discouraged.

Lastly, there has been and there remains the failure to ensure any great exchange of information among countries, bodies and specialists working on the development and management of inhabited high-mountain river basins. This exchange of information could also be promoted by using systems of horizontal co-operation which would facilitate better integration of the information.

d) Institutional or management problems

The institutional or management problems emerge mainly as conflicts and lack of co-ordination among the sectors operating in an upland river basin or high-mountain zone. This is evident in the river basins which do not have a local authority such as an independent corporation. However, even in places where these corporations exist there are problems between the agencies of the national government and the local urban areas or villages. These conflicts have resulted in lack of continuity in the management cycle and little success in achieving the goals of benefiting the mountain peasants and protecting the natural resources.

In many cases, specialized national programmes have been devised for the benefit of the high-mountain zones but only in one sector or subsector. For example, some countries have established national programmes of small irrigation works, small hydroelectric power stations, small drinking water supply installations, reforestation, camelidae-farming, etc. These programmes introduce their partial solutions to the area, often without any co-ordination with other programmes and with even less co-ordination with the users. This wastes the opportunity for co-ordinated management, it does not benefit all the people on a fair basis, and it does not achieve the proposed goals of integrated development.

Recurrent or operational tasks usually receive even less support and guidance than project study, formulation and implementation, so that the opportunity to attain the targets set in these projects is lost and the upland peasants are not given help at the time when they most need it.

2. The physical and technical problems

The peculiar physical conditions of the high-mountain river basins, the great diversity of situations which have to be tackled in the development and management of their resources, and their wide dispersal mean that few efforts have been made to restore and improve the techniques in use.

This lack of technological progress gives the impression that the techniques in use are the best ones, and it is constantly asserted that "the Indian knows best". That may be true, but there is no logic in maintaining them in this state when they could be helped to upgrade their own technology. This technology consists of an integrated set of practices, so that any proposed improvement must take the whole set into account. The failure up to now has stemmed more from ignorance of what the Indians do than from lack of efforts to help them.

If this work of rehabilitation and technical improvement is to be carried out on a large scale, relatively standardized and systematic studies will have to be made in order to establish the management processes and set of techniques employed by the users themselves to attain their own development goals; the resources available in each river basin will have to be evaluated to establish management criteria; new forms of natural resource management in high-mountain zones will have to be determined in the light of modern scientific knowledge; suitable working methodologies adapted to the high-mountain zones will have to be devised; and the effects of the projects implemented will have to be monitored in order to determine the extent to which they help to achieve the proposed goals.

Many Andean techniques have already been re-established but most of them only on paper. It is also necessary to determine how the techniques and systems used can be improved. The onward move must now be made from study and reflection to the stage of practical application.

IV. PROBLEM-SOLVING STRATEGIES

The mere listing of the problems indicates the critical state of the management of the inhabited high-mountain watersheds of much of Latin America. Programmes have been carried out under various titles and with various objectives. The strategies in current fashion are based on: integrated rural or microregional development; integrated river basin development for multiple use of the water; watershed management, administration or protection for conservation; hillside development and agriculture, forestry and livestock administration; and other approaches of varying duration and scope.

An attempt is made in table 3 to classify some of these programmes. It will be seen that some of them are multisectoral and others sectoral and subsectoral, while a third and more specific group is confined to the management and use of water resources.

The aim is to classify the strategies for purposes of evaluation and comparison to determine both their advantages and their disadvantages in different conditions and their possible complementarity.

In order to find the best combinations it is necessary to turn to actual documented cases of strategies already carried out or in operation. The programmes include: major installations such as those for the harnessing of water resources; national assistance programmes, such as the conservation subsidy programmes of the Venezuelan government; the watershed regulation and development programmes of the Autonomous Regional Corporation of the Cauca Valley (CVC); investment programmes such as the irrigation programmes in the Peruvian Sierra; and watershed protection programmes such as the one for the Río Blanco in the Dominican Republic (Dourojeanni, 1980).

Table 3

TRIAL CLASSIFICATION OF THE VARIOUS TYPES OF ACTIVITY WHICH
ENCOMPASS OR FORM PART OF INTEGRATED WATERSHED
DEVELOPMENT AND MANAGEMENT

Integrated development and management of natural resources

Regional development
Microregional development
Integrated rural development
Integrated development of river basin and/or high-mountain watersheds
Environmental management for development
Management of reserves and natural parks
Land/watershed use regulation

Sectoral development and management of natural resources

Watershed management
Soil and water conservation
Agriculture, forestry and livestock management
Forestry, grazing and land management
Cultivation of hillsides
Hillside development
Anti-desertification measures

Specific development and management of water resources

Collection, control, channelling and drainage of rain, snow or mist
water and of surface, subsurface and ground water
Watershed protection for sedimentation control
Watershed protection, erosion and landslide control
Torrents training
Channelling of rivers and protection of banks
Runoff and flood control
Control of pollution in general, control of salinity and drainage
problems
Drought control

Source: Manejo de cuencas y desarrollo de zonas altas en América Latina,
January 1981.

There are five main approaches: i) multisectoral global (integrated, rural, regional or microregional development, integrated river basin development and the like); ii) management of water resources, soils, grazing or forests for multiple or sectoral use; iii) conservation, protection, management or regulation of watersheds, agriculture, forestry and livestock management, hillside use and wildlife management; iv) management of such resources as crops, soils, grazing land, forests or wildlife on an independent basis for the purpose of production and conservation especially at the small-farm level; v) clearly protectionist criteria, such as control of avalanches and torrent training, concerned not with development but with prevention of disasters or protection of natural resources.

All these strategies have two very important parts. The first is the management method used in the application of the strategy (policies, laws, finances, organization, personnel) and the second is the set of techniques used (evaluation, design, management of crops, etc.). Alternative strategies proposed for the integrated development and management of a basin or high-mountain zone should include both parts.

1. Solutions to the socioeconomic problems

The fact that management for the development of river basins or high-mountain zones occupied by mountain peasants receives little political priority in comparison with similar investment options in more profitable zones is due in part to the lack of quantitative information about the capacity of the high-mountain zones to meet the needs of their users and the users' inability to bring pressure to bear owing to their weak organization. In order to overcome this problem, governments should allocate to the upland river basins resources accruing from profitable investments or taken from the public exchequer so that their specialized agencies can make systematic evaluations of the upland watersheds and determine their potential and needs, furnish objective, concrete and up-to-date information about these regions, and propose on this basis viable projects for priority implementation.

Projects and measures designed to benefit and incorporate the peasants of high-mountain areas must usually rest on clearly differentiated technical, social and economic bases. From the technical standpoint, local solutions must be identified so that they can be improved; from the social standpoint, the local inhabitants must be persuaded to participate in the programmes from the outset; from the economic standpoint, a statement of costs and benefits must be drawn up even if the project is a social one, for it is important to know exactly what it will mean in terms of cost or saving for the State.

If the projects are to be politically acceptable, their presentation must define their scope both for the local inhabitants and users and for the whole region or country and be accompanied by a work programme with an explicit description of the stages in the work and an expenditure budget. The action proposals must be supported by the users and inhabitants of the watershed. This means overcoming the dogmatic attitude which sees projects as solutions only to conservation or social problems, for this attitude will not be understood either by the users or by the politicians unless it

produces positive results for the development of the area and its inhabitants and for the region to which they belong.

If these goals are to be attained, the relative importance of the socioeconomic development of inhabited upland river basins or high-mountain zones must be defined in the general context of the development of the country to which they belong, and dynamic and permanent methods must be established for evaluation of the progress made in the application of these strategies, with a view to providing guidance for the politicians and keeping them abreast of what is happening. The political apparatus must take up these proposals in the legislation which it enacts and make an effective contribution to the equitable development of the high-mountain regions, giving priority to the poorest areas.

Solution of the economic and financial problems entails increased support for initiatives designed to benefit the mountain peasants and their resources. When an inhabited high-mountain basin lies within the sphere of operation of a big company responsible for water or mineral exploitation projects, part of the profits accruing from these projects can be used for the benefit of the mountain peasants.

When the inhabited high-mountain river basin does not lie within the sphere of operation of a big corporation or installation, solutions will have to be found which can be financed locally, with economies of scale and complementary production based on local needs. If the projects cannot be self-financed even with unpaid local labour, external sources of credit or subsidy must be found.

Solutions to the social and cultural problems must be based on co-operation between the users and the technicians who advise them. This requires the establishment of permanent local State assistance centres with technical and administrative independence who can call in more senior specialists from the regional centres and who join with the inhabitants in the formulation of their development projects. This system is not a new one but few countries actually have this kind of centre in sufficient numbers and furnished with the necessary equipment.

From the technical and professional standpoint, the training centres for integrated management for the development of high-mountain zones must be strengthened, and specialized programmes must be established for this purpose. Many such centres can be organized by combining the resources already available in various specialized areas. An important example of co-operation among teachers and technical personnel from various bodies and countries would be the joint preparation of relevant teaching texts, the scarcity of which is notorious at all levels in Latin America.

There are many different modes of organization for the management of river basins in Latin America, ranging from national programmes, with a central co-ordinating office and several local offices or agencies responsible for the implementation of integrated projects within each basin, to local projects of various kinds, with no apparent co-ordination.

There is considerable variation in the effectiveness of each mode of organization, and the various modes must therefore be evaluated in order to determine which will be most suitable for Latin America in various situations. Broadly speaking, two types of organization seem to have produced the best results; independent bodies which are made expressly responsible for the integrated management of a large river basin or of adjacent watersheds with connecting water resources, which usually operate only in basins of greater national or international importance and are concerned mainly with the multiple use of water or integrated rural development (if their activities are to be considered integrated, they must include management for development and not just for protection); and semi-independent national bodies which are assigned responsibility for watershed or microregion development. They usually have a central office with regulatory, advisory or monitoring responsibilities, and regional or local executive offices staffed by interdisciplinary teams. For inclusion in this classification their action plans must be integrated and not concerned with only one sector.

If the national, regional and local offices are to be effective, they must be supported by legislation and operate within a regionalized system. They also require adequate technical staff and working manuals or guides on integrated management. In only few cases are all of these conditions met. More often than not the national bodies responsible for upland watershed management or high zone mountain management are short of technical staff and suitable work manuals for the local decentralization of their activities, or they may spend all their time on only one kind of activity such as management of irrigation, reforestation or soil-conservation projects. A case in point is the National Plan for Improvement of Irrigation in the Sierra (Plan MERIS) of the Peruvian Ministry of Agriculture, which was adopted in 1976.

The evaluation of the different modes of organization could focus initially on study of the advantages and disadvantages of the two types of management systems and on their conditions of application and possibilities of improvement. But, in view of the many big almost entirely independent water use projects which there are in Latin America, some thought should first be given to the possibility that it would be sufficient to include the management of upland watersheds, among the activities of the bodies responsible for these projects, as the Cauca Valley Corporation (CVC) has done. This would require defining planning methods which leave room for the incorporation of management for the development of inhabited high-mountain watersheds in the planning processes of these projects.

2. Solutions to the physical or technical problems

The physical conditions in the high-mountain watersheds are a permanent technical challenge to man. Watershed management should include those techniques which the users themselves have traditionally employed, with a view both to their improvement and to the introduction of more advanced technology. This entails prior research or collection of past experience, followed by adaptation to more advanced technology. The use of suitable intermediate technology is extremely useful, especially with respect to techniques for the multiple use of water, such as the construction of small

simple hydroelectric power stations, hillside irrigation systems, and methods of collecting rainwater, always provided that they are used in conjunction with local technical and management skills.

It will be important to use various research systems in the preparation of these methodologies, for it is a question of adapting outside techniques or developing new ones with local participation. In either case it is useful to have the experience of projects in operation which, although they do not correspond to specific watersheds or areas of research, do adapt these technologies for their own use.

This work requires the establishment of systems for the exchange of information between the specialized bodies in these zones and between countries. Latin America still has very little material on project follow-up by high-mountain watershed or zone. However, the information is sufficient, given adequate horizontal co-operation, for important progress to be made quickly in the development of technologies, the exchange of experience the drafting of manuals, and in other activities.

INSTITUTIONAL FACTORS INFLUENCING PUBLIC SECTOR DECISION-TAKING
ON THE MANAGEMENT OF ANDEAN RIVER BASINS */

John Tipton

Introduction

This report is based on four case studies of Ecuador, Colombia, Peru and Venezuela submitted to the International Seminar on Integrated Systems for River Basin Development and Management in the Andean Region of Latin America. Its main purpose is to analyse the institutional factors which facilitate or obstruct the formulation and execution of policies for high-mountain river basin management in the Andean region.

There is a big difference between the management required for the development of high-mountain river basins inhabited since early times, such as those of the Andean region, and the management of river basins which are almost uninhabited or have been occupied only recently, typical of the semi-jungle slopes of the eastern Andes. This paper is concerned mainly with the institutional aspects of the management of the first type of river basins and its conclusions may therefore not be valid for the second.

1. Present situation in the high Andean river basins

This paper distinguishes three natural Andean areas: i) the big inter-Andean river basins with broad flat valleys; ii) high-mountain river basins with small valleys and hillside and upland farming; iii) semi-flat high zones known as páramos, punas or altiplano depending on the country. The term "Andean region" will be used to refer jointly to the three kinds of natural area, although for some countries such as Peru the local term "sierra" is used.

The inter-Andean river basins with broad valleys contain relatively more fertile and productive land (this situation varies with height above sea level) and more highly developed physical infrastructure, including road networks, airports, electrical services and urban services. Here are located the main towns and cities of the Andes with their public, health and education services, State bodies, universities and other institutions of regional importance. The inter-Andean valleys and their urban areas are the axis of economic activity, which consists predominantly of agriculture, livestock-raising and trade between the Amazon zone and the coast. The land is used mainly for commercial crops of national and sometimes international importance such as rice, sorghum and cotton in the Cauca Valley (Colombia)

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and for dairy farming, for example in the Guayllabamba basin (Ecuador). Both types of production are usually included in the so-called modern farming sector which makes extensive use of farm machinery, irrigation, fertilizers, pesticides and other techniques, pays cash wages to contract workers, applies the results of research, and practices soil conservation and similar techniques, provided that they result in increased profits or provide protection for earlier investments. The larger valleys have also been the site of the attempts to transform the landholding system made by most of the countries under the heading of agrarian reform, usually with uneven and inconclusive results. In short, these valleys and their immediate slopes are areas of commercial agriculture which is generally more productive and advanced than farming in the small valleys and on the slopes of secondary basins or upland watersheds.

The small secondary river basins or upland watersheds and the high plateau zones provide a marked contrast with the situation in the main valleys. They shelter the poorest of the inhabitants of the Andes. There seems to be consensus about the conditions prevailing here. They are zones of subsistence farming on smallholdings or on land belonging to peasant communities; monoculture is practiced with little crop rotation; there is increasing soil degradation and erosion; output and productivity are falling; the land is being over-worked and deforestation is increasing. There are few services such as roads, electricity, irrigation, drinking water, sewerage, schools and health care. From the economic standpoint, the inhabitants have little access to credit and technical assistance; they have hardly any means of marketing or storing the commercial crops which they produce; they are increasingly dependent on cash earnings but have few work opportunities, which results in massive emigration from their environment, especially to the urban areas. From the social standpoint, illiteracy, malnutrition, and high morbidity and infant mortality rates are the rule. In some places the inhabitants are losing their sense of community, their cultural values and their self-reliance; this generates in them a feeling of impotence and resignation which discourages individual and collective initiative and fuels personal despair. In short, these are areas where life has always been difficult and becomes unsustainable unless there is proper organization, attachment to the land and technical knowledge. As these qualities are lost, exploitation by man is degrading the natural resources of these areas.

Exceptions to this gloomy picture are the slopes which produce commercial crops of national importance, such as coffee in Colombia and Venezuela. These areas present many of the features of valley farming: cash wages, use of technology, access to bank loans and extensive industrial and marketing facilities. Moreover, both these countries have strong and well-financed national associations of coffee-growers which play an active role in improving cultivation techniques, promoting diversification and raising profitability.

2. The development consensus

Just as there is general agreement about the conditions prevailing in high-mountain river basins in the Andean region, there also seems to be a consensus among academics, development specialists and international

financing bodies as to what should be done and how to do it. The fundamental hypotheses, which are at least implicit, postulate that: the situation of the inhabitants is a problem requiring solution; the degradation of the natural resources is "bad" and must be corrected; the public sector (national governments and international organs) have a responsibility to take action; and the correct solution is the "integrated" development of the Andean river basins, this being understood to cover both primary and secondary basins or upland watersheds.

It is held that development must be "integrated" because this means that it must cover all the relevant fiscal, economic and human goals and not just one or two of them such as increased farm output or expansion of irrigation systems. It is emphasized that the content of the current programmes must be expanded so as to give primary consideration to the people in order to guarantee fair and sustainable development. It is also thought that development management should be focussed on zones defined by natural boundaries such as river basins and not solely on units defined by political/administrative boundaries. The beneficiaries should be the most needy people, to narrow the gap between them and the modern sector.

It is generally maintained that the most capable entities for promoting development are administratively autonomous regional or river basin corporations, preferably with independent and secure sources of finance, for it is assumed that these corporations will pay greater attention to local needs and problems. There must be full co-ordination of efforts among all the participants in the region or river basin with clear terms of reference and management authority for carrying out decisions and demanding results. Administrative innovation must be given priority. Continuity of the activities is essential, especially in the stage following the physical construction of works.

It is argued that development must balance increased output against improved conservation. It must encourage the organization of the beneficiaries and their participation in the development process, respecting their cultural values and rehabilitating traditional methods and techniques. Lastly, the definition of participant has been expanded to include all the users of the natural resources of the high-mountain watersheds, many of whom not only do not belong to river basins (for example, the management staff of big hydroelectric power companies) and are also usually regarded as agents who exacerbate the problems of the local people and natural resources instead of contributing to their solution.

The results must be measured in terms of productivity, sustainability and equity. The evaluation systems must furnish the managers with detailed and timely information so that they can determine how much progress has been made towards achievement of the project's goals.

3. Institutional structure of management for the development of high-mountain river basins in the Andean region

The governments of the Andean countries agree entirely that "something" must be done to correct the problems of the high-mountain river basins and give

their official endorsement. Accordingly, all of them have issued official statements of the goals of government policy, have established a legal framework of laws and regulations for the attainment of these goals, and have created institutions (ministries and their departments, independent institutes, regional development corporations, local departmental and provincial agencies, and local offices) for carrying out the official policy as well as numerous assistance programmes for irrigation, forestation, community support, fish-farming, soil conservation, crop improvement, etc.

The political statements, the national and sectoral plans, the legislation, and the statutes of the organizations usually agree on the type of development, especially when the objectives are to improve the social welfare of the local population and conserve the natural resources. Most of them also accept the concepts of development sponsored by international lending bodies ("integrated rural development", for example) which may have been adopted by the countries partly in order to obtain foreign aid and partly out of conviction of their necessity. They usually also reflect the ideological outlook of the government in power both in official policy statements and in the prominence given to this or that development approach or strategy; this does not significantly alter the order of priority of the needs of the Andean people for assistance and resource conservation.

There are a number of recognized deficiencies in the implementation of official policies, such as laws which are difficult to apply (owing to lack of resources or inadequate penalties) or the lack of workable procedures for carrying out such vital measures as regulation of land use according to its capacity or restriction of the cutting of the natural vegetation. Another negative factor is the constant internal reorganization of the fiscal bureaucracy, especially when a new government comes to power, for this results in replacement of personnel, confusion and dissipation of efforts until the new structure and the new managers have settled in. Official approval of the programmes suffers ups and downs in the course of time, as can be seen from the example of Ecuador's soil conservation programme, which was introduced in 1980 and abolished in 1985, or the CORTOLIMA operation, which lasted from 1982 to 1984; it was intended to achieve the rural electrification of the Río Saldaña basin in Colombia but was suspended in 1985 when a large irrigation project was begun. It must also be remembered that official statements and the promulgation of laws do not in themselves have a direct impact either on the quality of life of the inhabitants of the Andean basins or on the use of their natural resources, notwithstanding the popular belief that official recognition of a problem or the promulgation of a law automatically leads to its solution (government by decree).

In any event, an institutional framework for the development of high-mountain watersheds in the Andean region does exist and function, but there are few official documents giving an exact account of the actual results obtained. It is not easy therefore to obtain a comprehensive picture of how these institutions work in practice, what informal rules govern their behaviour, and why the programmes for which they are responsible sometimes do not achieve the development envisaged in the official pronouncements.

4. The policy perspective

a) National priorities

Governments evade making public statements about the order of priority of the measures which they wish to carry out, to avoid protest from the sectors placed at the end of the list. All aspirations, most of them powerfully supported, are thus indifferently classified as national priorities. However, since human and financial resources are always limited, selection is imposed and an order of priority must be established for assigning each objective some part of the total budgetary allocation.

Budgetary expenditures show that allocations are included for action to benefit the inhabitants and resources of the high Andean watersheds; however, these budgetary allocations are relatively small and even insignificant in comparison with the official statements about the importance of these zones and with the enormous investments made in other regions of the same country. For example, with the amount allocated to the Majes project in Peru (over US\$1 billion), the objective of which is to irrigate only 60 000 hectares, possibly all the abandoned terraces in the Peruvian sierra could have been rehabilitated, an area estimated at about 750 000 hectares.

It is often pointed out that, taken together, the inhabitants of the high zones receive a smaller proportion of government expenditure than the proportion of the country's population that they represent, but a much larger proportion than their contribution to the gross domestic product in terms of agriculture, forestry or livestock production. In the first years of the 1980s in Venezuela, for example, 9% of the national budget has been allocated for purposes which benefit the inhabitants of the Andean zone, who account for 13.8% of the total population but provide less than 5% of GDP. However, the examples often do not include the benefits which the high zones represent by way of mineral and energy resources; if these factors were included, the position would be radically altered, as in the case of Peru.

Nevertheless, the amounts allocated to the high-mountain zones in absolute terms are not insignificant and they are often incremented by large contributions from public and private international organizations. In many cases the problem does not even seem to lie in lack of money, although this is mentioned as a reason for failure to achieve official development targets, but rather in other factors such as the difficulty of actually spending the money in distant and scattered zones through the intermediary of centralized and sectoralized institutional systems.

b) Attitudes to high-mountain watersheds

Many persons working in the centralized metropolitan systems tend to see value in these watersheds only to the extent that they contribute directly to the attainment of the national priorities which are considered most important (such as payment of the foreign debt) and they disregard their value as areas of human and natural life. In the national order of priorities, the Andean basins are often regarded as adjuncts to more dynamic sectors located

elsewhere. They are regarded as valuable in terms of the provision of water for urban services and irrigation, the production of coffee and other crops for export, the extraction of minerals, the generation of electricity for use in other regions, and the cultivation of some foodstuffs for consumption by the urban population, i.e., as suppliers but not as places with their own life.

The human and ecological needs, in turn, are seen only as "problems" --a burden on the national budget-- for the lack of conservation and the unwanted migration from these places have a deleterious effect on hydroelectric installations and transport systems and thus affect the valleys and the distant cities. Contrary to what is stated in the official declarations, the only factor which seems to be appreciated in practice is the capacity for extraction of products from these zones and not the capacity of the inhabitants of the Andean region themselves to contribute to the country's progress.

In some cases the government's interest in high-mountain watersheds declines in direct proportion to their distance from the capital or the main provincial centres, unless they are strategic zones or have great potential. The valleys and watersheds which supply the large cities are usually the most highly developed and receive the majority of government and foreign resources (Guayllabamba in Ecuador, which is in the immediate hinterland of Quito; the Cauca Valley in Colombia, which includes Cali). Unusual factors can divert the government's attention towards certain watersheds: a big hydroelectric project whose useful life is coming rapidly to an end owing to soil erosion and sedimentation of the reservoirs (Paute basin, Ecuador); an important and ongoing interest on the part of the government and of the foreigners themselves in helping extremely depressed zones may also work to the benefit of a given area (Cajamarca, Peru); areas of rural violence (Peru, Colombia) and frontier zones may also attract investments. In such cases the area in question may become a true national priority and the target of a series of assistance programmes. This results in an informal but very clear differentiation between "important" and "unimportant" Andean valleys and watersheds. It seems that if a watershed does not supply a big city and none of the unusual circumstances described above obtain, it has little possibility of attracting government attention and programmes, with significant and sustained support, whatever the seriousness of its intrinsic problems or its standing in some governmental order of priority. This does not indicate lack of interest on the government's part but rather its inability to assign priorities to its actions.

State attention is sometimes channelled to the high-mountain zones only through certain institutions "specializing in marginal zones" which are the only ones operating in remote or inaccessible places. These institutions usually carry out "special" programmes adapted to the "peculiarity" of the residents to improve local self-reliance and identity (food aid programmes, assistance programmes for the peasant woman or child, community aid programmes). These programmes are usually of short duration. Other programmes often consist of sectoral actions designed to incorporate the whole zone in the national economy and cultural life; these include national plans for irrigation, reforestation or soil conservation. Unfortunately,

these programmes usually operate at the individual watershed level with little or no co-ordination.

c) Criteria for allocation of funds

Each country has a central budget office, usually part of the finance ministry or its equivalent, and it is this office which usually takes the vital decisions which determine what happens or does not happen in the Andean region with respect to investment. Decisions on budgetary allocations are of course affected by intervention from the various sectors with their annual or biennial requests. The problem is that these requests are usually far in excess of the available funds, with the result that "budget cuts" have to be imposed. These cuts often reduce the assistance programmes for the zones with which the economic and financial civil servants are less familiar, and this includes the high-mountain zones. This is why those concerned with the development of these zones opt for the establishment of "special" programmes which are exempt from these cuts and, more importantly, have access to extra-budgetary funds not controlled directly by the economic and financial ministry.

Another important factor in resource distribution is the economic model which many Andean countries have to adopt, for it gives priority to maximum financial profitability of development investments for reasons of borrowing, foreign debt and the need for foreign exchange. Projects of this kind tend to be evaluated in terms of their comparative advantages, economic effectiveness, profitability and expenditure capacity. Plans and programmes based on social and environmental criteria are usually regarded as having little or low profitability, and it is therefore difficult to award them priority in the intense struggle for the meager funds available. There are noteworthy exceptions to the rule; for example, major natural disasters such as earthquakes usually evoke extraordinary allocations and an unusual concentration of efforts to alleviate the people's suffering, even in the most neglected Andean zones. A devastating earthquake, for example, was the decisive factor in the investments made in the Callejón de Huaylas in Peru. It took the deaths of more than 50 000 people to attract attention to the area's needs.

5. The organizational perspective

a) Management style

The concept of development based on regions and microregions (regionalization and microregionalization) instead of on the old political/administrative units is gaining widespread acceptance. Part of this regional subdivision has been based on the river basin. Utilizing the fruitful experience of the 30 years of the Cauca Valley Corporation (CVC), it is Colombia that has made most progress in this direction, defining five primary, 56 secondary and 346 tertiary river basins and establishing a number of autonomous regional corporations to administer them. The CVC itself has been incorporating high-mountain sub-basins in its programmes; it has identified 28 of them and has drawn up management plans for the first six.

Ecuador is moving in the same direction and has chosen nine large Andean river basins as areas for many development activities. Peru is currently carrying out a series of programmes which take the river basin as the basis for development activities. Venezuela has recently drawn up several management plans for specific river basins including the Upper Uribante, the Chama/Mocoties, and the Negro/Bocaná. There is apparently no great problem in arriving at an acceptable definition of the physical limits of each watershed in the high Andes and reconciling them with the provincial, or at least the district or municipal, boundaries.

When no watershed authority exists, the central government organs collaborate in the high zones with the local government organs (district or community), peasant organizations, private companies, local universities, private foundations, religious congregations, foreign missions, etc. If there is no local watershed authority, these organizations do not always co-ordinate their activities with each other and they thus lose many opportunities for mutual support and in some cases create competition or conflict.

Since most of the annual budgets of central government organs operating in high-mountain watersheds are very often barely sufficient to pay the wages of their staff and other workers, many of them cannot carry out the activities for which they were created. Given this situation, management is effected, as pointed out above, by means of "special projects". The end result is lack of continuity and divisions between managers, planners and operational personnel and gaps between the phases of construction, operation and service. Much effort is expended in total, but meager results are obtained in the watersheds which are supposed to be benefited.

Budget cuts in the central government erode even further the possibility of proper management of the physical system. For lack of time, the cuts are usually made "vertically" and in equal amounts for all activities. This means that all the activities suffer the same cut. Sometimes there is not even time to set an order of priority for the budget cuts to concentrate the economic resources on the actions regarded as most important. When this situation occurs, a skeleton staff is retained for each activity but none has sufficient resources to perform its work with efficiency and continuity. Sometimes, for example, only some parts of hydraulic installations are constructed at the site (an irrigation dam but no canals), so that the installation is inoperable.

One of the most notable situations described in the country studies is the presence of a multitude of government agencies with officially authorized functions, jurisdictions and mandates to work for the benefit of the residents of the high Andean region. Problems of co-ordination and spheres of competence usually arise among these bodies. Long-term interinstitutional agreements are the exception, but they seem to work admirably when they do exist, as in the case of the agreement between the Ministry of the Environment and Renewable Natural Resources and the Electric Energy Corporation in Venezuela which defines spheres of competence in fundamental areas, the obligations of the organs, their executive functions and their financial commitments.

A second problem is the difficulty of officially sharing information among these bodies, sometimes for the simple reason that there are insufficient resources to publish adequate numbers of documents for distribution. Other factors impeding access to information are the absence of a systematic numbering or registration of studies carried out under ministerial programmes and projects, and in some cases the confidentiality with which they are handled. Lastly, it seems that the more concrete and clearly defined the mandate of an organ, the more likely it will be to achieve efficient management, even within narrow margins of manoeuvre which leave little room for integrated development. Every one of the Andean countries has organs with express and almost exclusive responsibility for such areas as forestry, an activity which is making important progress in several regions. But this does not happen, for example, in the case of soil conservation, an activity dispersed among many different organs and subunits with a consequent dilution of responsibility. This means that it has not been made clear what kind of agency is required for the integrated management of high-mountain zones. The existing ones can be evaluated but nobody knows which are lacking. Nor is it clear in which areas of the country these agencies are operating and in which they are not.

b) Organization

The country papers recognize three general types of structure for State organs responsible for development of the Andean region. The most traditional and still the commonest is the sectoral structure: bodies are assigned a specific function at the national level which is performed through a central office in the capital and a network of regional offices with defined geographical jurisdiction, almost always one or more political or administrative provinces. There are separate organs for roads, irrigation, agriculture, forestry, etc. Social welfare matters such as schools, health care, drinking water and sewerage systems are usually the responsibility of "service" organs but they remain sectoral. These organs operate independently of each other with a budget and staff allocated by each sector, with or without co-ordination among sectors and sometimes at cross purposes (for example, the construction of a service road through a wildlife sanctuary or national reserve). As pointed out earlier, some sectors have little funds for operational purposes once they have paid their wages bill, while others have an ample investment budget which makes them even more unique.

A second kind of structure consists of the "national programmes" which have led the way in Andean development. Established partly with an eye to obtaining foreign loans and partly to achieving effective co-ordination of the activities of sectoral bodies, the national programmes consist of a central co-ordination office in the capital and various local offices responsible for executing development projects in specific geographical zones, which with increasing frequency are natural river basins and not a province or combination of provinces. Although many of these national programmes tended in the early years to concentrate on only one or two aspects such as irrigation and farm output, since 1980 there has been an expansion of their content to cover other areas. For example, the tendency in Peru is for the several national programmes (farm output, irrigation, forestry, soil conservation, etc.) to co-ordinate their activities for the

development of critical microregions. The rural support organizations in Colombia and Ecuador have abandoned their preoccupation with farm output in favour of multifaceted activities including forestry, livestock, marketing and training in the shape of integrated rural development programmes.

In close step with the rise of national programmes, autonomous or semi-autonomous national institutes or corporations have been created to administer them. These organizations are in fact executing agencies which control their own budgets drawn from relatively abundant investment funds which often include foreign contributions. They enjoy relative freedom from the rigid rules of the central government concerning expenditure, hiring, wages, staffing limits, purchasing and submission of accounts. As they have the best financing, they tend to attract better personnel. Ecuador now has institutes for water resources (INERHI), peasant training (INCCA) and sanitation works (IEOS); Peru had an institute for extension of the agricultural frontier (INAF), which recently became the Department of Irrigation, as well as a forestry institute (INFOR), a development institute (INADE) and an agricultural research and development institute (INIPA). Venezuela has institutes of agrarian affairs (IAN), farm credit (ICAP) and rural education (INCE). Furthermore, almost all the countries have autonomous public corporations concerned with the generation of hydroelectricity, with drinking water and sewerage, and with mining, and they maintain offices in high-mountain zones.

The third type of government structure found in the Andean region is the autonomous regional corporation responsible for development activities in a specific zone, usually a large river basin (Colombia) or the whole of the Andean region (Venezuela). The general opinion is that this type of body is the most effective, and this is certainly true of several corporations in Colombia, now as in the past. However, there have been several limitations. One of them is financing. If these bodies are to be effective they must have their own income from foreign loans and donations, from the sale of services, and from direct taxes; they do not always have such incomes. Then there are interinstitutional rivalries both with sectoral organs and with institutions responsible for national programmes. As a rule, local workers resist interference by the power centres of the central government, and central government officials in turn are against the autonomous regional organizations and try to restrict their independence, activities and spheres of influence.

c) Operations

It must be stressed once again that not all of the activities described so far necessarily have a direct impact on the living standards of the inhabitants of the Andean region or on the use of the natural resources of the watersheds. It is now necessary to examine those which do have an impact.

There is no doubt that the Andean region, even under the best conditions, is a difficult place for outsiders to work or residents to earn their living. The topography, natural conditions and rainfall patterns are amongst the harshest and most unpredictable in the world and they offer a severe test to man's inventiveness in effectively coping with the forces of

nature. However, the magnitude of the task is more often employed as an excuse for the ineffectiveness of the central government's action than as a spur to redoubled or improved efforts. A circumstance is usually regarded a priori as an obstacle when in practice it can be a positive factor.

i) External forces. External forces affect the Andean region in different ways. They usually take the form of a large-scale project, generally a hydroelectric dam or a big system for collecting water for irrigation or urban services. These works are of national importance; the investment is large and public and foreign funds are committed; the leaders of the central government are personally involved and play a direct part and the beneficiaries live outside the project area. Big supplementary works are usually built after the commissioning of the initial installation, in order to keep it in operation (protect the investment). Up till now these works have provided few indirect benefits for the inhabitants of the zone, except for temporary waged jobs, and the works may mean a net loss for them because they no longer have access to the place's natural resources. Obviously, they will have little incentive to take action in support of the purposes of the installation, such as soil conservation, but considerable incentive for taking a negative view of it. Colombia, for example, has overcome this problem to some extent by allocating part of the income from electricity generation (4%) to rural development and local electrification. This is an example worthy of imitation.

Then there are the normal activities of government organs, both sectoral ones and those responsible for national programmes. The projects, of which there is a considerable number, tend to be dispersed --a road here, an irrigation work there, a reforestation project elsewhere-- but they are all designed to benefit at least some of the local inhabitants. The big intermediate valleys are usually given first priority, followed by hillsides and then the plateau zones. The big valleys of the "important" river basins receive more projects than the "unimportant" ones, but even in areas such as the Cañar river basin in Ecuador, which would not seem to have any qualities warranting government attention and investment, an impressive number of activities is being carried on.

Global plans for the "integrated" development of a specific zone, formulated either by an autonomous regional organ or by a national rural development organization, usually suffer from the defect described above: the planning organs do not have the capacity to carry out their plans or to persuade or compel the executing agencies to comply with them. Accordingly, in most cases the results have disappointed the hopes placed in these plans. The rural development activities in Colombia and Ecuador might be exceptions to this rule.

Each Andean country apparently has some kind of fund for special projects controlled by the Office of the President which is responsible for responding to petitions from members of the public, producing very small but politically necessary results: a school, the repair of a small access bridge, a local rural electrification network, a health post, a small irrigation project, etc. The political parties which support the government seem to have considerable influence on the distribution and timetabling of these activities. Civilian projects carried out by the military also tend to fall

in this category. Owing to their dispersal and small scale, these activities and projects, although many in number and having a local impact, do not contribute to changing the Andean situation on the required scale.

Foreign public bodies providing multilateral development assistance (for example, the Inter-American Development Bank) and bilateral assistance (for example, USAID) enter the Andean region by various routes. It is the first group which almost always provides the basic financing for large-scale works and these bodies impose rigorous counterpart conditions: cost-benefit analyses, environmental impact reports, viability studies and accounting practices. Bilateral bodies are the main sponsors and sometimes the firmest advocates of the national programmes carried out by the executing agencies. In Peru, for example, there are USAID programmes for soil conservation and small-scale irrigation works, and the Netherlands has assistance programmes for drainage, land rehabilitation and forestry. Without the initial support of these countries it would have been difficult for Peru to launch Plan MERIS I (17 irrigation projects in Cajamarca and Junín departments financed with US\$21 million from USAID, plus the Vilcanota valley project financed with German funds), or the ongoing drainage and land-recovery programme at the coast initiated by a Netherlands mission, or the forestry programme with community participation in 10 departments of the sierra (backed by US\$5 million channelled through FAO by the Government of the Netherlands). Other foreign governments prefer to concentrate their efforts and resources on a geographical zone: for example, the sustained interest shown by the Belgian government in the Cajamarca and Condebamba basins in Peru. The main advantages of official foreign participation in Andean development do not lie solely in the amount of money which they contribute but mainly in the catalytic effect which facilitates the continuity of the programmes, for the mandatory counterpart is faithful execution of the programme. On the other hand, if the recipient country does not put its objectives and concerns across properly, some of these programmes, owing to the influence of the donor or "soft" lender, can end up by investing US\$1 million in 50 "pilot" hectares which will provide the subject matter for a dozen doctoral theses in a foreign university.

The same is true, on a much smaller scale, of private foreign activities carried out by religious groups, volunteer organizations (such as the United States Peace Corps), universities and social welfare bodies (for example, Caritas). These organizations concentrate on social and community development projects and some small practical projects involving peasant participation; the results are very variable, for success depends mainly on the nature of the local community and on the person sent to the place, and not on the programme for which he works.

It must be stressed that the organizations described above come from outside the watershed. The operational model is development "from the outside". Cases of development of a watershed from the inside (endogenous) are not mentioned as relevant in the four country papers despite the many existing examples which demonstrate the importance of local input, such as the forestry and agriculture programme of Cajamarca University.

ii) Physical projects and social projects. There are two main types of project in the Andean region: those aimed at the construction of physical

works and those concerned mainly with social work (loan services, trade, health, etc.). Of course part of the official justification of any project is that it will benefit the community, so that a social component is usually included with the more technical civil-engineering proposals. However, the emphasis lies elsewhere and "development" tends to be defined largely in terms of specific construction works.

Investments in construction projects far exceed investments in social projects mainly because it is easier to justify them and because they can be effected without much delay with personnel brought in from outside and without local participation. From the technical standpoint, the Andean countries have produced engineers and other professionals of world class who have devised innovatory and often brilliant technical solutions to complex problems of modifying the environment of high-mountain watersheds. Nevertheless, no matter how difficult the engineering problems are, they are always more concrete and predictable and less frustrating than the social problems of the local people who, moreover, take a different view of things from an outsider. The overwhelming majority of the professional personnel of government executing agencies are technically qualified in one or another academic discipline, few of which include social studies in their curriculum. The most successful professionals are those of Andean origin or who have acquired from their long experience in the field the knack of dealing and co-operating with the local people.

Another factor which tips the balance in favour of construction works is the possibility of quantifying the progress (the number of hectares irrigated, for example) for allocations of funds and personnel are made on the basis of tangible parameters. This pleases the government and the lending agencies.

iii) Project implementation. Most available project statistics list work accomplished and sometimes goals attained, but few mention what still remains to be done. As for co-ordinating implementation the impression is that project investment decisions are taken without considering the various existing plans and in spite of them. It can be seen, moreover, that some programmes sponsored by a specific government tend to expire with it.

Another problem is that the Andean region is clogged with pilot projects, many of them imposed from the outside, which have not borne fruit in the shape of other, larger projects, even in the same zone. The involvement of foreign financing and economic assistance bodies does solve the problems of financing and continuity, but these bodies' liking for pilot projects is partly responsible for the present situation. However, the local bodies should exercise proper supervision to ensure that their own goals are not neglected. This can only happen if the country has sufficient local personnel to defend its ideas and prevent domination by the interests of the bilateral aid body. Another negative factor is that the interest taken in the project by the executing agency and by the lending agency declines or dies on the completion of the works. Sometimes the complementary support services included in the original project design are not set up, although it is true that post-project technical assistance and extension activities are becoming increasingly more common and effective. One way of preventing this abandonment or loss of interest is to encourage participation by the local

residents, being the beneficiaries, from the start-up of the project. The success of the farm development programme in the high valleys of Venezuela seems to have been based on such participation.

The most noteworthy defect in project support activities is the failure to organize self-sustaining maintenance systems in conjunction with the users, especially by training and organizing them in matters of finance or participation: for example, to operate and maintain irrigation works and other recently constructed installations. When the installation breaks down, it remains idle until the only remedy is to prepare another "project" to secure financial resources for the repairs.

iv) Project evaluation. The country studies indicate that, as a rule, there is insufficient formulation and evaluation of projects for the high-mountain zones. The studies lack sufficient data for derivation of the necessary recommendations for improving them. The experience acquired from pilot projects and the implementation of other projects is usually not stored systematically. It is unusual to find a data bank offering policy-makers and project managers a range of techniques and solutions which have proved their effectiveness in the high zones. Each project is usually regarded as a unique case set in local circumstances which cannot really be adjusted in the light of the experience of other projects. Common criteria are not established for comparative evaluation of the results with those of other similar projects. Accordingly, there is little in the way of useful information and feedback systems to guide those responsible for project implementation in high-mountain zones.

6. The watershed perspective

a) Government policies and the informal sector

Most of the inhabitants of Andean watersheds are members of marginalized groups which the governments find it extremely difficult to deal with. They are the main users of the natural resources of the place but they either totally ignore or offer only a weak response to official policies, laws, regulations, operations, incentives and penalties. Land-use planning, legal penalties, tax policy, landholding systems, resettlement, jobs programmes and other methods commonly used by a government to introduce reforms or impose its policies have not worked perfectly, to say the least.

The main lack seems to be any significant or tangible benefit which would motivate the inhabitants of these zones to behave as the government wishes. Several centuries of bitter experience of unbidden outside interference in the Andean valleys and watersheds explain this mistrust and the widespread lack of respect for government institutions and activities, for there is a deep-rooted suspicion that any change will inevitably be to the detriment of the local people. Governments have had little success in overcoming this lack of confidence although they may have had the best of intentions and may have executed their projects with great technical efficiency. They are therefore more likely to succeed in places where they are responding to local requests.

b) The results

The absolute magnitude of the problems of Andean development should not be confused with the relative measures adopted for their solution. Such measures will always seem insignificant. For example, if a country has a million hectares suitable for reforestation but all it does is to plant a thousand hectares in one given year, this will scarcely reduce the total magnitude of the problem. In some cases and in certain places, however, spectacular progress has been made. In others --the majority-- the official statements give an impression of much greater progress than what is actually being achieved in the field.

Another problem is to determine the criteria to be used in evaluating the results. The common consensus indicates that the most suitable criteria are productivity, sustainability and equity. The first criterion is decisive in practice, the second has become a common factor, and the third is usually forgotten.

Output figures are the most widely used indicators of productivity, especially the figures for farm output, which is usually taken to be equivalent to the total economic activity of the Andean region. Excellent results and very high outputs have been achieved in the modern farming sector in the valleys, both for the mechanized commercial crops of the Cauca Valley in Colombia and for the dairy farms of the northern and central basins of Ecuador and of Cajamarca in Peru. Output has reached its maximum theoretical level in some cases, for example the mechanized farms of the Cauca Valley. The output of commercial crops grown on hillsides has also risen, especially coffee in Colombia and Venezuela, owing to the replacement of the old plantations, the introduction of new varieties and cultivation techniques, and the improvement of marketing and storage systems.

In short, the modern sector is doing very well and has the potential to do even better. It is part of the formal and established system, which is the one which governments --up to a point-- manage best. It already has an infrastructure: roads, irrigation systems, installations and equipment, technology, credit and marketing. This kind of investment is producing very good results in economic terms. In terms of equity, the inhabitants of the big valleys, villages and commercially cultivated hillsides are clearly not the most needy in the Andean region, for they are the most productive and best paid. As to sustainability, the modern sector is incorporating improved conservation techniques and is willing to adopt others, for the owners are operating with medium- and long-term targets and are not worried about day-to-day subsistence.

Agriculture and livestock production for local consumption is also showing a general increase in non-commercial hill and plateau areas, but this increase may not be sufficient to keep step with population growth and certainly not to improve overall standards of nutrition. However, the results indicated in the country studies vary from basin to basin, so that it is difficult and risky to make generalizations. For example, between 1980 and 1985 Ecuador enjoyed a considerable increase in the output of some basic foods (soft maize, beans, vegetables, potatoes) especially in the northern

and southern Andean zones, while output of other crops (wheat and barley) fell. The total area sown with basic crops declined, for the land was used for export crops (coffee, cocoa) and livestock.

The installations constructed in big valleys and "important" river basins are beginning to motivate the management of the upland watersheds which they contain to attenuate the degradation of the natural resources (by checking erosion, for example) but they have not yet succeeded in reversing this process. Reforestation and forestry are making noteworthy progress in the "important" zones. The "unimportant" zones are showing little or no progress. The unbridled degradation of the basic natural resources is continuing apace in recently settled areas. Almost always, the greater the distance or altitude the less likely it is for the government to be assisting with the management of the natural resources. However, in areas settled long ago distance and altitude are not indicators of greater degradation of the resources because the peasants know how to use them.

Owing to the modernization of the big valleys and commercially farmed hillsides, subsistence farming and the peasants themselves have been displaced to increasingly steep hill areas and to the upper fringe of the forest, occupying marginal land which very quickly becomes exhausted and barren. The result is the situation described in the first section. The expulsion of farmers from traditional zones has also destroyed communal labour practices, and the techniques and management of agriculture at different ecological altitudes. Although the present big-valley system is rational from the standpoint of the national economy, it offers very little benefit for the local peasant and his family. The modern sector has not generated enough job opportunities to absorb and integrate the available workers and offer them an alternative means of livelihood. As a rule, the government's programmes and projects have still not succeeded, despite the official pronouncements and policies, in helping these people who are not living either on their own ancestral land or in the big valleys.

7. Institutional factors and Andean development

There are many things happening in the Andean region and projects are everywhere, even in the most remote and unimportant valleys and watersheds. However, the whole seems to be less than the sum of its parts. Development focused on the people and based on conservation of the resources as envisaged in the consensus and in political statements by governments has taken place only partially and incompletely. Some Andean watersheds have hardly been touched.

What has happened and is happening is a different kind of development based on the construction of works justified by economic criteria and designed to achieve quantitative goals for the benefit of areas and people often located far from the watersheds in which the investments are made. In spite of some inefficiency in implementation and some management gaps, this is a rational system designed and managed by intelligent persons for the attainment of logical objectives. It is an institutional system which works more or less well within its own parameters. What is still not being achieved is improvement of the living conditions of the inhabitants of the

high-mountain watersheds and conservation of the natural resources found there. The priorities lie elsewhere, although the official statements say the opposite.

The main purpose of this paper is not so much to describe the current problems as to suggest avenues of research to help policy-makers to pursue the type and level of development most suited to the Andean region. The above analysis contains a number of assertions and statements based on national case studies and talks with expert civil servants. However, these proposals are no more than first approximations or indicators which must continue to be studied in order to establish a list of "problems" and a list of "solutions".

In general terms, what is needed is a more thorough and systematic study of the institutional factors in the development of the Andean region. Take, for example, the following hypotheses:

1) Actual investments bear little relationship to official plans and lists of priorities for the high-mountain zones. What are the reasons for this? Can the correlation between official statements and budgetary allocations for the high zones be improved?

2) There is a much larger volume of information than might be supposed. There are studies on all imaginable topics and geographic zones, and some technical mission or other has probably visited every part of the Andean region. Nevertheless, there are still no methodical and efficient systems for delivering this information to organs and civil servants in a timely and useful manner. This means that up till now many decisions for improvement of the high zones have been based largely on conjecture. How can this process be improved with a view to furnishing the key civil servants with a selection of useful data and tested solutions which will contribute to the better informed adoption of decisions and methods?

3) Some institutional arrangements, such as the "national programmes" entrusted to independent or semi-independent institutes or corporations seem to be more effective than others in developing the high Andean region. Why is this? How can the co-ordination of the various programmes and projects operating in the high zones be improved?

4) There seems to be a direct relationship between foreign participation and programme efficiency, especially with regard to the continuity of the work. How can this same continuity be achieved in the exclusively national programmes?

5) It seems that human needs are not usually a factor in determining the "importance" of a valley or watershed for government investment. How can the inhabitants of "unimportant" zones attract the attention of the policy-makers? How can these zones be developed into effective contributors to the country's progress?

6) It seems that a greater relative proportion of investments in high-mountain watersheds goes on big projects whose purpose is to benefit persons living far from the watershed and generally not to benefit the local

people. What can be done to ensure that the local people do benefit? Furthermore, how is it possible to secure the support and active collaboration of the local inhabitants in the execution, conservation and protection of the projects?

These are all unanswered questions. No doubt other equally valid questions could be asked. The answers could make a concrete contribution to decisions on the nature of the future development of the Andean region.

Annex

INFORMATION NEEDS

It is possible that the information needed to support or modify many of these proposals already exists or could be assembled. The following topics are the most important ones to be researched.

- The true national priorities determined in the light of budgetary expenditure over a suitable period, and the ranking in this list of programmes designed to benefit the inhabitants of high-mountain watershed.

- The percentage of public expenditure allocated to the inhabitants of high-mountain watershed in comparison with the percentage allocated to the population living outside them.

- The volume of international public and private financing channelled to high-mountain watersheds in comparison with the volume of exclusively national resources used for the same purpose.

- The volume of investments in the high-mountain region in comparison with investment in other areas of the country, distinguishing investments in big projects from those allocated to marginalized peasants.

- The real volume of public expenditure per watershed compared with the ranking of each watershed in the official list of priorities, with a view to identifying the true factors determining a watershed's "importance".

- The weight of ethnic and cultural factors in the content and methodology of the programmes for the inhabitants of the Andean region.

- Evaluation of the relative importance of political, economic, financial, social and humanitarian factors and of production and conservation factors in the effective allocation of resources.

- The degree of use of areas formed by natural regions (river basins, ecosystems, etc.) as against the degree of use of political/administrative units as management areas for resource development and conservation.

- The cash contribution of non-governmental organizations to the development of the Andean region in comparison with the resources allocated by the public sector.

- The percentage of the annual budgets of ministerial organs actually available for field activities. The ratio of the operating budget to the investment budget in high-mountain zones.

- The impact of budget cuts on staffing levels and field activities.

- The effects of competition between public organs in co-ordination, dissemination of information, innovation and delimitation of each organ's responsibility.

- Classification of the public organs working in the Andean region by administrative structure, programme content, and source of financing.

- The extent to which big projects have benefited the inhabitants of the watersheds in which they were carried out.

- The effective distribution of investment projects between "important" and "unimportant" valleys and watersheds.

- The percentage of investment and land area entrusted to independent regional corporations and integrated rural development organizations in high-mountain zones.

- The nature, geographical distribution and cost of civilian support activities (community co-operation, communal work, etc.) and civilian activities carried out by the military in high-mountain zones.

- The degree to which these activities have been incorporated in broader development programmes.

- The degree of continuity of specific programmes in operation and the degree of continued attention given to specific geographic zones (watersheds or microregions).

- The type and scope of support services provided by the government for the operation and maintenance of installations built in high-mountain zones.

- The extent to which the principles of preservation, production, restoration and conservation of renewable natural resources are applied during the implementation of investment projects in high-mountain zones.

- The extent to which governments are capable of imposing official policy on the informal sector of the inhabitants of Andean watersheds.

- Differences in levels of output, living standards and resource conservation between the "modern" sector of the valleys and the subsistence sector of the watersheds.

STRATEGIES FOR THE DEVELOPMENT AND MANAGEMENT OF HIGH-MOUNTAIN
WATERSHEDS AND ZONES IN LATIN AMERICA:
A CRITICAL ANALYSIS */

1. Interest in the high-mountain zones and what has been done for them

The search for strategies for grappling with, stabilizing and reversing the steady deterioration of the quality of life of the inhabitants of the high-mountain zones and of their natural resource base is a relatively recent concern of the region's governments: it dates to no more than 20 or 30 years ago.

This interest in the high-mountain zones has different motives, most of them not specifically to benefit either the inhabitants or the resources. In the beginning, the high-mountain zones were considered from the standpoint of extraction of resources for use in relatively lower and flatter areas, in urban areas, and sometimes in distant countries. This led to a great diversity of investment, for example in mining, livestock and forestry operations. Subsequently, the need for energy, water and farm goods for urban settlements diverted attention to the construction of water and transport works. This led in turn to control of the erosion, landslides and floods which damaged the installations, cut communications or inundated urban zones. Even today it is by no means rare for programmes of erosion control or watershed management to be devised for the sole purpose of protecting water works. This is why there still persists in some places the traditional definition of watershed management as "the art and science of managing a watershed's natural resources in order to control the delivery of water in quality, quantity and time", resulting in statements in documents on management projects such as those on the Upper Magdalena river basin project in Colombia: "It has been clearly established how our river basins in the Andean region of Colombia, which provide the water resources for energy, irrigation and human consumption, are being gradually degraded not only by natural physical factors such as lithological characteristics, rugged topography, heavy rainfall or long periods of drought but also by social and economic factors determined partly by the uncontrolled growth of settlement, by the types of farming, forms of landholding and current land uses, and by intense demographic pressure.

"These imbalances in most of our watersheds have had harmful consequences for aqueducts, hydroelectric power stations, dams, irrigation districts and industries. These effects are produced in winter by the large increase in the flow of the rivers and in their sediment load which clogs and blocks the civil engineering installations, hydroelectric stations and irrigation areas, causing flooding into the bargain, and in summer, by insufficient flows to meet the various demands made on the water resource" (Colombia, 1984).

*/ Statement of Axel Dourojeanni at the International Seminar on Soil and Water Conservation (Lima, 13 to 17 April 1987).

It is equally true that there have been many government programmes actually designed to benefit the inhabitants of high-mountain zones and, at the same time, conserve their natural resources base. The first approaches were based almost exclusively on preservation, protection and conservation of the natural resources. Then the priority shifted to infrastructure to benefit the peasants (irrigation works, roads, health posts, etc.), not necessarily with the people's participation. Subsequently, programmes were executed to support and facilitate marketing and borrowing and to provide other services. The evolution of many of these programmes led gradually (and necessarily) to the incorporation of the local inhabitants as an essential variable in the programmes, to talk first of "training" and "extension" for the peasants or Indians, and then of "participation". Participation is the most advanced concept: it was long thought --and regrettably it is still thought in some circles-- that the peasant should only listen and learn and not participate with his own knowledge.

Parallel with these advances, another group of persons began to concern itself with executing programmes and pilot projects which incorporated little by little what was being revealed as strategic. A case in point is the forestry, agriculture and livestock development project being executed by Cajamarca National University in Peru. These pilot projects are found throughout the Andean region, some sponsored by local bodies and many by international and foreign organizations. Other programmes in more recent times have undertaken larger-scale activities. Much of this large-scale effort had and still retains a sectoral approach (improvement of irrigation, reforestation, wildlife management, fish-farming, improvement of certain crops, etc.). Several of the national programmes reach out to activities of other sectors from the base of their own speciality.

Other more ambitious proposals adopt integrated solutions from the outset. They stress the need for integrated analyses, plans and projects and they conjure with magic terms such as integrated planning, integrated management, multisectoral approach, and multidisciplinary development: all of this reflects the concern to involve several sectors or disciplines. There then emerge the "integrated rural settlement projects", the "integrated rural development projects", the "integrated watershed development programmes" and the like. These programmes and projects have received wide attention in Peru and Ecuador and above all in Colombia. It must be noted here that to say "integrated" is, at least for now, just as utopian as to say "optimum", so that in practice integration is simply a goal which will be met only in the much longer term. For the present, the successful co-ordination of two or three sectors and basic subsectors can be considered an achievement.

Other people, with their attention focused more closely on considerations of geographic area with a view to setting priorities for and co-ordinating more decentralized actions, point to the need for subdivision into regions and microregions. Some of these new moves have again remained merely proposals, mainly because the regional subdivisions which were created were not recognized by everyone, or were too large, or were devised only for planning purposes (planning regions) and not for the administration and co-ordination of action programmes.

Other proposals have been concerned with the creation of national institutions, services or councils and other horizontal-action organs with a view to persuading vertical-action organs such as ministries or regional agencies to incorporate specific additional activities. The success of most of these initiatives has been proportional to their capacity to solve financial and staffing problems and to overcome their conflicts of competence with local bodies and other sectors. Their greatest weakness has been to try to administer and plan mainly from the centre. Many of these programmes have died, some shortly after termination of the external source of financing or the international agreement which supported them, and others owing to changes in policy or government or even in the persons responsible for their management.

Lastly, another move designed to benefit the high-mountain zones was the creation of regional or provincial agencies, branches and offices, especially in provincial capitals. A case in point is provided by Puno Department (Peru) which, according to Alberto Giesecke (1986) had 67 public offices in 1984. Many of these offices had only a nominal representative. Others lacked local independence. Many of them administered projects handed down from Lima with the result that they were usually not integrated in the local scene; they did not satisfy regional needs or manage adequately their relationships with the rest of the public sector, and their actions proliferated without rhyme or reason (Giesecke, 1986).

2. What can be rescued and used for a stable and rational strategy?

Every one of the attempts to develop the high-mountain zones has positive and negative aspects. There is no denying that for purposes of derivation of reasonable working strategies there is a wide variety of experience in all the Latin American countries, especially in the high Andean areas, in Central America and in several Caribbean countries. What has been achieved is by no means insignificant in itself; but it is insignificant when set against the challenge of the high-mountain zones, a challenge which far from diminishing, is increasing daily for the degradation of the natural resources and the population is growing. From now on this topic cannot be dealt with without taking into account the experience already acquired by the many persons and institutions which have opened the way. It is an accepted fact, moreover, that the high-mountain zones require a serious and rigorous approach adapted to the heterogeneity and complexity of their problems.

The challenge today is to gather together what has been learned, and organize and apply it in order to secure effective improvement of the people's living standards and of their resource base. It is no longer a question of pilot projects but of large-scale projects; this entails satisfaction of several requirements such as extent of cover, continuity, technical resources, training and organization.

At least there is a general belief that "something" must be done for the inhabitants and resources of the high-mountain zones. However, many of those who share this positive attitude and even play an active role lack the necessary knowledge of what is happening in these zones, what can be done and

where, and who should do it and how. It has already been pointed out that the accumulated material on this topic is abundant although not assembled in one place. The initial task therefore is to find a method of systematizing this material in order to make the accumulated experience available to everyone.

3. How to derive desirable strategies from past experience

Part of this work can be done by comparing on the one hand the official and unofficial versions of the situation in the high-mountain zones and on the other the official and unofficial versions of the performance of the institutions operating there. The first thing therefore would be to take account of a set of considerations and factors which explain the existing situation in the high mountain zones, with respect both to their inhabitants and their natural resources, and secondly to consider a set of considerations or factors which explain the performance of public, private or joint institutions with respect to the high-mountain zones.

The necessary data on the actual situations are recorded and widely documented in available studies and reports. The situations in the high-mountain zones are usually described in these documents in terms of:

a) studies or analyses, with or without analysis of problems or solutions;

b) reports of problems or constraints for the development of high-mountain zones;

c) proposal of solutions or strategies, with or without details of their formulation and execution; and lastly

d) progress reports on programmes and projects with tangible results and achievements which can be verified in the field.

Generally speaking, the volume of available documents is greater for the first items in this classification and much smaller for the latter. From the few reports on solutions put into practice, moreover, it is easy to see what was done but not what was left out or remains to be done. Nevertheless, these documents constitute a valuable source of information, from which can be derived the two types of factor mentioned above.

a) Factors which explain the current situation in the high-mountain zones with regard to the inhabitants and their environment

- The high-mountain zones are not homogeneous and continuous areas and they cannot be treated as if they were. The inhabitants may differ a priori even within one watershed, depending on whether they are valley or hill people, urban or rural dwellers, industrial or peasant, owners or non-owners, etc. The ecological characteristics are usually different at different points in the same watershed. All of this creates different situations, and although there is certainly widespread poverty in rural areas and environmental degradation in the high-mountain watersheds, the situations

are uneven. This unevenness must be evaluated in order to reduce the differences by giving assistance to those who need it most, subject to available resources.

- The problems of the rural inhabitants of watersheds are different, moreover, if they have occupied the land since early times, as in the Peruvian sierra for example, and are organized into communities or other associations, or if they are relatively recent settlers; even more difficult is the case of migrants and temporary settlers, such as on the upper fringe of the selva. The government's approach and action cannot therefore be the same in all cases. In fact, there is a greater tendency to assist long-time and organized occupants of the land rather than temporary settlers, and this explains the larger number of existing assistance programmes for "communities".

- The management for the development of watersheds or microregions in high-mountain zones is not a process concerned exclusively with the agriculture and livestock sector or conservation and protection of a watershed's water and soil (watershed management). In the words of Juan Sánchez (1986), the high-mountain zones, especially in the Andean region, are "a complex in which agriculture and industry, town and countryside, energy and technology must be present within the same sierra ..." and there is indeed no prospect of improving the quality of life of the inhabitants or conserving their resource base without diversification of actions beginning with the family --which simultaneously works in agriculture, livestock, handicrafts, trade, gathering, provision of services and as hired labour-- and continuing with the community, district, province or region.

The so-called "appropriate technology" for the inhabitants of the Andes consists therefore, as argued by Eduardo Larrea, technical consultant to the microregional development project of Peru's National Planning Institute (INP), in the construction of a "technical matrix of the peasant". It is a question of studying, not a collection of isolated techniques, but a complicated interplay of techniques. If improvements are to be made to this matrix and be accepted by the Andean people, they must include modern technological advances and they must not have an adverse impact on existing activities. Success in this matter, moreover, does not depend exclusively on "technical quality and simplicity" but on the organizational and managerial capacity of individuals. The first thing is to have the managerial capacity; the second is to acquire a detailed knowledge of the existing techniques and their purposes; the third is to improve the techniques in terms of their interrelationships and applicability.

- The development and management of high-mountain watersheds or zones can take two directions: from the inside to the outside, and from the outside to the inside of the area. In the first case, the effort and initiative start with the inhabitants and occupiers of the place themselves who are concerned with their security and self-sufficiency and generally with improvement of their living conditions. (They may receive assistance for these purposes or not.) In the second case, the initiative comes from persons outside the area and may be designed to help the inhabitants or to extract, exploit or protect certain resources.

The management procedures proposed for the high-mountain zones should combine both these efforts for the benefit of the inhabitants of the zones and avoid situations such as those observed in the Colca Valley in Arequipa: despite the great investments made for the delivery of irrigation water to the distant Majes pampas, the valley itself obtained no benefit (Manrique, 1985).

- Another important point is that the inhabitants of these zones have two kinds of concern: urgent ones (to feed themselves, cure illnesses, repair the only access road to their village); and other less urgent and longer-term ones (to resolve a land dispute, achieve literacy, improve irrigation, communications, and access to markets, etc., with a view to overcoming their backwardness and isolation). Support activities must tackle both types of concern and not just one; in other words, there must be a simultaneous combination of short- and medium- and long-term actions.

These factors affecting the situation, needs and strategies in the high-mountain zones, and many others which could be included, provide a working framework for the Andean subregion. The heterogeneous prevails over the homogeneous in this subregion; standard recipes cannot be applied; most of the imported resource classification systems collapse in the face of the unwillingness of the local inhabitants to be measured by outside formulas; there are urgent needs, and more than anywhere else it is the people, their families and their organizations which must be the starting point for any action, and all action must necessarily be concerned with a specific area.

This is the kind of experience which must be collected together and transmitted in colleges, universities and specialized centres. No professional, and even less an employee of an agency working for the high-mountain zones, should try to operate without having studied and absorbed these concepts. He must also have done this with respect to other regions of his country --in the case of Peru, for example, the Costa with all its peculiarities, and Amazonia. This means collecting together existing information and accumulated experience which is a difficult task in view of the disorganized manner in which material on this subject is published. Very few ministries have numbered records of all their various publications, studies, reports, memoranda, seminars, meetings, etc.; there is no follow-up of the projects implemented; the documents have very limited print runs (20 to 100 copies); the libraries are unreliable and there is usually a great deal of tendentious information, while the real and objective reports are classified as confidential.

b) Factors affecting the performance of public, private or joint institutions with regard to the management and development of high-mountain zones

The first of these factors is the question of what actually prompts the State or institutions to take action in the high-mountain zones. Of course all of them have one or more stated objectives; however, some of these objectives provide the key to explain the institution's performance. For example, some of them pursue a policy of resource protection in the high-mountain zones but with a view to safeguarding investments in transport

and water installations in the lower zones; others are seeking to prevent or reduce Indian migration to the urban areas: others want to increase output and reduce imports and food dependency; others are concerned with supplying the cities with cheap farm goods; and others concentrate on tourism or wildlife protection. Several of these programmes, such as the various projects on technical assistance, subsidies, loans, support for the peasant woman, etc., which exist in the Andean countries are genuinely designed to benefit the inhabitants of the region. Many of them, the majority in fact, are mixed projects, or at least attempt to be so, catering simultaneously to local, regional and national interests.

The second factor is that government institutions have usually worked by sector and subsector without any agreement or co-operation among them --an approach unsuited to the Andean situation. The result is duplication of functions, fragmentation of resources and, above all, disorganization and confusion among the recipients of the aid. Each sector divides up the territory at its own discretion, sets up offices in regions and provinces, organizes the users into committees which serve only its own purposes, and formulates its action plan without reference to other sectors. It is believed, moreover, that the whole development process in a zone must turn on a specific area of interest: irrigation, trees, terraces, rural energy, drinking water, etc. Even worse, in many cases the decision is taken in an office in the national or provincial capital as to which places or persons should receive the benefit of a programme, and rarely is there any discussion or even reporting of the decision to the authorities of other organs with a view to co-ordination of activities. Nor do national offices report their decisions to local corporations or other levels of regional or local government; nor do the local or regional agencies inform the central government.

Another factor which makes intersectoral co-ordination even more difficult is that the institutions are created, at least in theory, to work in an organized manner, carrying out specialized functions in matters large and small. There are for example bodies concerned only with planning, some only with technical regulations, others only with project implementation, and yet others only with scientific matters, etc. The problem is to ensure that their functions complement each other. It is almost impossible in practice for every institution to pass on the baton to the next one at exactly the right moment and to supply it with the information it needs. The end result is that all the institutions do a little of everything and, as in the case of sectoral programmes, think that the others should fall into line with them.

Many people believe that co-ordination will come about of its own accord as a result of the issue of memoranda, creation of multisectoral committees, formulation of integrated plans, commissioning of integrated analyses or creation of big institutions to deal on an integrated basis with the broad range of needs of the inhabitants of the high-mountain zones, always assuming their own sector maintains control.

As another type of action some of the region's governments have tried to launch programmes of the "integrated" type from the outset, creating institutions of multisectoral and countrywide scope, integrated development programmes or projects, independent corporations and many other forms of

management. Some of these arrangements have had the serious drawback of duplicating the region's centralism, causing conflicts with other institutions, and sometimes benefiting certain sectors to excess.

All these attempts, almost without exception, have also run foul of the common evils of public management --excessive government "by decree" and without resources, lack of continuity in structure and staffing, budgetary rigidity (which requires miracles for the attainment of the goals or rapid expenditure of the money according to cycles which do not coincide with those of Andean development), institutional jealousies arising from conflicts of function and legislation, the sometimes inadequate control systems, and other systems unsuited to the situation. All this has meant that much of the civil servants' time is taken up in keeping their agency in existence (preventing its termination or cutback) and in surviving as individuals, carrying out many extra-curricular advisory tasks and attending to several different jobs.

These factors lie behind the implementation in the high-mountain zones of actions involving minimum risk of controversy undertaken by common agreement between the government and the lending bodies, even though in many cases they are in conflict with the actual situation in these zones. This avoids institutional and personal conflicts and friction and secures resources and a degree of stability. This is why many of the attempts to break new ground are reduced to "pilot projects" or merely to plans or studies involving little commitment. This reduces or prevents criticism of a system which does not reward innovation. In fact, the critics are ready to exaggerate any fault when a proposal for change is carried out; this has happened in the case of some of the attempts to secure budgetary and administrative decentralization when, as a result of an instance of peculation in only one of the headquarter offices, the existing independence of action was abolished throughout the country.

Accordingly, the stratagems used by institutions to ensure their own survival usually work against the requirements of the high-mountain zones. In order to obtain resources, an institution must formulate profitable projects, which precludes to social goals of participation and integration. In order to ensure continuity, international agreements are sought to support a given institution, even when the goals of these agreements are not best suited to the Andean situation and needs. (These agreements --even without money-- are important as catalysts to underpin the continuity of the action.) In order to secure economic resources, projects which can be quickly finished and which show immediate results are chosen, precluding possibilities for education and participation of the local inhabitants and out of step with the life cycle in the high zones, and so on.

4. What is being done to find desirable strategies

In the recent International Seminar on Integrated Systems for Watershed Development and Management in the Andean Region of Latin America a number of strategies were proposed for dealing with these problems. The Seminar's recommendations can be adapted to serve as a means of comparison with existing programmes in the high zones and thus to facilitate their

evaluation. The main contributions made at the meeting were translated into the following recommendations:

a) The need to subdivide the high-mountain zones into regions and microregions with a view to specifying units or areas (such as river basins or microregions) where the physical space can be harmonized with the operational space. These areas must be sufficiently small for identification of the various participants in their development. The Seminar emphasized in particular the need for all State institutions and the local authorities to recognize this microregionalization.

b) The need to co-ordinate and organize State action in each of these areas. The starting point for this must be a participatory-operational planning and implementation process which operates from the bottom upwards, assembling local ideas and proposals and reconciling them with the ideas and proposals of the technicians, as well as with the available resources and the country's regulations.

c) The need to form for this purpose "bargaining committees" in which are represented all the agents who have a common interest in improving the area in question (watershed, microregion, township, etc.). This method makes it possible to organize State management into programmes which combine the activities of two or more sectors without seeking to cover all the sectors, at least at the outset, but selecting only the priority ones.

d) In addition to the foregoing, there are several other recommendations referring mainly to matters of organization, financing and legislation. The starting-point is to accept a very simple fact: the organization and the activities of the institutions concerned must be adapted to the present Andean situation and not vice versa.

When this set of recommendations is applied to the various existing forms of organization, it can be seen that Peru and Colombia have made progress which is fully consistent with the requirements. The most noteworthy development, by virtue of its potential scope, is the proposal for the so-called Special Project of the Development Programme for Economically and Socially Underdeveloped Microregions assigned to Peru's National Planning Institute. Colombia has made progress with a similar proposal, taking regions and townships as the basis and widening the scope of its Integrated Rural Development programmes. It is to be hoped that the action already taken in these countries will be consolidated. Other specific studies have taken more traditional approaches, confined to sectoral programmes and projects.

5. The most immediate tasks

ECLAC has taken a number of initiatives --although certainly only a small start in relation to the magnitude of the task-- to systematize and summarize all that has been learned. The first exercise was to evaluate the strategies, programmes and projects used or formulated for the development and management of high-mountain zones in the Andes. The first step was to indicate the most important zones and river basins in the high-mountain regions of each country; and an attempt was made to differentiate the

importance which governments attach on paper and in fact to these areas and to determine their current, possible and potential productivity. The next step was to identify all the programmes and projects designed for the improvement of these areas and the effects produced by their implementation, to identify the obstacles and limitations encountered, and lastly to formulate recommendations combining the positive aspects of each programme or project. The results of this first exercise are useful, but the available information is still insufficient and it is therefore recommended that the comparative analyses of programmes and projects as suggested in the annex should be continued.

At the same time, an attempt is being made to construct a system for establishing, developing and delivering working methodologies for the high-mountain zones. This means providing an information matrix for the technicians assisting the Andean people. This matrix must cover organizational matters, projects, production and conservation systems and methods of integration. None of this work can be done without the collaboration of each country's experts and institutions.

In the case of Peru, the sectoral programmes which have been or are being carried out and can provide useful experience include, for example, the National Plan for Improvement of Irrigation in the Sierra (Plan MERIS), the National Programme on Land and Water Conservation on River Basins, the Institute for Transfer of Appropriate Technology to Marginal Sectors of the "Andrés Bello" Agreement (ITACAB), the Land Improvement and Rural Housing Programme (PRATVIR), the programmes carried out by the National Forestry and Wildlife Institute (INFOR) in conjunction with FAO and the Netherlands government, the programmes of domestic and foreign private foundations such as the Friedrich Ebert Foundation, the National Development Foundation, the Nature Conservancy Foundation of Peru, the programmes of the National Science and Technology Council (CONCYTEC), the Forestry, Agriculture and Livestock Programme of Cajamarca National University, the programmes of the departmental development corporations, and many other programmes of direct assistance to the peasants, the direct community assistance funds, the experimental project on the ecodevelopment of a Meso-Andean region of Peru based on rehabilitation of terraces, which is being carried out by Nature, Science and Local Technology for the Social Service (NCTL), etc. All these programmes are sources of support and information.

Peru's microregional development programme, which is the responsibility of the National Planning Institute (INP), may be the kind of system which can integrate all the efforts in each microregion. The most important task for the countries is to achieve this integration in order to facilitate large-scale types of action by joining forces, concentrating studies and resources, increasing their efficiency, and succeeding once and for all in creating a stable and continuous working system. This is the only way to improve the quality of life of the inhabitants, at least with respect to their basic needs, and it is also the only way to restore, protect and conserve the resource base.

Annex

PROPOSAL FOR IMMEDIATE ACTION TO SYSTEMATIZE THE METHODOLOGICAL
EXPERIENCE ACQUIRED IN THE PROGRAMMES AND PROJECTS DESIGNED
TO IMPROVE THE QUALITY OF LIFE OF THE INHABITANTS OF
HIGH-MOUNTAIN ZONES AND CONSERVE THEIR RESOURCE BASE

1. Aim

To systematize the experience gained in the many programmes and projects, both completed and current, in high-mountain zones of the Andean subregion at both national and local levels, in order to make it available to the teaching systems and to the organs responsible for running them.

2. Purposes

The most important thing is that this effort should help others to share in all these programmes and contribute to their integration and massive extension, respecting the identity and purposes of each of them, with a view to increasing their efficiency. Where necessary, a bargaining committee consisting of the heads of these programmes could be formed, a joint information bulletin could be published and, in general terms, mutual support could be provided and duplication of efforts avoided.

3. Method

To make a comparative analysis of the plans and programmes designed to improve the quality of life of the inhabitants of high-mountain zones or watersheds in the Andean region and to conserve their natural resources, especially soil and water.

4. Steps

a) To convene a first meeting of the heads of some of the programmes representative of different action policies and sectors.

b) To establish the working framework, including the content of the document to be compared. To set deadlines for delivery.

c) To prepare a general document comparing and summarizing the documents submitted by each programme.

5. Procedure

Each head of programme or project in the participating countries will submit a document prepared in accordance with a common frame of reference designed

to facilitate the exchange and compatibility of topics. The work will begin in a single country, Peru or Colombia for example.

6. Comparison matrix

Each programme will supply information which will then be presented at a meeting and included in a summary document. The final outline of the content of these contributions could be determined at a prior meeting attended by the programme and project heads. The matrix could include, for example, the following points and any others added in the light of experience.

a) General background of the programme

Number of the programme or project, brief history or background, law or regulation which created or maintains it, including, where appropriate, declared objectives, main approach (physical --such as irrigation, conservation, reforestation, crops, etc.; or social, economic or research). Staffing, agreements reached, sources of financing, scope of action (national, regional, local) and other similar points.

b) Activities undertaken

- i) Promotion of participation, organization of participants, training, etc.
- ii) Carrying out of preliminary or final feasibility studies.
- iii) Formulation of plans, programmes or projects (indicate level of detail).
- iv) Implementation of actions in the field: construction works, sowing, training, etc.
- v) Assistance with the operation of systems constructed, communities established, etc.
- vi) Furnishing of loans, subsidies, food aid, inputs, tools, equipment, etc.

c) Methodology, criteria and operating areas

d) Documents published

On planning methods or methods of reaching the communities, townships, etc.; technical or procedural manuals.

e) Forms of co-ordination

f) Others

To be determined at an initial meeting.

7. Possible participants in Peru

National programmes: Special Project of the Development Programme for Economically and Socially Underdeveloped Microregions, National Watershed Land and Water Conservation Programme, National Plan for Improvement of Irrigation in the Sierra, INFOR programmes, ITACAB restoration and transfer of technology programme, Centre for Audiovisual Training Services (CESPAC), University research programmes, Land Improvement and Rural Housing Programme, local programmes such as the Programme on the Rational Use of Hillsides of the Ancash Departmental Development Corporation (CORDE), supplying aid to San Pedro de Casta, the Cajamarca Integrated Rural Development Programme for Forestry, Agriculture and Livestock, etc.

Note: The heads of programmes and projects in other Andean, Central American and Caribbean countries may also be invited to participate.

MOUNTAIN WATERSHED MANAGEMENT IN THE DEVELOPMENT AND CONSERVATION OF NATURAL RESOURCES */

I. MANAGEMENT OF THE CRISIS, RECOVERY AND DEVELOPMENT IN MOUNTAIN ZONES

The selection of management strategies for the development of inhabited mountain zones --either watersheds, microregions or other areas-- is influenced by the history and present state of these areas, by the standard of living of their inhabitants and by the state of conservation and potential of their natural resource base.

In the relatively depressed mountain zones of Latin America there are at least two possible situations:

- Zones undergoing active deterioration which is visible in a constant loss of arable land, decreasing output, increased areas of eroded land, decline of vegetation and wildlife, abandonment of production infrastructures, and forced migration, all of which translates into clear deterioration in the inhabitants' living standards.

- Zones with relative backwardness or stagnation in their growth owing to lack of attention and investment but without signs of major decline in the traditional ways of life of their inhabitants or of progressive deterioration in the conservation of their renewable natural resources. These are zones which have been neglected in government plans and are lagging behind other regions which have received greater attention.

The first goal for the zones which are clearly deteriorating is to check this process, i.e., to overcome a crisis situation. Those responsible for management must organize themselves to be able to cope constantly with random situations requiring urgent solution and they must tackle the effects of the deterioration (forced migration, violence, political pressures, natural disasters); in most cases this takes up time and resources which could be used for controlling the causes. Emergency and short-term considerations prevent the tackling of medium-term priorities. At the same time, strategies to check the decline must be planned and executed with a view to restoring the former levels of standard of living and natural resources; this means tackling the causes of the decline. In terms of programmes and projects it means obtaining and allocating resources, for example, for reforestation of degraded areas, rehabilitation of terraces in hill areas, restoration of the artificial-pond (cocha) system of farming in the high plateaus (punas) and ridge farming (waru waru) in flood zones, repopulation with local wildlife,

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and reconstruction of destroyed irrigation and drainage systems. In social and economic terms, the local inhabitants must be helped to restore their management capacity, their former eating habits, their systems of organization, and their self-sufficiency in general; at the same time they must be granted fair prices, and marketing channels for their products must be opened up.

Lastly, in order to bring the development of the inhabitants of marginal zones into line with the development of people enjoying better services and incomes, it is necessary to encourage investment in hydroelectric works, mining operations, processing industries, and improvements in public services, to provide systems of credit, marketing, regulation of landholding, and education, and in general to carry out actions involving large and small investments which will benefit all the inhabitants and users and not only the more deprived or only the relatively more developed.

This is the triple challenge common to the majority of the high-mountain zones whose development has traditionally been neglected in Latin America and the Caribbean.

The management structure established by governments varies according to the state of crisis and the stage of recovery and development.

In the case of crisis, the government creates special institutions when these areas are declared to be emergency zones (and not before). The emergency may be due to a natural phenomenon such as an earthquake, a drought or a major flood, to forced migration from these places, or to political or social movements, especially violent ones. It is symptomatic that at least four of the five countries studied have created organizations with considerable resources and autonomy under such titles as "economic and social organization for emergency zones" in response to actual or potential violence or as the result of earthquakes, floods or droughts. Previously these zones lacked any organized support.

In the second case, i.e., management for recovery, State action is concerned more with the implementation of national programmes and projects (for example, soil conservation, reforestation, rehabilitation of hill farming with forestry, agriculture and livestock systems, etc.) or with regional programmes and projects with the same purposes. As a rule, the likelihood of obtaining financial resources for these actions depends on the skill of a few technicians in formulating and maintaining programmes and projects based on prior studies which justify investment in the eyes of financing organs, especially bilateral assistance agencies. These programmes usually begin with a pilot research component. Peru has its well known Plan for Improvement of Irrigation in the Sierra (Plan MERIS), the Plan for Rehabilitation of Coastal Land (Plan REHATIC), and the National Watershed, Land and Water Conservation Programme.

In the third case, the management structure for development can take two forms: one for big concentrated investments and the other for small dispersed investments. The first structure consists of independent or special organizations or corporations for a watershed, region or political/administrative area created to promote the implementation of big

projects or works. These organizations allocate 10 to 20% of their investments to aid for depressed zones within their areas of responsibility in such matters as erosion control and assistance to peasants. These investments benefit the poorest groups but also serve the purposes of the big project, for example by reducing the sedimentation of a reservoir. The second form is to create organs, corporations or projects designed specifically to assist zones with fewer resources with a more or less integrated approach. This group includes projects on integrated development of watersheds and microregions, integrated rural development, settlement, and others with similar titles.

The practical ideal would be for governments to promote all three types of action, balancing the allocation of investment resources to cope with the different situations in each area. However, past experience indicates a bias in the attention given to each case: big projects (generation of hydroelectricity for example) are favoured over small investments which directly benefit the inhabitants of high-mountain watersheds and microregions. The selection of the areas to receive the small investments is also unevenly distributed. More attention and more resources are given to zones favoured by the presence of big investments or where social emergencies or natural disasters have occurred. Unless something of this kind happens, the high-mountain zones usually remain almost entirely neglected owing to lack of resources for implementation of continuing policies of broad scope which treat all small watersheds or microregions on a fair basis.

Given this situation, the most important thing is to help those responsible for administering development policies, programmes and projects in high-mountain zones to cope on a more balanced basis with the three situations at the national, regional and local level. With a view to providing management options, an attempt has been made to answer the following questions:

What criteria, concepts and processes are relevant as guides for the management for the development of high-mountain zones?

What is the actual state of the high-mountain zones compared with their output potential?

What management strategies will be most successful in the equitable development of high-mountain zones?

What working methods are most suitable for facilitating the application of the strategies in watersheds and microregions?

II. CRITERIA AND CONCEPTS APPLICABLE TO THE MANAGEMENT OF HIGH-MOUNTAIN ZONES

The following series of criteria, concepts and management processes for high-mountain zones has been derived from documents prepared by ECLAC.

1. Criteria

Persons responsible for development management activities should begin by defining their action criteria. Various documents (annex 1) advocate, for example, the following criteria:

- The high-mountain zones cannot be treated as homogeneous or continuous areas. Each area, be it a watershed or microregion, must be treated separately. Furthermore, its peculiarities should not be regarded a priori as an obstacle before potential has been evaluated.

- The management of these zones must therefore operate at the level of basic development units which are sufficiently small to allow identification of their peculiarities and the participation of their inhabitants and users. These basic units must be associated with larger areas by means of pre-established rules.

- Mountain watersheds are excellent basic management units because in them it is easier to deal with production matters in conjunction with environmental matters in the effort to improve the standard of living of their inhabitants and users. However, political/administrative areas must also be taken into account in their management.

- The management for the development of high-mountain zones is not a process associated exclusively with agriculture or with environmental conservation. There must be diversification of actions beginning with the family --which normally engages in agriculture, livestock-raising, handicrafts, trade, gathering, services and hired labour-- and continuing at the community, district, provincial and regional levels.

- Management of mountain river basins entails maintaining the interconnection between ecological levels (associated with altitude above sea level), the organization of the inhabitants, the use of appropriate technology and implementation timetables. However, at the present time it is not a question of defending everything traditional and local. Activities of practical value must of course be retained, but fallow periods can be reduced by use of fertilizers, firewood can be saved by use of more efficient ovens, the construction of terraces can be facilitated by using aerial cables and the transport of materials by using trucks or carts.

- Appropriate technology for the high-mountain zones must be developed by combining the technical matrix of the peasant with the technical matrix of the professional. The peasant matrix consists of an interrelated set of activities and techniques and not of isolated techniques. The techniques which make up this matrix cannot be altered individually without first establishing the impact of the alteration on the set of activities and the other techniques.

2. Concepts

Pierre de Zutter has included in the Forestry, Agriculture and Livestock Manual (Manual Silvoagropecuario) (UNC/EEC, 1987) a series of conceptual observations which can be summarized as follows:

Development: The new interpretations of the word "development" are doing something more than merely adding prefixes or qualifications to the term. They are reinterpreting it. The word "development" is now derived not from the active verb "to develop" but from its reflexive form meaning "to increase in value, broaden and realize all internal possibilities while retaining the essential overall harmony". It is no longer a question of "being bigger" comparatively speaking, as measured on a universal scale, but of "being better" subject to the possibilities and limitations of each situation and each society.

Participation: Man is the main factor in the balance or imbalance of an ecosystem in terms of its use, conservation or destruction. The control and management of an ecosystem must necessarily rest with the human actors involved in it.

Sponsors: The sponsors of the development of a watershed or microregion must define the limits and scope of their role. They must not see the local inhabitants in a father-child relationship. Without falling into passivity (expecting only local initiatives) or subservience (accepting any local decision), rather than replace them the external body should support the people in seeking to develop their capacity to decide, design, administer and implement their own development, ensuring balance between collective and individual interests.

Planning: Planning is a tool of management and not an end in itself. Traditional planning is based on big quantitative production targets or implementation of certain projects or actions. The development of high-mountain zones must be based more on a quest for balance than on the attainment of preset targets. Planning must therefore be a continuous process in the service of management.

Projects: Administrative regulations oblige many sponsoring bodies to formulate investment projects. The main problem with the prevailing project model is that it is subject to expenditure goals to be achieved within a specific period. The failures of sponsoring bodies often stem from their eagerness to adapt nature and man to the regulations and frameworks of their projects instead of the reverse.

Culture: There are no absolute criteria for definition of low or high levels of culture. Culture is the degree of knowledge and control of one's own situation and ecosystem. Therefore, a development process with external sponsorship must seek to use knowledge on a mutual basis and avoid unilateral negation or contempt.

Extension: Extension has traditionally consisted of disseminating among the peasants the findings of research centres, i.e., remedies prepared in laboratories. What is needed is dialogue and exchange rather than the handing

down of recipes, combining the technical matrix of the peasant with the technical matrix of the professional and accepting the best of both in concordance with the local system of management.

Methodology: Methodologies should not become mere tools in the service of policies alien to the environment in which they are carried out. Therefore instead of imposition of methodologies, there should be discussion with the local people to determine the action criteria to be used in their adoption, for the methodologies must be selected in accordance with the criteria and not the reverse.

3. Management processes in high-mountain zones

Management for the development of high-mountain zones operates in practice both from the inside to the outside and from the outside to the inside. The first style corresponds to the traditional management effected by the local people with or without external assistance. The second is typical of intervention in river basins or microregions by external agents, whether or not for the benefit of the local people. These two types of intervention must be reconciled with each other. Big investments (in hydroelectric works, for example) can increase the value of smaller investments and vice versa.

The State operates in high-mountain zones with two management systems: one formal, characterized by centralized, rigid, sectoral and continuous management and usually represented by government ministries and their departments; and the other ad hoc characterized by a decentralized, flexible, sectoral or multisectoral and non-continuous structure, and usually represented by national or regional programmes or projects. The two systems are complementary and need each other if they are to survive at the national level. What is needed is co-ordination of their activities in specific watersheds or microregions.

The proliferation of formal and ad hoc systems also generates a large number of levels and areas of action. The institutional systems tend to operate through the political/administrative demarcation of the country (departments or states, provinces, districts or townships and villages). The ad hoc systems create their own levels and areas (regions, microregions, river basins, irrigation districts, forestry districts, national parks, emergency zones, depressed zones, and many others). It is essential for the criteria for determination of areas to be unified at the national level, with subdivision into regions and microregions common to all sectors.

Continuity of action over time is essential in high-mountain zone development and resource conservation. This cannot be achieved solely by means of programmes and projects. It is therefore extremely important to create institutions which will have continuity of action under either a formal or an ad hoc management system. This continuity is usually directly connected with the source of financing. This is why institutions with their own income survive much longer than those which depend on budgets subject to annual debate.

Co-ordination of the action of the State apparatus in high-mountain zones, under both formal and ad hoc systems, works much better when it is focused on specific areas (such as river basin or microregions) which are small enough for agreement to be reached on clearly defined topics. These agreements must be consistent with the regional and national policies. The co-ordination system is a process which must generate basic support from the top downwards by means of policies and laws which provide the framework and basis for subdivision into microregions and the creation of river basin or microregion bargaining committees. This support must take the form of concrete proposals which originate in the microregions or river basins and are communicated to the higher levels.

Environmental programmes and projects --preservation, rehabilitation, protection or conservation of resources-- must be formulated as part of programmes and projects designed to increase the output and the overall standard of living of the inhabitants and users, especially in economically and socially depressed zones.

With respect to the desire for integrated development, it is more advisable to accept that what is needed is to begin actions in specific areas which will work towards integration, without trying to achieve it from the outset. It is sufficient in the early days to try to co-ordinate two or three key sectors.

III. THE DEVELOPMENT POTENTIAL OF HIGH-MOUNTAIN ZONES

The first step in promoting the management for the development of high-mountain zones and the conservation of their resources is to establish their present state and potential (as seen by their own inhabitants and by the professionals).

For most of these zones there is insufficient information to provide guidelines for management, and so studies must be carried out to provide information about each area in the light of clearly established needs (target studies).

In the project administered by ECLAC with the support of the Italian government, case studies were commissioned for five Andean countries (Bolivia, 1987; Colombia, 1986 and 1987; Ecuador, 1986; Peru, 1986; and Venezuela, 1986); a reference framework was prepared for the consultants. The following information was requested:

- General information about the high-mountain zones with specific reference to at least three river basins or microregions considered representative of the high-mountain zones of the five Andean countries under study: Bolivia, Colombia, Ecuador, Peru and Venezuela.

- Determination of the current minimum and maximum forestry, agriculture and livestock output in each of the selected river basins or microregions under the prevailing conditions of natural resource use and conservation in the river basin and with various degrees of technical

development and differing soil and climatic conditions. Determination of the feasible potential for improvement of the zones under several alternative situations of technological change and resource rehabilitation and conservation.

- Comparison of State investments in high-mountain zones in each of these river basins or microregions, distinguishing: investments in marginal rural sectors; investments in urban sectors; and investments in big projects such as hydroelectric works, roads and mines.

- An inventory, if possible with brief descriptions, of the main programmes and projects already completed or in progress in each of the chosen river basins or microregions, with, where possible, a classification according to purposes. Identification of any subsequent follow-up programmes to concluded programmes and projects. Evaluation of coverage in terms of land area and number of inhabitants benefited. Differentiation of fixed-term investment projects from permanent service or operating programmes.

- Comparison and, where possible, evaluation of the effects of the programmes and projects (if subsequent studies are available) in increasing forestry, agriculture and livestock output, rehabilitating and conserving the renewable natural resources, and generally improving the inhabitants' living standards. Determination of the proportion of this improvement in relation to the area and potential beneficiaries of similar programmes.

- Determination, where possible, of the physical and administrative interrelationships among the various (permanent or fixed-term) programmes and projects carried out in each of the selected areas. Determination of whether it is possible, in theory at least, to use and extend the activities of these programmes and projects within and outside the areas under study. Proposal of action strategies to move from theoretical proposals to practical action.

The results of the case studies in the five countries have confirmed or provided many of the arguments underpinning the comments and recommendations made in this summary. However, it is important to assemble and present a number of figures from the case studies which provide confirmation in respect of: i) the progressive deterioration of depressed high-mountain zones, mainly in Peru, Ecuador and Bolivia; ii) the recovery and development potential of these zones; iii) the actual importance assigned to these investments to help the marginalized zones.

The deterioration and the inequitable living standards in marginal high-mountain zones, which are similar in Bolivia, Ecuador and Peru, is described very well in studies on Peru ("La Molina" National Agrarian University and "Bartolomé de las Casas" Centre for Rural Andean Studies, 1986). The Peruvian sierra produces between 25 and 30% of the country's farm output. The area harvested has been declining since 1970 when it stood at a maximum level of 1 308 961 hectares. The depressed zones of southern Peru have recorded the largest declines in area harvested, apparently as a result of droughts and abandonment of land (from 100% in 1965 to 66% in 1984). In Ancash the area cultivated fell from 123 000 to 87 000 hectares between 1975 and 1979, owing largely to erosion. Per capita output has declined proportionally in the Sierra (from 373.2 to 228.7 kilograms). There are

statistics which indicate a decline in the production of irrigated alfalfa from 1976 (attributed to droughts and the invasion of kikuyu grass), irrigated maize and barley, and especially wheat (159 000 hectares in 1967 and 99 000 hectares in 1979). Potatoes have also been in clear decline since 1971. Similar figures are available for Ecuador.

The population of the high-mountain zones of the five Andean countries was estimated at 40 million, representing 52% of the total population. In Peru, the sierra lost its position of most populated area of the country only 25 years ago. However, 80% of the poorest families still live there, with an average man/cultivated area coefficient of 0.50 hectares for 500 000 families, 1.1 hectares for 850 000 families, 2.5 hectares of cultivated land and 10 hectares of grazing for 250 000 families, and up to 5.18 hectares of cultivated land and 49 hectares of grazing for the richest 100 000 families.

The recovery and development potential of these zones has still not been clearly determined. As some authors indicate, the Andean potential has usually been measured with alien classifiers which classify resources as unsuitable when in practice they are productive. It is not easy to evaluate the potential of the high-mountain zones unless the evaluation criteria used are relevant to each river basin or area. Some examples will illustrate this argument. With regard to farming land, it has been estimated that there are almost a million hectares of terraces in various states of repair, of which only 25% are in use today. This means that there are 750 000 hectares which could be rehabilitated. In the high-plateau zone (Puno Department) where only 321 300 hectares are being cultivated at present, it is estimated that there are no less than 82 000 hectares of ridges or waru waru unused but capable of producing 10 000 kg/ha of potatoes, as against the present average output in Puno of about 3 000 kg/ha. Puno also has the potential offered by the artificial-pond (cocha) system of farming: there are about 20 000 such ponds distributed over 256 km² at an altitude of about 3 900 metres (Flores and Paz, 1986). The average diameter of these cochas is 60 metres --equivalent to 2 826 m² suitable for cultivation in each of them. Their rehabilitation would provide about 6 000 hectares of additional land. Almost 30% of the land suitable for cultivation in the Peruvian Sierra --about 600 000 hectares, which could be boosted to two million hectares with the rehabilitation of terraces, cochas and other systems-- can be irrigated. Only about 250 000 hectares are irrigated today. With respect to management of the vegetation cover and collection of surface runoff at Aylambo, Cajamarca, it was found that the vegetation cover increased by 10 to 40% in three years in the areas equipped with infiltration channels. The yield from recharged springs in these zones increased in three years in three different ravines as follows: from 0.2 l/s (1974) to 0.4 l/s (1977); from 0.3 l/s (1983) to 0.45 l/s (1985); and from 0.1 l/s (1982) to 0.21 l/s (1984). In another place the yield of three springs increased by a factor of eight in four years (from 0.4 to 3.2 l/s) as a result of equipping 40 hectares with infiltration channels. This system makes it possible to irrigate formerly abandoned terraces. Where output is concerned, merely by restoring terraces and irrigation systems it is possible to increase the yield by 50 to 200% under actual conditions (Peru's National Watershed Land and Water Conservation Programme) (Chang, 1986). The increases range from 200 to 400% on experimental stations. At Carchi and Patate in Ecuador for example, the following increases were obtained on the farm: potatoes 29%; wheat 150%; maize 233%; beans 65% ; and

increases of 55%, 400%, 678% and 108% respectively were obtained on the experimental stations. In the high zones of Venezuela increases of 54% and 96% were obtained in potatoes and coffee. All that was needed for increased output in all these cases was simply improved use of water, fertilizers and seeds. The most difficult thing is to establish a means of winning the peasant's confidence in order to work with him. Where livestock and wildlife are concerned, it is estimated that three million vicuña could be raised on 18 million hectares of the high plateau of the Andean mountains. It is estimated that there are only about 50 000 head at present. A reasonable target would be an increase to about 500 000 head.

The investment costs needed for attainment of these rehabilitation and output targets are dramatically lower than in the projects for extension of the agricultural frontier. According to Luis Masson (1986), it costs between US\$750 and US\$1 000 to restore one hectare of terraces in Peru (with direct creation of jobs and immediate improvement of local incomes), as against US\$15 000 to US\$20 000 to irrigate one hectare of desert at the coast, not to mention the additional money and time needed to bring this land into production (3 to 10 times longer and more costly than in the sierra). However, State policies have given little encouragement to these initiatives. They have generally supported only a few national programmes and pilot projects enjoying soft loans and bilateral grants.

The available data on investments in the five countries under study indicate that for every US\$100 invested in big projects at the coast or in the sierra only US\$1 to US\$17 has been invested in projects for the rehabilitation and development of forestry, agriculture and livestock, marketing, erosion control, small-scale infrastructure, loans, and general social and economic support for high-mountain peasants. The best coverage and distribution in the comparison between investments in big projects and investments in watershed management and rural assistance are found in Colombia. In this country the big autonomous river basin corporations such as the Autonomous Regional Corporation of the Cauca Valley (CVC) and the Rionegro-Nare Autonomous Regional Corporation (CORNARE) allocate between 4 and 10% of their investments to social infrastructure and conservation projects. Although these figures may not seem very high in relative terms, in absolute terms they are very significant when compared with the figures for places where such corporations do not exist or where no big hydroelectric installations have been constructed. There are also Colombia's integrated rural development programmes, which are extremely important in depressed zones. In the Paute River basin in Ecuador US\$494 million (83%) has been programmed for investment in large installations and US\$104 million (17%) in conservation, social services and watershed management; this is also a good coefficient. In Venezuela the ratio of big infrastructure investments to peasant support investments, land conservation and watershed management is similar to those of Colombia and Ecuador. In the Uribante-Caparo complex for example, 17 112 million bolívares (95%) has been programmed for investment in big installations and 868 million (5%) in development and conservation assistance in the high zones (tourism, upland livestock-raising, coffee and conservation management in the watersheds). In Peru, however, under the Majes project for irrigation of only 60 000 hectares in the desert with water channelled down from the high zones at a cost so far of over US\$600 million, less than 0.2% has been invested for the benefit of the high-mountain area

(these are only estimates). It is estimated that the Majes project may cost up to US\$1 500 million with the programmed hydroelectric works. To compare this with other options, with this amount of money the country's 750 000 hectares of currently abandoned terraces could be rehabilitated and brought into use.

The reasons for this investment bias are: i) the refusal by national and international bodies to disperse their investments owing to the difficulty of controlling and recovering them; ii) the shortage of external loans for this kind of project for the same reasons; iii) the lack of support for this kind of project owing to the absence of pilot studies including direct and indirect costs and benefits; iv) the lack of studies on individual watersheds which identify investment options; v) the lack of data at the national level for launching large-scale projects; and vi) the lack of knowledge about the Andean situation and the people's capacity for participation --a factor which sharply reduces the projected cost. There are also deeper-rooted problems such as the undervaluation of the Andean people and their products, the subsidy of the urban areas by the countryside, the need to obtain foreign exchange (at the cost of postponing investment in conservation of production systems), and the emphasis on support for export crops. These are the so-called "deep-rooted evils" which again bring to mind the difference between development and self-development, between to do and to have, and to be.

Another piece of research carried out by ECLAC in connection with the descriptive analysis of situations in high zones was to compare 15 watershed and microregion studies mainly on the Andean subregion to determine in what way they provide information useful for management purposes. This comparison produced the following conclusions:

a) There is a widespread confusion of terms in defining and qualifying the level of detail in the studies. In high-mountain zones, for example, the terms inventory, evaluation, analysis, plan and programme are used indiscriminately. The terms watershed management, watershed regulation, watershed protection, watershed development and watershed plans rarely reflect the content of the documents. For example, many documents entitled "watershed management" are merely projects to control torrents or channel rivers. The need therefore is to define and adopt uniform terminology in Latin America and the Caribbean.

b) Most of the topics covered by river basins, microregion or high-mountain zone studies and the indicators or parameters used provide little guidance for the development management of river basins. It is suggested that the selection of topics and indicators to be studied could be improved by basing it on a definition of the problems stated and solutions requested by the inhabitants and users of the high-mountain zones themselves (provided that they are genuinely representative of all the inhabitants) and then --the reverse of the usual process-- to use this as a basis for determining what methods, topics, indicators and parameters best define the problems (causes and effects) and their solutions.

c) Most of the studies on high-mountain zones are for use only by the professionals who prepare them and they are therefore incomprehensible to the

local users and inhabitants (sometimes this makes them equally valueless for the professionals who are required to use these studies in the field). For example, classification of soils, plants and sowing cycles may bear no relation to the local classifications and names and may thus be difficult to use. The most obvious difference is between the studies made by anthropologists and sociologists, who inquire about and collect local names and customs, and the studies made by engineers who use universal names, typologies and classifications. Paradoxically, although the anthropologists and sociologists produce excellent descriptions of the situations, they do not design any concrete projects. In contrast, the engineers, who do not describe the situation well, do in the end design and implement projects. Thus the need is to learn to work as a team.

d) There was found to be a lack of methods for planning (defined as a tool for management) of practical activities and tasks for high-zone development. The so-called plans are usually mere lists of headings referring to what has to be done, assembled without any explanation of their interrelationships within and outside the watershed or microregion. The so-called integrated plans suffer from the same defect, not only in their results but also in their formulation. The suggestion, therefore, is to establish a practical method for teaching professionals how to ensure the coherent integration of the various projects, activities, practices and tasks which are defined as priorities in a watershed instead of simply listing them.

e) It is common for river basin studies to be poorly drafted and edited owing to lack of training in technical drafting and drawing and in publishing techniques. For example, there are titles which do not relate to content, there are no declared goals either of the development plan or of the document, no scales are indicated on the maps, the objectives and results do not tally with the conclusions and recommendations, there is no indication of publication dates or prints runs, or even a publication number. This does not happen in some centres experienced in the study of natural resources or in planning work, but it does happen in the reports of the various government bodies which study watersheds or microregions. The recommendation, therefore, is that technical staff should be trained both in the analysis of concrete areas and in technical drafting.

f) It was also found that the technical staff responsible for analysis and description of river basin and microregions did not normally have access to working manuals and methods which use tested local experience. Rarely are the manuals and methodology produced by the personnel of public organs widely distributed, and apparently such works are not encouraged. Accordingly, many of the known and available methods are produced by the authors of projects and members of bilateral assistance missions which have special publication funds. As a result, it is a matter of urgency to assemble the manuals produced in each country, evaluate their relevance and distribute them.

g) Lastly, although this depends more on the presence of authorities in the watersheds or microregions and on a national collection centre (such as the institutes for evaluation or planning of natural resources), it is important to have a register of programmes and projects in operation broken

down by watershed. Each public sector should at least keep such a register of its own watershed programmes.

The analysis and description of high-mountain zones is essential for guiding management. If such works are to be useful they must follow certain patterns which have yet to be assembled from the large volume of experience available. It is recommended that this experience should be exchanged.

IV. MANAGEMENT STRATEGIES FOR THE DEVELOPMENT OF HIGH-MOUNTAIN ZONES

Many of the principles, criteria and recommendations described in this paper have been taken from official documents, meetings and programmes. The obvious question asked by anyone who reads these documents is: How many of these criteria and recommendations are being used in order to halt the degradation of living standards and natural resources in high-mountain zones? Which strategies are most effective in practice and to what extent are they being used in high-mountain zones?

It is commonplace to read assertions in numbers of official programmes that they recognize, for example: the importance of regionalization, microregionalization or work at the river basin level; the importance of involvement of the inhabitants and users in decisions on development of the area in which they live or work; the need for the State to support each area and take co-ordinated action in it; the need to restore appropriate techniques and respect cultural identity; the vital importance of encouraging conservation of natural resources; the need to restore native crops and foodstuffs; and the need to ensure that actions are integrated and uninterrupted. What then are the management methods which will make it possible to apply the criteria on the necessary scale and with the necessary continuity? Various answers to this question are given by public and private institutions. There are many current programmes which operate in accordance with all or some of these principles. However, in some cases the solutions are accepted only for a time and subsequently drop from sight, and in other cases the coverage extends to only a few watersheds and microregions blessed with pilot programmes.

These facts prompt a number of comments about the strategies which governments have used in their activities in high-mountain zones. These strategies are based on the two management systems described above --one formal and the other ad hoc. However, it is very necessary also to spell out the existing methods of applying these two management systems in specific areas. These methods come in three versions related to the form of intervention (inside-outside and outside-inside) in the areas to receive development aid.

The first method has been to try to administer the State's activities from outside each area. This is an interventionist approach to State action. Efforts are made to overcome the criticism of the State for intervening and acting without co-ordination in each area both with its formal system (through its agencies) and with its ad hoc system (through the local offices

of its national programmes and projects). What usually happens in practice is that multisectoral co-ordination committees are established and integrated co-ordination and development plans for regions, watersheds or microregions are formulated in an office in the country's capital.

The second method has been to try to administer the State's activities from within each area. This is also an interventionist approach to State action. It is a response to the recommendations for creation of State authorities for each region, watershed or microregion to co-ordinate the activities of the central government (both formal and ad hoc) in each place. This has resulted in regional or river basin headquarters or microregional authorities. These authorities usually keep a register of what the various government sectors are doing within the area of their jurisdiction and they try to prevent duplication of efforts.

Both these methods are designed to administer the activities of the many different State institutions, programmes and projects. In these cases, dealing with the local people may mean:

i) Decisions taken by the local inhabitants and users as to the type of assistance programme or investment project which is most suitable for them. Such decisions may involve the imposition of a State programme in the area: for example, running a road through it, building a hydroelectric power station and erosion-control works, or promoting an activity which "sells" some programme on, for example, irrigation, reforestation, housing, improvement of some crops, construction of roads or improvement of housing. In the second case, the local inhabitants or users can only decide to accept or reject what is being offered, for they cannot change what is in fact an unalterable proposal.

ii) Selection in conjunction with the inhabitants and users, avoiding influence by unrepresentative groups or persons, of the type of assistance programme or investment project most suited to the collective needs of the development area. This choice implies participation by duly represented inhabitants and the creation, and investment with power of decision, of local regional, river basin or microregional authorities. The best known examples of this type of authority in Latin America are the autonomous river basin corporations in Colombia, the regional development corporations in Peru, and a few special projects and programmes.

The third method is to try to help the inhabitants and users themselves to be self-reliant in the management for the development of their area. State resources are channelled through formal and ad hoc administration systems to furnish support and funds for creation of the necessary conditions for the inhabitants and users themselves to be able to take decisions and participate in improving their situation. Models of this type of method are provided by a number of microregional development programmes, programmes of technical assistance for various kinds of community, co-operation with the local people, integrated rural development programmes, and programmes of forestry, agriculture and livestock development, etc., which establish bargaining committees or assemblies of local inhabitants.

These three methods of action usually operate side by side in the Andean countries although they are often in conflict. The worst conflicts stem from: institutional rivalry between the formal and ad hoc systems, for the latter have more resources and better-paid staff and they are invested with local powers with which they challenge ministries and national institutes; the shortage of trained human resources to work at the regional, river basin and microregional levels; the lack of sources of financing (the regions, river basins or microregions which are developed by means of big projects --hydroelectricity for example-- or which have oil or mineral resources are in a better position than the poorer ones); the difficulty of creating bargaining committees and electing river basin and microregional authorities owing to problems among the inhabitants; the difficulty of appointing and respecting a single public authority owing to institutional rivalries; the failure to set a fair order of priorities for the most needy regions, microregions or river basins owing to political pressure for changes in the order; and the need to solve a huge number of immediate problems requiring urgent attention (fire-fighting) which obstruct the work of medium-term management.

These are some of the challenges which face governments even when they have the political will and legal framework to promote the development of high-mountain zones in addition to solving the immediate problems that come up, for the tasks which they must tackle are so numerous. One alternative is for the formal State system to be restructured to bring its organization and activities into line with the needs of the high-mountain zones. In practice, it is utopian to try to achieve this by means of an initiative internal to the system. The first step, therefore, would be to design and test over a sufficiently long period an ad hoc system of State action which would eventually, once tested and equipped, become a formal system in the sense that it would have its own source of financing (specific tax).

The prior requirements for the creation of an ad hoc system to promote the development of high-mountain zones has been satisfied in Peru, for example, with the Special Project of the Development Programme for Economically and Socially Underdeveloped Microregions. These requirements are: i) political will embodied in legislation; ii) subdivision into microregions and assignment of priorities to them; iii) establishment of authorities in each microregion; iv) establishment of regulations governing interaction in the microregions; v) establishment of regulations governing relationships between regional and national bodies; vi) allocation of financial resources (which must be backed by a specific and permanent source of financing); vii) setting-up of a follow-up system.

Other countries, such as Colombia, have created autonomous or semi-autonomous river basin corporations and effective integrated rural development programmes.

These systems which are already in existence represent major progress which must be consolidated and upgraded in order to ensure constant improvement in the attainment of their objectives. The kind of support that they can be given includes:

1. Assistance with the design of methods based on their own experience which will enable them to extend their management systems to a larger number of river basins and microregions. New river basin and microregion authorities usually need firm technical support, especially at the outset. They must study, strengthen and organize the existing participation systems in the zone; make analyses of the area in which they are going to operate; familiarize themselves with the activities carried out locally by the government; learn to work with the local people and identify power conflicts; identify in conjunction with the inhabitants and users the local collective and individual needs; formulate and propose specific projects and manage financial resources; resolve conflicts between organizations and the local inhabitants; find solutions for immediate problems and supervise the activities of other bodies in the area as well as their own work.

2. Training for the personnel who will work in the microregions as part of a technical team. This personnel should be of the middle-management or professional level. The training must cover a sufficient number of persons to meet the demand for technical assistance in every river basin or microregion. The trained personnel must be capable of learning from the local inhabitants and users as well as imparting their own knowledge. It is important to base the organization of training courses on previous study of the Andean situation and adequate preparation of the teaching materials, so that these courses cover a broad front; otherwise, the possibility of large-scale extension of the activities will be lost.

3. Collaboration with the national authorities to create the necessary political, financial and monitoring conditions to support the initiatives undertaken in each river basin or microregion. The national bodies responsible for planning and monitoring and the lending organizations are usually reluctant to disperse their activities, and especially their financial resources, among many distant areas owing to the difficulty of monitoring expenditure and progress. It is therefore essential for the monitoring and control system to function efficiently, especially when investment projects are involved. The reluctance in Latin America to carry out many different projects simultaneously obliges the setting of priorities. This reluctance is the result of unfortunate past experience, but the problem could be overcome by a monitoring system. The necessary funds could also be supplied in some river basins by means of taxes or levies on some important local products or activities (such as oil, minerals, hydroelectricity and frontier trade).

These tasks, as well as others which will emerge, will have to be tackled in conjunction with the strengthening of the formal and ad hoc administration systems which each country has or wishes to establish (microregional programmes, autonomous corporations, regional corporations, integrated rural development programmes, integrated river basin development programmes, etc.). This work will eventually result in the consolidation, extension and continuity of the activities to the point at which the system becomes institutionalized. The practical results will include the consolidation of political support for high-mountain zone management, injection of financial resources into the system, and the involvement of the inhabitants and users of the river basins and microregions. In addition, the personnel required by the system will be trained, and a school of thinking on

management policies for the development of high-mountain zones will be created and consolidated. It will then be possible to acquire material and knowledge to serve as the basis for improved management.

V. WORKING METHODS APPLICABLE IN HIGH-MOUNTAIN WATERSHEDS AND MICROREGIONS

The person directly responsible for the development and management of high-mountain river basins or microregions must know about and have access to working methods suited to the individual conditions of each place. These methods will provide him with options from among which he can choose the most suitable. The methods proposed cover assistance in the development of watersheds or microregions and a reference manual or operating system to be used in the selection and design of action options.

ECLAC has prepared a methodology for co-ordination of activities which indicates the necessary sequence in initiating the process of management and development of watersheds or microregions with local participation. There are six steps:

- Formation of the bargaining committee.
- Identification and negotiation of management criteria.
- Identification and negotiation of problems and constraints.
- Ranking and order of priority of problems and constraints.
- Selection and negotiation of alternative solutions.
- Order of priority and ranking of alternative solutions.

The alternative solutions selected in this first part of the management process lead to the start-up of the so-called integration cycle (this stage is being drafted). The integration cycle includes:

- Conversion of the alternative solutions into goals.
- Breakdown of each goal into its stages of formulation, design and execution.
- Harmonization of the goals.
- Planning of integrated and target-oriented actions.
- Monitoring and follow-up of projects in operation.

The requirements for implementation of each of the stages described in the bargaining cycle will be found in a document on this subject prepared by ECLAC (1987).

For the purposes of systematizing knowledge on management for the development of high-mountain zones it is important to prepare specifications, descriptions and sequences with a view to identifying, understanding and carrying out each of the many activities, practices, tasks and steps which form part of a management process.

Once a system of arrangement and cross-referencing has been devised, it ought to be possible to record the processed information on coded cards.

These cards are called: i) classifiers; ii) descriptors; and iii) processors, depending on their purpose and content.

The systematic arrangement of this knowledge is equivalent in practice to breaking down and then classifying and ordering the many components of development programmes and projects in high-mountain zones (resources, techniques, material, inputs, organizations, investments, etc.) with a view to storing them on coded cards. The cards may contain single or combined elements and, if the operational system is to function, it must be possible to retrieve these elements in order to formulate strategies adapted to the individual needs of each high-mountain area. It amounts to having available hundreds of models and alternative components --of a house, for example (doors, roofs, windows or materials)-- with instructions for their assembly depending on the place in which the house is to be built.

With this goal in mind a system has been proposed for collecting, arranging, storing and subsequently retrieving the acquired knowledge in sequential form, in order to provide guidance for the management and planning of relatively small high-mountain zones. This system must cover at least four aspects of these processes:

- a) Resources and integration bases (of the areas chosen).
- b) Organization and administration bases (of inhabitants, users and organizations).
- c) Investment projects (multisectoral, sectoral or subsectoral).
- d) Production systems (agricultural, livestock, forestry, industrial, commercial, etc.: individually or combined).

The first part of the proposed manual or operational system amounts to guidance for the integrated study of the resources, the understanding of decision-taking procedures, and the techniques for assembling the many components of an integrated management process.

The other parts of the proposed system contain the classification, description and procedure for locating, selecting and designing or applying each of the components. Each of these parts will have to be coded for rapid recovery.

If a computer is to be used, each process and component must be classified and coded, and algorithms must be established for the assembly of these processes and components at will. This will require not only an understanding of the processes and elements which make up each process but also establishment of the interrelationships among them.

The process of obtaining the elements amounts to a sequence of successive enlargements of detail (similar to the successive enlargements of a photograph). For example, the "investment projects" column is broken down as follows:

Programmes = set of projects
 Projects = set of activities
 Activities = set of practices

Practices = set of tasks
 Tasks = set of steps

Each of these components has a classifier, a descriptor and a processor with the sequences for its handling. It is thus possible to retrieve the process and components (aggregated or broken-down) in order to formulate integrated systems of development management. The management and organization columns and the production-systems columns must also be broken down into their component parts following a similar sequence.

The system's success will depend on the extent to which it can perform this break-down and, inversely, can furnish the necessary systems for meeting the needs of each area.

This means that the information on the classifier, descriptor and processor cards must be summarized as briefly as possible. They should not therefore contain information repeated on another card but should refer to that card by means of a code so that it can be retrieved from whatever column or module.

For example, if the purpose is to formulate a small irrigation project for a high-mountain zone, the first step will be to locate the card with the sequence of activities which must be carried out. This sequence will have to refer to four main components: i) infrastructure design components (investment projects); ii) components of cultivation plans (production systems); iii) organization and management components (inhabitants, users and organizations); iv) resource and integration bases components (management resources).

Using the sequence of activities as a guide, it should be possible to assemble the necessary information for formulation of the project. The retrieval method will use codes for each main activity included in the index which will indicate where to find the components of the activity. The establishment of the proposed system (called simply "manual for management for the development of high-mountain zones") will require the assistance of specialists and co-operation among institutions.

However, with the support of the PADT-Rural project of the Board of the Cartagena Agreement (financed by the European Economic Community) information has also been extracted directly from programmes and projects. An example of this was the preparation of a forestry, agriculture and livestock manual which contains detailed information on the results of 18 years' experience in the rehabilitation of hillsides in Cajamarca; this programme was run by the local university.

It is hoped that this is the kind of information which will be included in the proposed system.

Annex

ACTION STRATEGIES FOR THE DEVELOPMENT OF HIGH-MOUNTAIN ZONES IN
LATIN AMERICA AND THE CARIBBEANList of documents prepared or in preparation

A. DOCUMENTS ON CONCEPTUAL ASPECTS

1. ECLAC, Manejo de cuencas y desarrollo de zonas altas en América Latina (E/CEPAL/L.253), 15 October 1981. Document submitted to the Regional Interagency Co-operation and Co-ordination Meeting on Environmental Regulation in River Basins organized by UNEP's Regional Office for Latin America (ROLA), Mérida, Venezuela, 18 to 22 January 1982.
2. ECLAC/JUNAC, Informe del Seminario Internacional sobre Sistemas Integrados para el Desarrollo y Gestión de Cuencas Hidrográficas en la Región Andina de América Latina (IC/G.1460(Sem.36/3)), 26 March 1987.
3. ECLAC, Políticas de gestión para el desarrollo de cuencas y microrregiones alto andinas (IC/R.605), 7 September 1987. Document submitted to the International Workshop on Institutional Aspects of the Integrated Management of Demonstration Watersheds organized by FAO's Regional Office for Latin America and the Caribbean and the Forestry Department of Costa Rica's Ministry of Agriculture, Heredia, Costa Rica, 30 November to 4 December 1987.
4. ECLAC, Division of Natural Resources and Energy, "Institutional factors in public sector decision-making in Andean watershed development", working paper (no symbol), March 1987.

B. DOCUMENTS ON DESCRIPTIVE ASPECTS

5. ECLAC, "Análisis comparativo de las actividades estatales para el desarrollo de zonas altas en Bolivia, Colombia, Ecuador, Perú y Venezuela". Working Paper.
6. ECLAC, Evaluación y diagnóstico de las estrategias, programas y proyectos utilizados o formulados para el desarrollo y manejo de cuencas de alta montaña y/o zonas de la región andina en el período 1980-1985 y proyecciones hacia 1990. Case studies on Bolivia, Colombia, Ecuador, Peru and Venezuela prepared respectively by: Vladimir Salinas (Bolivia), Jaime Saldarriaga (Colombia), Emilio Polit (Ecuador), Fundación para el Desarrollo Nacional (Peru), and Gonzalo Peña (Venezuela). Working Papers.
7. JUNAC-PADT-RURAL/EEC, Manejo y desarrollo de cuencas altas andinas en Colombia: La experiencia del desarrollo rural integrado, Bogotá,

January 1987. Prepared by: Alcides Gómez J., Soledad Ruiz M., and Darío Fajardo M.

8. ECLAC, "Guía para orientar procesos de gestión para el desarrollo en cuencas y microrregiones de alta montaña". Published by ILPES, November 1989, Serie Ensayos No. 89/05.

C. DOCUMENTS ON STRATEGY ASPECTS

9. ECLAC, Transacciones ambientales en el campo de los recursos hídricos (LC/L.364), 13 December 1985. Statement at the National Water Congress, Mendoza, May 1985.
10. "La Molina" National Agrarian University and "Bartolomé de las Casas" Centre for Rural Andean Studies, Estrategias para el desarrollo de la sierra, Cuzco, Peru, April 1986.
11. ECLAC, Estrategia para el desarrollo y manejo de la región andina: Una propuesta de acción a nivel de cuenca hidrográfica (LC/G.1433), 20 October 1986. Document submitted to the Seminar-Workshop on Integrated Watershed Management organized by the Tropical Agronomy Research and Training Centre (CATIE), Turrialba, Costa Rica, 20 to 23 August 1986.
12. ECLAC, Estrategias para el desarrollo y gestión de cuencas y zonas altas en América Latina: Un análisis crítico (LC/L.430), 11 September 1987. Statement at the International Seminar on Water and Soil Conservation, Lima, 13 to 17 April 1987.
13. ECLAC, Metodología para asistir la gestión del desarrollo de cuencas o microrregiones de alta montaña: Ciclo de concertación (LC/R.609), 6 October 1987.
14. ECLAC, "Metodología para asistir a la gestión del desarrollo de cuencas o microrregiones de alta montaña: Ciclo de integración". Working Paper. Not for publication.

D. DOCUMENTS ON OPERATIONAL ASPECTS

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Note: Documents 2, 3, 4, 5, 6 (five case studies), 8, 11, 12, 13, 15, 16 and 18 are part of the output of the project entitled "Water resource planning and management in high-mountain river basins in Latin America and the Caribbean" financed by ECLAC and the Italian government.

MANAGEMENT STRATEGIES FOR DEVELOPMENT OF HIGH-MOUNTAIN RIVER BASINS IN
THE ANDEAN REGION */

I. CHARACTERISTICS OF THE HIGH-MOUNTAIN ZONES OF THE ANDEAN REGION

South America is traversed longitudinally over most of its length by the Andes range, a geographical formation which has shaped through complex interaction the ecological, production and human factors which make life possible in this region. The Andean region covers parts of Venezuela, Colombia, Ecuador, Peru and Bolivia, with a total area of 1 227 240 km² (26% of the total territory of the five countries). In 1982 it had 38.9 million inhabitants, representing 64% of the total population of these countries (see table 1).

Despite their diversity of geography, climate and rainfall patterns, the high regions of the Andes have common problems and potentials. About 60% of the population lives in rural areas, and 50% of them engage in agriculture; 61.4% of the production units are between 0.1 and 5 hectares in size and are located at the highest levels on slopes of over 30%, and on the plateau areas (páramos and punas), at the very limits of the possibility of human life and production. Production units of smallholding size account for 2.9% of the total area and they are worked intensively by farmers and stockmen, which causes serious problems of soil erosion and the water management is inadequate. According to various estimates, between 75 and 93% of the land in the high Andes has already been eroded or is rapidly losing its surface soil.

The inhabitants of the marginal regions of the Andes in South America have been displaced from the inter-Andean valleys to areas of steep slopes and harsh climate and they have lost their vertical control of the ecological levels --control which they had maintained over several centuries; this has reduced their standard of living to the level of extreme poverty. Absolute rural poverty is the lot of 54% of the families; furthermore, 75% of them have no land from which to gain their livelihood. This situation has caused a shift to other, non-farming, activities and to urban centres, mostly among the most productive age-group of the population (aged 20 to 40). The loss of population for this reason amounted to 39 persons a day in Venezuela in 1971-1981 and to 56% in the Ecuadorian sierra between 1974 and 1982.

*/ Based on the case studies prepared by Salinas (1987), Saldarriaga and Balcázar (1986) National Development Foundation (Peru) (1986), Polit (1986), and Peña (1986).

Table 1

ANDEAN REGION: AREA AND POPULATION, 1982

Country	Area (km ²)	Percentage of total	Population (inhabitants)	Percentage of total
Venezuela	79 580	8.7	2 000 000	13
Peru	335 000	26.0	7 000 000	39
Ecuador	145 060	51.6	4 100 000	48
Colombia	360 000	31.5	22 800 000	80
Bolivia	307 600	28.0	3 000 000	52
<u>Total</u>	<u>1 227 240</u>	<u>26.0</u>	<u>38 900 000</u>	<u>64</u>

Source: Analysis of Programmes and Projects for the Development and Management of High Andean River Basins. Case studies, 1986. For Colombia, Atlas Regional Andino. Agustín Codazzi Geographical Institute (IGAC), 1982.

This migration from the high-mountain zones indicates an excess of economically active population which peasant families cannot absorb owing to the smallness of their plots, soil erosion and declining fertility, and the forced shift towards profitable commercial single-crop farming. It also suggests that sufficient numbers of paid jobs are not being generated by the big mining or energy companies established in the high-mountain zones. Farm unemployment or hidden unemployment fluctuates between 44 and 54% in the Andean countries, and this has a direct impact on yields, family incomes and reproduction of the production unit.

The high-mountain Andean regions of South America play a role in agricultural production for export, especially coffee. In Colombia, 85% of total coffee output is produced on high hillsides on production units up to 20 hectares in size; the areas of medium-high altitude in the other Andean countries contribute an average of 15% to their total coffee output.

The impact of smallholding and community farming in the high-mountain Andean zones on production of basic foods such as wheat, barley, maize, beans, potatoes and vegetables is much more significant. In Peru, they produced 51% of the wheat, in Ecuador 52.5% of the sweet corn, and in Venezuela 31% of the beans. They also make a significant contribution to both family subsistence and regional and national consumption of beef, milk, and wool (in Peru, 74% of sheep and 60% of cattle belong to units of less than 5 ha or to peasant communities). They also provide wood and firewood for human and industrial use.

The Andean region has always been used for the exploitation of very profitable resources, in addition to the land, such as mineral, energy and water resources. The peasant subsistence systems have been used as suppliers of cheap labour or foodstuffs to meet the local or regional demand of the mining and hydroelectric companies.

The modernization and development of these sectors has resulted in serious problems for subsistence farming and has increased the fragility of the ecological environment to such an extent as to displace a large part of the population of the Andean region. This intensive use and abuse of the land has multiplied the factors causing exhaustion of essential natural resources and the deterioration of living standards. This situation has also affected the business system because, since the mountain peasant does not have suitable assistance or control mechanisms, the imbalances have caused serious erosion as well as large migratory flows which reduce the opportunities for investment projects in the region and prevent realization of the potential of all its resources.

The clash between systems exploiting the resources of the high-mountain Andean river basins for different purposes has frustrated the possibility of mutual benefit which might have reconciled the conflicting interests. On the one hand, the neglect of the mountain peasants by the persons involved in the formulation and implementation of programmes and projects for the exploitation of the water, energy, or fish resources has resulted in an undervaluation of the actual and potential contribution of subsistence farming to the country's foodstuffs and agroindustrial market, preventing an improvement in peasant incomes which would have enhanced their standard of living and ensured better control of the natural resources which they exploit. On the other hand, the policy of favouring producers in the major inter-Andean valleys, on the highly profitable hill farms or on the temperate plateau areas, and the urban inhabitants of the big regional metropolitan centres and other regions has prevented reinvestment in the form of assistance and production projects in the high-mountain zones to benefit their marginalized inhabitants. These people should participate on an equal footing with the big users in decision-making and in the use and control of all the resources of the region on the basis of reconciliation of interests.

If the functioning of the Andean region and the development conditions of the high-mountain zone are to be understood, it is important to keep these conflicts of interest in mind, for they reflect a different development style consisting of strategies formulated with an eye to exploitation with no negotiation among the agents operating in the region. This arrangement is inappropriate for the Andean countries at the present time, when the requirements of harmonious growth, realization of the resource potential, and saving of foreign exchange indicate that the development management of the high-mountain zones should be based on economic efficiency with internal redistribution of profits in order to reduce the high social and political costs borne so far; this will demonstrate in the end that improvement of the standard of living of the marginalized inhabitants of the high-mountain zones will in turn enhance the living conditions of the whole population.

1. Venezuela

The Andean region covers a total area of 79 580 km² or 8.7% of the territory of Venezuela. Its population was estimated at two million in 1982, representing 12.6% of the country's total population; 75% of the population occupies 30% of the land in the mountain or high zone itself, and the other 25% occupies the remaining 70% of the land --the foothill areas and alluvial plains which have good soil and a very high agricultural and livestock potential.

Excessive demographic pressure in the high-mountain zones is one of the main problems of the Andean region of Venezuela and it has resulted in degradation of the renewable natural resources, especially land and water, and uses of the land inconsistent with its natural aptitude; this has caused depressed living conditions and low per capita incomes. This situation is illustrated by a number of social indicators such as illiteracy (25.3%), infant mortality (52 per thousand), and housing (a deficit of 173 000 units) affecting 35% of the total population of the Andean region.

This uneven distribution of the land and of population density has caused widespread migration from the high Andean region of Venezuela (39 persons a day between 1971 and 1981) to the more dynamic centres; this has deprived the countryside (with a rural population 48% of the national total in 1980) of a large number of workers in the most productive age-group in favour of the cities, where enormous marginal populations have accumulated.

Agriculture remains the principal activity in Venezuela's Andean region. This sector employs 50% of the economically active population and generates 16% of the national farm product; it plays an important part in the production of coffee, vegetables, potatoes, bananas, cotton, maize, sorghum, citrus fruits, beef and timber. In recent years there has been an important increase in other types of activities such as metal-working and construction.

Venezuela's Andean region has a high resource potential. More than 40% of the country's farming land is located in this region, with 2.5 million hectares in the high western plains and 500 000 hectares on the alluvial plains; there is a further 135 000 hectares of land in the mountainous zone suitable for intensive farming, especially the cultivation of coffee and temperate crops. The high zone has 300 000 hectares of land suitable for livestock which could be used for increased production of milk, meat and wool, and 400 000 hectares of forest with an annual production capacity of 200 000 m³ of timber (40% of the national output) which would meet more than 50% of the domestic demand.

Venezuela's main watercourses rise in the Andean region and flow towards the basins of the Orinoco and Lake Maracaibo. Potential electricity output totals 5 500 million kW/hour, sufficient to supply the whole of the western region of the country. The hydroelectric development of the Santo Domingo river, with an output of 250 000 kW, means that the region not only supplies its own energy needs but also exports energy.

There is considerable potential for extraction of non-metallic minerals such as, lime, phosphate and silica, and there are also large deposits of

coal which, with reserves of 2 500 million tons, could sustain a mining-industrial complex of national importance. The climate is a natural resource with great production potential: the Andean region contains examples of all of the country's climatic and habitable zones, and this facilitates agricultural diversification and development of tourism.

If Venezuela is to make full use of the natural resources of the Andes, it will have to solve such problems as soil erosion and improper land use resulting from the unequal distribution of the population between the high mountainous areas (with high population density) and the alluvial plains (with low density). In 1971, 43.5% of hill farms had less than five hectares of land each and occupied less than 1% of the total farmland. Moreover, public sector support in resource allocation is not sufficient. In the last five years only 6 to 9% of the central budget has been allocated to the Andean region, a proportion which bears no relation to the potential or to the problems of this region of Venezuela.

The following are the main river basins in Barinas, Mérida, Trujillo, and Táchira, the main states of Venezuela's Andean region:

a) The upper river basin of the Chama river (Mérida) has a usable area of 13 013 hectares, 35% of which is underused, owing mainly to the scant use of irrigation which prevents production of more than one harvest a year. The land is stony with steep slopes and therefore has only limited potential for intensive farming. Traditional techniques are employed in most of the basin because the low incomes of the small peasants (the majority group) make fertilization, pest control or renewal of plants out of the question. The main activities in this river basin are traditional coffee-growing, market gardening and dairy farming.

b) The upper river basin of the Motatán river covers a small area of Mérida and a large part of Trujillo. The sector in Mérida includes an arable area of 12 000 hectares, of which 66% is used for agriculture and the rest is available for extending the agricultural frontier. The main activities are cultivation of tubers (potatoes) and vegetables, and dairy farming. In the Trujillo sector 35 000 hectares are under coffee; as in the Chama river basin, the coffee is grown by the traditional method, with yields five times smaller than those obtained under normal conditions. This sector has considerable agricultural potential and, if appropriate measures are taken, its present output of basic foods could be doubled.

c) In the upper river basin of the Boconó river (Trujillo) agriculture is the main activity. The cultivated area totals 43 000 hectares, i.e., more than three times the usable area in the two river basins described above. The basin's farming potential is calculated at 75 000 hectares in addition to those already in production; this represents 47% of the total area of the Boconó river basin. However, the steepness of the slopes is an obstacle to farming; this feature has accelerated erosion while, together with the system of land distribution and the depressed living conditions of the peasant population, results in land use which bears little relation to its potential.

d) The upper river basin of the Uribante river (Táchira) has no physical limitations and has suffered no degradation of resources; it has a large

agricultural potential, with 48 000 hectares suitable for farming, of which 40% can be irrigated without any water-supply problems. The conditions in the river basin favour the cultivation of tubers, which is very widespread, in irrigated areas and on smaller farms.

2. Colombia

The Andean region of Colombia covers an area of 360 000 km² (31.5% of the country) and in 1982 it had a population of 22.8 million (more than 80% of the total). As in Venezuela, the foothills and hillsides with slopes of between 8 and 15% are generally considered to make up the Andean or mountainous region (the delimitation of "high" areas is somewhat imprecise). In both Venezuela and Colombia there are high altitude plateaus in the Andes where production activities and the resident population have been neglected in favour of the development of the mostly hot and flat valleys of the river basins. In the case of Colombia, the proportion of the population living in the cities of the region has been increasing, and the cities have received preferential attention in the allocation of resources. Bogotá, Cali and Medellín have 35% of the population of the Andean region.

The hill zones, which can be partly assimilated to the high Andean region, are very heterogeneous in respect of climate, soil and vegetation and the kind of use made of these resources. The differences narrow when observation is concentrated on the group of river basins located between mountain ranges whose rivers flow into the bigger systems of the Andean region, such as the Cauca and Magdalena. The soils of the Andean river basins of the Cauca and upper Magdalena are of the high-plateau type in the highest parts of the central and western mountains (4 000 m) and of the mountain type in the middle section of the Cauca basin and in the northern section of the Magdalena basin (2 500-3 500 m). Soils of the mountain type are also found on the lower and gentler slopes with soils of flood origin at the confluence of the tributary rivers.

The inhabitants of the Andes in Colombia have considerably altered the landscape and land use. Logging has been replaced by commercial agriculture which has altered the vegetation cover and stripped the soil of its protection; this development has been less harmful in the flat areas where erosion is less of a problem; it has also taken place in the hill areas at medium altitudes where the precipitation is high, but here there is the additional problem that the native forest has been razed to make way for crops, such as the modern varieties of coffee, which offer little protection against erosion.

At higher levels, the poor soil fertility is a major obstacle to its use for forestry and pasture. The mountains at altitudes of 2 200-3 200 m, where some of the hill soils are found, have variable topography and intense erosion. The main activities are livestock, domestic poultry-farming and cultivation of annual crops such as legumes and maize and perennial crops such as coffee and sugar cane. The plateau land (páramo) lies at an altitude of 3 200-4 000 m, with rugged land separating wide plains where vegetables are grown and sheep and cattle are raised on a communal basis. Above the snow-line at 4 000 m the vegetation is sparse and the land can only be used

for grazing sheep and some cultivation of native potatoes or onions. Small operations for self- consumption are the rule.

The plateau land above the snow-line and the highest parts of the mountains contain 60% of the production units with between 0.1 and 5 hectares of land; together they account for only 0.04% of the total area of farmland. The high proportion of peasant smallholders with small plots suitable for intensive farming has accelerated the ecological ruin of much of the Andean region in Colombia, visible in the absence of native vegetation, alteration of the hydrological régime, and intense soil erosion estimated at 75% in 1977.

The upper basin of the Cauca river (firstly) and the basin of the Saldaña river (secondly), which are part of the hydrographic system of the Magdalena river in its upper reaches, have been taken as typical examples of Colombia's high Andean river basins.

a) The mountain or hill zone of the upper basin of the Cauca river covers an area of 1.8 million hectares. Only 6% of this area has soils of class IV or higher, which are the classes considered suitable for all temperate crops with little risk of degradation. In this zone 53% of the land is under natural grasses. The area occupied by livestock is rather more extensive than the area considered suitable for this purpose, but the opposite is true of forestry, the conclusion being that livestock-raising has invaded part of the highest land occupied by protective forests, thus reducing the cover which helps to conserve the natural resources.

The hill zone is a depressed area from the socioeconomic standpoint; the techniques used are of the traditional type, and the situation is exacerbated by difficulty of access and scant and decaying infrastructure. The upper basin of the Cauca river has a flat zone in addition to its hill zone. This is an area of about 400 000 hectares classified by the Cauca river regulation project as a flood zone and flood-protection zone. As 95% of the area is planted with crops, including grasses, the utilization of the farming potential is clearly high, but it could improve on conclusion of the works for land improvement, flood control, irrigation and drainage which are being built in the flood zone, which is 65% of the area of the flat zone.

b) The basin of the Saldaña river has an area of 9 162 km², representing 39% of the land in Tolima department. In 1984 the population was 410 000, of which 25% was economically active; 85% lived in rural areas and 79% engaged in agriculture.

Three levels of altitude are distinguished within the basin: the low zone below 500 m; the hill zone between 500 and 3 000 m where coffee is grown on 48% of the farmland; and the plateau zone above 3 000 m on the eastern spurs of the central range. Farm output is fairly diversified. Recent years have seen a decline in the area under the main annual crops --rice, sorghum and cotton-- and the same is happening with dual-purpose livestock. This development is due in part to the expansion of the area under coffee and sugar cane and also to the increased erosion and sedimentation in the lower parts of the basin.

3. Ecuador

Ecuador's Andean region or sierra runs north to south over an area of 145 060 km², which represent 51.6% of the country's territory. In 1982, 4.1 million people were living there, i.e., 47.7% of the national total. The characteristic feature of the sierra in Ecuador is its broken topography, consisting as it does of a succession of 15 inter-Andean valleys limited by mountain ranges and separated by transverse bands of high ground known as nudos.

The life of this Andean region, which is barely 130 km wide, centered in early times around the use of different ecological levels, from the drylands at 2 000 m to the icy peaks above 4 000 m, i.e., from maize to sparse grazing; irrigation was introduced in some valleys with a view to crop diversification and rotation, and the hillsides were terraced for cultivation of crops. The system of natural resource use and the organization which maintained it provided food self-sufficiency based on the integrated use of different levels in a single Andean area.

Life in the Andean region of Ecuador changed with the emergence of the large farm as the main production unit, the introduction of agrarian reform, the intensification of international economic relationships, and accelerated urban growth, the result of widespread migration from the rural Andean zones.

The land use organization of the Andean river basin usually centres around a flat valley with abundant irrigation water and occupied by large modern farms which have gradually abandoned cereals in favour of highly efficient and mechanized dairy farming; between 2 600 and 3 000 m there are also smallholdings and medium-sized farms which, taking advantage of the fertility of the land in the humid and semi-humid ecological levels, have abandoned the cultivation of traditional self-consumption products in favour of fruits and vegetables for which there is a greater market demand.

The hill zone at the level between 3 000 and 3 400 m known as ceja andina is an area farmed by poor smallholders displaced by the destruction of the landowning system; most of this area is inhabited by loose communities of Andean peasants who were left without direct access to land and resorted to the complex and intensive system of alternating use of the highest ecological levels for crop and livestock farming on plots with an average size of under 0.8 hectares. According to the 1974 farm census, 67% of the Andean hill farms in Ecuador had less than five hectares of land and together they occupied only 6.7% of the total area.

The third sector making up the Andean river basin is at the edge of the high plateaus; this area contains the traditional large cattle ranches, smallholdings growing potatoes and cereals, and traditional (and marginal) Indian communities whose subsistence is based on native crops with very poor yields and on sheep herding.

The structure of the Andean basins implies a number of imbalances resulting from the collapse of the rational system of resource utilization. With the modernization of the large farm and agrarian reform, food production

in the Andean region entered a phase of slow growth (although it was negative for crops such as wheat, barley and potatoes) outstripped by the rapid population growth. The Andean peasants abandoned the traditional self-consumption crops which made up their basic diet (melloco, oca, etc.) in favour of industrial food crops (oil, grains, etc.), for their shortage of land compelled them to specialize in a cash crop which connected them to the regional and urban market. This development has generated unemployment and underemployment in the family production unit which at present represents 50% of the labour force.

The shifts of population to the ceja andina and the plateaus have generated other migratory movements in search of non-farm income to supplement income from smallholdings. Migration increased by 56% between 1962-1974 and 1975-1982 in the main provinces of the Ecuadorian sierra; in the most depressed provinces in the centre and south of the region (Cotopaxi and Loja) the figures were 96 and 108% respectively. In 1978 it was calculated that 48% of incomes on family smallholdings in the Andes came from non-farm activities; 30% of this 48% was earned by urban work, especially in the city of Quito.

The food crisis, in conjunction with migration and the subdivision of the land into smallholdings, has had harmful effects on the conservation and use of natural resources. The limited access of Ecuador's Andean peasants to the factors of production and of control of the ecological environment impedes their vertical use of the ecological levels of altitude; they are thus compelled to overexploit poor-quality land, thereby increasing soil degradation. The vicious circle of degradation is completed by the deposition of sediment in the valleys or the reservoirs of hydroelectric stations.

These problems make life difficult for the country's poorest Andean peasants, who number more than 250 000 families, i.e., 30% of all the families living in the Ecuadorian sierra; this same group is capable of producing at least 75% of the country's requirement for basic foods.

Only eight of the 15 river basins which make up the Ecuadorian sierra can be regarded as upper Andean river basins. From north to south, they are:

a) The Carchi basin, with an area of 1 125 km² and 45 225 inhabitants, altitude of 3 000 m, arid climate and rugged topography; its main products are maize, barley, wheat and potatoes; the yields are low owing to the lack of irrigation.

b) The Chota basin, has an area of 4 760 km² and a total population of 150 080. The valleys which cross it support diversified mountain and subtropical agriculture. The population density is over 100 inhabitants/km² and the land is seriously overexploited by smallholders. The various social services reach no more than 25% of the rural population.

c) The Guayllabamba basin is narrow but long and covers an area of 5 200 km²; it supports a population of 509 600, not counting the population of Quito, which is located in the centre of the basin. The basin is highly productive and has five valleys specializing in irrigated maize in the

northern part, pasture land for dairy farming in the centre, and cattle ranches in the south.

d) The Patate basin has an area of 4 275 km² and a population of 402 000. It contains five extensive longitudinal valleys and two high plateaus used for diversified agriculture in rotation with natural grasses. The Indian communities which live in the upper parts of this basin are extremely poor, and large numbers of temporary migrants leave these areas for Quito. The area occupied by smallholdings is very large and there is a marked technological imbalance in dairy farming in comparison with the valley farms.

e) The Chambo basin is the highest in the inter-Andean depression and it contains both high plateaus and valleys. The basin covers an area of 3 555 km² and has a population of 269 436. The vegetation cover (as in the Patate basin) has been largely destroyed over much of the area as a result of the indiscriminate felling of both protective and productive trees; intense erosion occurs in the upper parts; the lower parts, in turn, lack protection against sedimentation. These problems manifest themselves in heavy runoff which has formed large numbers of slopes and ravines. Living conditions in the upper parts are very difficult; the various services reach less than 15% of the population and the illiteracy rate is around 50%.

f) The Cañar basin is the primary basin of the southern Andean region; it has high relief and fertile soil. It covers an area of 1 500 km² and has a population of 72 000. The main crops are soft maize and beans, but productivity is low owing to the serious lack of irrigation. There are large numbers of smallholdings in the middle and upper parts of the basin.

g) The Paute basin consists of broad plateaus in its northern part and valleys in the centre and south; it covers an area of 5 200 km² and has a population of 48 000, 65% of which lives in rural areas. The middle and upper parts of the basin have been intensely eroded owing to the undiversified farming practiced on large numbers of smallholdings with low per hectare yields. The rural population is widely dispersed, and it is difficult to provide it with basic services. The services reach less than 35% of the people. The illiteracy rate is about 40%.

The Paute river forms an extensive network with numerous tributaries and subtributaries. The water flowing down from the high plateaus has been used to create the country's largest hydroelectric complex, which began partial operations in 1984.

h) The Jubones basin has an area of 4 200 km² and a population of about 250 000 with roughly 60% living in rural areas.

Several of the valleys in the basin's interior are hot, and the farmers cultivate a mixture of crops, with coffee and hard maize found alongside beans and soft maize. The convolutions of the river's main bed argued for the implementation of a multiple-use project (the Jubones project) of dams on the high plateaus and irrigation and human and industrial consumption in the hot valleys.

4. Peru

Peru's sierra or Andean region traverses the country from north to south and occupies an area of 335 000 km², a little over 26% of the country's territory. The Andean population was 7.0 million in 1982 (38.9% of the national total).

The region has a rugged topography with large numbers of steep hillsides at altitudes between 1 800 and almost 7 000 metres. Rainfall is irregular and extensive areas require irrigation. The richest farm land is found in the valleys and on the inter-Andean hillsides, where some 1.8 million hectares are cultivated. Natural grasses grow on about 18 million hectares on the high plateaus. Farm productivity is low in the high parts of the region; most of the land is unirrigated, and the irrigation potential is probably no more than 25 to 30% of the cultivated area; there is little mechanization. Crops are rotated at long intervals in the high-mountain zones. The overexploitation of marginal land and the destruction of the natural vegetation have led to a reduction of the farming area, especially as a result of soil erosion on slopes and overgrazing. This phenomenon is due largely to the very low ratio of cultivated area to rural population: barely 0.54 hectares in 1981.

The problems of this region of Peru, which are shared to a greater or lesser extent by Ecuador and Bolivia, stem from the period following the Spanish conquest when new systems of landholding were imposed and new crops and animals were introduced, thereby altering the system of simultaneous working of several ecological levels of altitude and undermining the conservation techniques of the Andean peasant communities.

The privatization of the land and its consolidation into large farms changed the nature of peasant communities. Many displaced peasants occupied land unsuitable for farming and worked it intensively on smallholdings. The intensive farming and overgrazing of hillsides, without the previous construction of terraces or their maintenance, destroyed the vegetation cover and eroded the soil, causing even further contraction of the limited agricultural frontier. In 1972, 78% of hill farms had less than five hectares of land, equivalent to only 6.6% of total farmland.

The agrarian reform initiated in the 1970s did not overcome the physical and socioeconomic problems of the high region of the Peruvian Andes. The reform brought little or no benefit to smallholders and landless peasants who, owing to the expansion of the bigger production units, had to move to unsuitable land high in the mountains or on steep hillsides, destroying the protective forest to sow self-consumption crops. This accelerated the erosion, and in the end the vertical control which was still exercised over different ecological levels fell apart in many places as the peasants began to specialize in the cultivation and marketing of a single crop. The peasants and villagers were increasingly compelled to use their smallholdings for cash and to cut back self-consumption; this compelled them to leave their own area to seek supplementary work in the modern farming sector or the informal urban sector, thus stimulating migration and non-rural marginality.

The loss of food self-sufficiency and the meager incomes which they earned depressed the living standards of Peru's Andean population even further. Several 1980 indicators confirm this: the illiteracy rate is above 50% in 58% of the provinces which make up the sierra region; in 40% of these provinces over 80% of the population has no drinking water service; 95% of the housing in 37 provinces (38% of the total) has no electricity; in over 42% of the provinces the infant mortality rate is above 200 per 1 000 live births. Financing from the public sector for productive investments has tended to be focused on big projects, and its economic impact on the region has been insignificant. Furthermore, the resources generated by mining (very important in the Peruvian sierra) have been used by the public sector not for sectoral or regional reinvestment in the Andes but to finance activities at the coast or in the forest region and for urban development. Public social investment in infrastructure represented 41% of all public investment in the sierra in 1971; this proportion had fallen to 11% by 1980.

The public sector's discreditable performance in the Andean region of Peru is due largely to its lack of knowledge of the rationale underlying the behaviour of peasant communities and mountain peasants in general, which has caused it to treat the region as a homogeneous whole. There is thus no individual attention for small areas with acute problems of rural poverty or urgent need for conservation and rehabilitation of renewable natural resources.

The very heterogeneity of the geography of Peru's high Andean region is in fact one of its resources, for it ensures the complementarity of different ecological levels and internal integration of more developed and more depressed zones.

The great variety of ecological zones in the region is another potential asset. Of the 103 types of habitable zone in the world 61 are found in this region. This enabled the early Andean communities to plan the long-term use of the land for various forestry, agriculture and pastoral uses and to meet the food needs of large numbers of people, and this is still possible today. The high plateaus, too, are extremely well suited for camelidae farming, especially in the central and southern Andean zones.

In this depressed region of great potential the organization of the Andean peasant communities is of vital importance as an integrating and dynamic factor. The potential to ensure the survival of the marginal rural population in such difficult ecological and economic conditions is an asset which must be exploited.

The drainage systems of Peru's high Andean region are divided into three basins: the extremely arid Pacific basin; the Atlantic or Amazon basin; and the basin of Lake Titicaca, which finally discharges into the Amazon as well.

The Santa river basin is the most important in the Pacific watershed and the only one to contain a longitudinal Andean valley; it has an area of 10 053 km² and a population of 218 749. The mountains of the Santa river basin are the highest in the region: the Andes divides into two mountain ranges creating the inter-Andean depression known as the Callejón de

Huaylas. Other important river basins in this watershed are those of the Majes and Ocaña rivers in the south, the Cañete, Rimac and Chancay (Huaral) in the centre, and the Jequetepeque and Chancay (Lambayeque) rivers, and the Chira-Piura and Chao-Virú-Moche-Chicama (Chavimochic) systems in the north.

The rivers which flow into the Amazon watershed form a number of valleys in their upper reaches, where most of the population of the high Andean region lives. The most important river basins are:

a) The Cajamarca and Condebamba river basins in the department of the same name, including the river basins of the Cajamarca (2 271 km²), Condebamba (2 012 km²) and part of the Crisnejas (171 km²). They lie between 1 800 and 3 900 metres above sea level. The rainfall is 600-700 mm in the low areas and as high as 1 000-1 200 mm in the mountains. In the Cajamarca river basin 28 095 hectares of land are used for intensive agriculture, 53 044 hectares for pasture, and 119 901 hectares for forestry. In the Condebamba river basin there are 12 011 hectares of farmland and 77 287 hectares used for forestry. Up to 8 221 hectares can be irrigated in the Cajamarca river basin and up to 5 313 hectares in the Condebamba. The present population of the two river basins is about 230 000; 73.04% of the population lives in the city of Cajamarca.

b) The Mantaro river basin is the largest and most important in the central zone of the Andes, with an area of 32 547 km² and a population of about one million. The high part contains two of Peru's main mining centres --Cerro de Pasco and La Oroya-- and the city of Huancayo. The Tablachaca hydroelectric power station which supplies the city of Lima is located in the narrow middle part of the basin. This river basin is a centre of farm, livestock, and forestry production. It also has a considerable fishing industry. The Mantaro river is seriously contaminated by mine wastes which is a serious problem both for the valley itself and for the distant city of Lima which channels water from this river basin to generate electricity and supply its population; it is planning to expand this system.

c) The Vilcanota river basin is located in Cuzco Department. As far as the town of Pisac it has an area of 7 145 km². The Vilcanota river rises at 4 320 metres above sea level in an area with peaks over 6 000 metres high. The basin's population has grown exponentially. In 1940 it had 207 000 inhabitants; in 1961, 245 000; in 1973, 310 000; and at present it must have over 400 000 inhabitants. It has an estimated area of 26 310 hectares suitable for irrigation. At present there are 47 000 hectares of farmland, with 25% irrigated and the rest unirrigated. Only 14% of the irrigated land is left fallow, as against 60% of the unirrigated land. Of the 460 000 hectares legally owned in the river basin only 130 000 belongs to peasant communities. The rest belongs to co-operatives, production associations, and smallholders.

d) The river basins of Lake Titicaca cover more than 57 000 km². The tributary river basins located in Peru cover a drainage area of about 39 000 km². The most important tributary river basin is that of the Ramis River with an area of 16 000 km² (one third of the basin excluding the lake). It had a population of 317 551 in 1975 but today the figure is nearing 400 000. This is a high-mountain zone lying at over 3 900 metres above sea

level. Less than 16% of the area is used for farming, the rest for livestock-raising; 80% of the farmland is unirrigated and 20% irrigated. Recent years have seen an increase in the use of the water both to irrigate pasture land and for crops, with subsurface irrigation systems which can reach 50 000 to 100 000 hectares of land by the lake and improve the drainage in a further 40 000 to 120 000 hectares. This river basin is subject to serious flooding and prolonged periods of drought.

5. Bolivia

Bolivia's high Andean region occupies an area of 307 600 km², representing 28% of the national total. It had a population of three million in 1982 (52% of the country's total population), with 53% living in rural areas. The population concentration was even greater 20 years ago. The eastward shift of economic activity has generated large migratory flows from the high plateaus to the plains and to the main urban centres of the high Andean region, especially La Paz and Oruro. The region is tending to become an area of population loss, and the rural peasant migrant is becoming a marginalized urban dweller.

This has been a mining region since colonial times; the country obtains 60% of its foreign exchange from exports of tin, copper, antimony, lead, zinc and silver. The exhaustion of the mines and the crisis in the world tin market in 1984 have had a depressive impact on the high Andean region.

Oil will be a marketable resource in the Andean region, to judge by the geological conditions and structures identified during recent exploratory work. The part of the region in the south-east of the country has large geothermal springs.

The renewable resources have little potential in Bolivia's high Andean region. The soils are poor and produce low yields, and the peasants have very little land, finding it impossible in most cases to supply their own needs for basic products. The gap between output and consumption is over 50%, and it is even greater in Oruro Department. Native high-plateau crops are the most successful: quinoa, oca, and upland barley, potato and maize.

The region supports many different species of livestock, but practices are very traditional; the most important activities are camelidae and pig farming and wool production. Fishing is an important activity on Lake Titicaca; the main species are trout, pejerrey and bogue. Water resources are fairly scarce, and water distribution among the peasants has always been a problem. The enclosed Altiplano river basin is typical of the high region of the Bolivian Andes; it has a supply of surface water of 11 028 m³/km² a year (3% of the supply in the Amazon basin, the country's largest). Leaving aside the huge volumes of water stored in the high lakes of Titicaca, Poopó and Uru-Uru, the Andean region has only 0.5% of the country's total supply of surface water.

On top of this relative poverty of natural resources came the impact of the country's economic contraction in 1980-1985 and the successive changes in economic and social policy which obstructed the implementation of various

programmes and projects. The farm sector was the only one to emerge from that five-year period with positive balances, except in 1983 when Lake Titicaca overflowed its banks. Farming activities in the high region are based on family labour on smallholdings for subsistence production; in the eastern plains, in contrast, agribusiness predominates, with hired labour and production for export. The high Andean region has had better prospects since 1984 and has overcome its stagnation to supply domestic markets with cheaper goods; with an eye to this result, the prices of peasant agricultural products were deregulated in May of that year.

In the case of social services --housing, health and education-- the Andean region is clearly undersupplied and no worthwhile progress has been made in recent years. Where housing is concerned, peasant self-construction is the rule; the few social programmes for rural housing have been impeded by the wide dispersal of the population in the Altiplano, especially in its southern part. Health conditions are precarious; mortality and morbidity rates rose between 1980 and 1985 and life-expectancy fell. There is no social security for the peasants, and health facilities did not increase in rural areas between 1980 and 1985. Education has been in decline in recent years. Pupils in rural schools represent 30% of the total, and the population of school age represents 53% of the country's total population. By whatever indicator it is measured, the education system is inadequate in rural areas, and the Altiplano region has the worst indices in this sector.

Bolivia's high Andean region consists basically of the enclosed basin of the Altiplano and perhaps also the mountain ravines of the rivers Pilcomayo and Beni and the La Paz river. The waters of the first two rivers are used to generate electricity for the city of La Paz.

The endorheic basin of Lake Titicaca in Bolivia has an area of 145 081 km², representing 13% of the country's territory. It has a water resource deficit: it has 1 600 million cubic metres of water a year and an average annual rainfall of only 220 mm (under 100 mm in the southern part). This basin is divided into four main sub-basins:

a) The Lake Titicaca sub-basin, of which a little over 10 000 km² belongs to Bolivia out of a total area of 57 000 km²; this is the area of heaviest population density and most intensive livestock-farming in Bolivia's high Andean region. The soil has been seriously degraded by overgrazing and intensive cropping. Mineral resources and the fish of the lake constitute the area's main wealth.

b) The Lake Poopó sub-basin has an area of 57 215 km². It has two hydrological units --the lake and the Desaguadero river. The salinity of the soil is something of an obstacle to agriculture. This sub-basin is the site of the Tacagua dam which provides irrigation water for 4 200 hectares, serving 812 families. The main crops in the irrigated area for farms with more than five hectares are alfalfa and broad beans. The irrigation is only 40% efficient owing to the salinity and the deterioration of the canals; this is the reason for the low farm yields.

c) The sub-basins of the Coipasa and Uyuni saltpans are located in the southern part of the basin and have areas of 30 170 and 46 625 km²

respectively. Characteristic features of this subregion are the big saltpans and vast empty dry pampas. The lack of non-mineral resources and infrastructure in this inhospitable zone are the reasons why it is unpopulated.

II. FARM PRODUCTION CAPACITY OF THE MAIN HIGH-MOUNTAIN RIVER BASINS

A high proportion of production units in the high-mountain zones of the Andean region have no more than five hectares of land; these units are mostly small farms located on steep hillsides and smallholdings on the upper levels of plateaus (páramos or punas). Owing to factors such as inappropriate land distribution, use of family labour, poor soil quality and lack of funds for significant technical innovation, these units are usually considered as having a low agriculture and livestock production capacity, for they are based on peasant subsistence farming, which has the concomitant effect of increasing the domestic supply inelasticity of farm foodstuffs.

However, the past 20 years have seen renewed vitality in the peasant output of crops grown on the hillsides and in the high-mountain zones of the Andes, and a new impetus in livestock-raising. Whether for technical production problems (smallness of the plots, for example) or the capitalization policy of the peasants who still occupy areas of fertile land in the Andes, these peasants are today more involved in the marketing of farm goods, especially foodstuffs. This development can be attributed to several factors such as: specialization in livestock on production units with more than 20 hectares, for which purpose farmland is converted into artificial pasture or is sown with high-return crops such as fruit and vegetables and coffee; more intensive use of labour on the smallholdings and smaller farms under a system of diversified subsistence farming, which involves lower costs in comparison with the capital required for investments in big farms or agribusiness; or the inability of the Andean countries to continue paying for imported food at a time when the larger units were specializing in export crops.

Small farms and smallholdings make a considerable contribution to the production of agricultural foodstuffs for direct consumption (see table 2).

It has been estimated (ECLAC/FAO, 1986, p. 14) that in the 1980s the Latin American peasant controlled 38% of the arable area and in 1983 45.4% of the harvested area. For the Andean region (ECLAC/FAO, 1986, p. 22) it was calculated that the 1980 peasant output accounted, on average, for 60% of final-consumption farm goods and that around 1976 the peasants had 53% of the cattle, 45% of pigs and virtually 100% of sheep (CATIE, 1981).

Despite their large agricultural contribution, the many peasant units in the Andean zones have little land and it is the least productive land owing to the increasing degradation caused by intensive use and to the rugged topography of the high levels which makes them difficult of access. In proportional terms output is far in excess of available land (see table 3).

Table 2

ANDEAN REGION: PERCENTAGE CONTRIBUTION OF
MOUNTAIN PEASANTS TO TOTAL OUTPUT
OF SOME CROPS

Level: 0.1 to 5 ha

Product	Venezuela 1971	Colombia 1970	Ecuador 1974	Peru 1972	Bolivia 1980 <u>a/</u>
Potatoes	17	70	68	73	34
Barley	-	70	54	80	32
Wheat	-	49	40	60	65
Maize	44	47	52	36	49
Beans	31	69	61	80	13
Lentils	-	50	37	73	-
Cassava	27	60	33	73	-
Bananas	13	85	17	40	-

Source: Venezuela: Agricultura de ladera en América Tropical, International Seminar. CATIE, Costa Rica, 1981.

Colombia, Ecuador and Peru: Agricultura campesina, ECLAC/FAO Joint Agriculture Division, Santiago, 1986; and Agricultura de ladera en América Tropical, op. cit.

Bolivia: Sobrevivencia campesina en ecosistemas de altura, vol. II, ECLAC/UNEP, Santiago, 1983.

a/ The reference area is the Andean part of Chuquisaca Department, which has 40% of the cultivated area of the Bolivian Altiplano, where 81% of the units are smallholdings.

The output of the mountain peasants contrasts with that of the units in the lower areas and plateaus where, despite high levels of technology and mechanization, the area under crops is much smaller than the total farming area. The mountain peasant, with 3% of the farming area, contributes 60% of the farm goods consumed by more than 75 million people in the Andean countries under study.

The farm output of the high regions of the Andes rests on the steady impoverishment of the population as the number of production units increases and their size declines. Between 1960 and 1970 in Colombia the number of units rose by 2.8% and their size fell by 16.7% (1.8 to 1.5 ha). Between 1954 and 1974 in Ecuador the number of units increased by 95 000 and their average size declined from 1.7 to 1.6 ha. In Peru the proportion of owners of units

Table 3

ANDEAN REGION: TOTAL AREA AND CULTIVATED AREA OF
MOUNTAIN PEASANT UNITS

Level: 0.1 to 5 ha
1971-1976

	Units (percentages of total)	Total area	Cultivated area
Venezuela	43.5	0.9	5.0
Colombia	60.0	0.04	-
Ecuador	66.6	6.7	20.0
Peru	77.6	6.6	36.0
Bolivia	59.3	0.2	-

Source: CATIE, Agricultura de ladera en América Tropical, op.cit.

smaller than one hectare rose from 37% to 47% between 1870 and 1978. It was calculated for 1975 that 39% of the peasant units in Latin America has less than two hectares of land.

1. Venezuela

The high-mountain zones of Venezuela's intermontane valleys have 35 000 hectares of land suitable for intensive farming; at the middle altitudes there are more than 100 000 hectares suitable for high-yield coffee-growing; in the high-mountain zones the livestock potential is 230 000 hectares but full use cannot be made of this land without a suitable management system.

The average monthly flow of the main rivers of Venezuela's high river basins --Motatán (Lake Maracaibo basin), Uribante, Boconó and Santo Domingo (Orinoco basin)-- is estimated at 356 m³/s, which is about three times the average flow of all the rivers which discharge into the Caribbean Ocean, but the flow is irregular owing to the extremely seasonal rainfall pattern. These rivers cross the regions which seem to have the best potential for irrigated agriculture; however, evaporation, the shallow average depth of the rivers (except the Boconó) and the seasonal nature of the rainfall make regulation installations essential throughout their courses, and this reduces the possibilities of irrigation and hydroelectric development.

The good quality land, without use limitations, totals 4 million hectares for the whole country; 1.6 million hectares of land suitable for agriculture was cultivated in 1984. The Andean region accounts for 40% of this total and 65% of the usable land is worked. About 350 000 hectares are available for extending the agricultural frontier.

The most important products are vegetables, potatoes and coffee, together with beef and milk (see table 4).

Table 4

ANDEAN REGION OF VENEZUELA: AREA AND OUTPUT OF
IMPORTANT FARM PRODUCTS, 1983

	Area (hectares)	Country (%)	Production (tons)	Country (%)
Vegetables <u>a/</u>	6 840	56	71 077	70
Potatoes	6 000	31	73 055	40
Coffee	113 400	44	31 450	56
Milk	2 520 000(head)	23	10 000 000(1/day)	13

Source: Case study on Venezuela and Estadística Agropecuaria Andina 1980-1986. JUNAC, 1986.

a/ Includes cabbage, garlic, celery, tomatoes and carrots.

The stoniness of some of the land and the steep slopes of the upper river basins in Mérida and Trujillo states are obstacles to the cultivation of vegetables and tubers. More intensive use of the land is impeded by the lack of irrigation (only one harvest a year is possible) and the relative gap between what the mountain peasant producer needs and the available technical assistance and agricultural extension measures in terms of fertilizers and pest and disease control. Although coffee could be grown on a considerably larger area than at present, it's production suffers from the low level of technology, for fertilizers are not used and the plants are not renewed; this situation is due to the smallness of the farms and the low producer incomes. Dairy farming is carried on with intensive methods on medium-sized and big units. Modern inputs are used and technical advice and financial support are available from the public sector. This activity has problems for the peasant in terms of quality of pasture land, livestock management on very small areas, and inadequate hygiene; the difference in yields in a single river basin is therefore very wide. The potential increase in these products is indicated in table 5.

The variation in yields is especially wide in the Chama, Motatán and Boconó river basins, indicating a wide diversity of physical, technological and socioeconomic factors. The increases in yields of potatoes range from 33 to 54%, coffee from 67 to 96%, and milk from 38 to 100%.

Table 5

ANDEAN REGION AND UPPER RIVER BASINS OF VENEZUELA:
POTENTIAL INCREASE IN IMPORTANT ITEMS OF
FARM OUTPUT

Item	Current output (kg/ha)	Potential output (kg/ha)	Available area (ha)	Volume increase (tons)
Potatoes	13 000	20 000	6 000	42 000
Celery a/	5 000	10 000	3 000	15 000
Coffee	276	462	70 000	13 020
Milk	871 _b /	1 200 _b /	130 000	42 770 000

Source: Case study on Venezuela.

a/ It was assumed that celery occupied 45% of the vegetable-growing area in 1983.

b/ Litres per hectare.

The possibilities of increased output to meet the currently unsatisfied demand or to secure exportable surpluses will depend on satisfaction of certain conditions such as: technological innovation in coffee-growing; programmes to control the erosion caused by the amount of soil removed with potatoes; alteration of the size of the production unit in dairy farming; and acceptance of native farming practices in vegetable-growing; all of this is connected with management of prices and marketing channels for the peasant, for he must be enabled to stabilize his income and family employment and thus to check migration.

2. Colombia

Farming activities are closely connected with the size of the production unit in the Andean region: the smaller the farm the larger the proportion of the land farmed. The opposite is true with respect to the proportion under grass. The hillsides and high-mountain zones of the river basins contain 73% of production units with less than 10 hectares of land; an average of 63.5% of the arable area is actually farmed and 23% is under grass.

Most of the land in the middle valleys and the Altiplano is either under annual crops or lying fallow, whereas in the eastern basin the preference is for permanent crops --mainly coffee, which occupies more than 30% of the agricultural land.

As a rule, agricultural output is fairly consistent with the situation in most of the upper river basins of the five countries studied. The hot valleys (of the Cauca and Magdalena, for example) are suitable for a variety of crops such as irrigated and unirrigated rice and cotton and sesame, cultivation of which is highly mechanized. In the hill areas with moderate climates permanent crops such as coffee, cocoa and sugar cane predominate. The high-mountain zones with cold climates are suitable for maize (also grown on hillsides), potatoes, barley and wheat which are grown on smallholdings using traditional techniques.

Livestock-raising is generally extensive in the Colombian Andes. Densities of over 1.5 head per hectare are found in areas with little pasture, i.e., where smallholdings predominate. The river basins have specialized in type of animal: cattle farming is concentrated in the low hot parts to an extent of over 70%; almost all the dairy farms are found on hillsides and higher, with agribusiness predominating (see table 6).

Table 6

ANDEAN REGION OF COLOMBIA: MAIN FARM PRODUCTS
OF THE HIGH-MOUNTAIN ZONES, 1979

Item	Area (ha) <u>a/</u>	Percentage of country	Output (tons) <u>b/</u>	Percentage of country
Coffee	1 015 400	37.8	832 628	27.7
Maize	398 100	65.3	563 320	71.1
Potatoes	125 000	82.8	1 712 250	82.9
Barley	67 200	75.5	115 987	69.5
Wheat	32 800	73.7	46 806	82.5
Beans	94 800	80.3	61 336	68.8

Source: Atlas Regional Andino, EGAC, Bogotá, 1982.

a/ Hectares harvested.

b/ Based on 1979 yields.

Table 6 illustrates the importance of upland crops in the national totals in terms of both area and output. Their importance is even greater when it is remembered that the basic diet of Colombians consists of potatoes, maize, beans and wheat, as well as plantains and rice, and that 80% of the coffee is produced by farms with under 50 hectares of land. In 90% of cases the crops mentioned above are produced on smallholdings at altitudes between 2 000 and 3 500 metres, with only rudimentary technology used on 80% of the units. This is why the yields are declining and are much lower than those obtained on agribusiness units.

This comment is valid for the whole of Colombia's Andean region, but especially for the high hillsides and plateau land (Boyacá, Cundinamarca, and Nariño departments). A large proportion of peasant income and family or waged farm work depends on the crops listed in table 7. In 1976 these crops occupied 68.8% of the farmland in the Andean region of Colombia which, including the area under coffee, totalled 2 517 910 hectares in that year. Despite the predominance of coffee in the Andean region (40.3% of the farmland) and the high proportion of land under grass (46%), it can be inferred from the 1971 farm census that in the Altiplano departments, where potatoes, barley, maize and wheat are the main crops, the unused area amounted to 25% of the total usable land, i.e., some 650 000 hectares.

Table 7

ANDEAN REGION OF COLOMBIA: POTENTIAL INCREASE IN OUTPUT
OF BASIC CROPS IN THE ALTIPLANO DEPARTMENTS a/

Item	Current output (ton/ha)	Possible output (ton/ha)	Area available (ha)	Volume increase (tons)
Maize	1.42	3.0	103 000	162 740
Potatoes	13.70	15.4	32 500	55 250
Beans	0.65	1.1	24 700	11 115
Barley	1.73	2.5	17 500	13 475
Wheat	1.43	2.0	25 000	14 250

Source: Atlas Regional Andino, op. cit., Desarrollo de Cuencas Andinas en Colombia (1986).

a/ Boyacá, Cundinamarca and Nariño.

The possibilities of increased output of basic Andean crops in Colombia on the part of the peasants living in the high part of the region and farming plots of 0.5 to 5 hectares depend on: a minimum of mechanization for maize; expansion of the area under wheat; soil and infrastructure management after the potato harvest; introduction or improved use of fertilizers for beans; and production of improved barley seeds. Given these conditions, the difference between the current per hectare yield in the Andean region and the possible or potential yield in other non-smallholding areas or departments would be equivalent to the increases in output indicated in table 7.

The impact of increased output would vary for each crop. An increase of 19.5% of the region's output of maize could be achieved, which would eliminate the present need to import 16 000 tons and would involve the peasant in the agroindustrial market where his income would be improved; the increase in potatoes represents barely 3.2% of the region's output, but consumption could be increased in the Altiplano and land could be released

for other uses in other Andean departments such as Antioquia or Santander; the region's output of beans would increase by 18%, cutting the country's import requirement by 50%; in barley, the volumes would increase by 11.6% of the region's output and a larger proportion of this grain could be used for human consumption, improving the people's diet; lastly the domestic output of wheat, a crop for which the region has large areas of suitable land, would rise by 24%, and the proportion of imports in the total supply would fall from 92 to 88%.

3. Ecuador

About 55% of the farming land in the Andean region is used for growing basic crops at altitudes between 2 400 and 4 000 metres above sea level. The people exert considerable pressure on the land through repeated plot subdivision and the private appropriation of land. In 1980, 78% of properties in the Andean region were smallholdings with less than five hectares of land and representing only 11% of the area.

There is marked specialization of land use in this region in comparison with the rest of the country. Almost all the land sown with cereals, legumes and potatoes is found here, together with 77% of the vegetable-growing areas and 42% of the fruit-growing area. The Andean region supplies almost all the basic foods consumed by the population. In addition, 76.3% of the arable area is used for grass and livestock (1 704 504 hectares), representing 42.4% of the national total. The region raises 46.7% of the country's cattle, 50% of the pigs and 99% of the sheep.

The Andean region of Ecuador has several agricultural advantages over other areas of the country, especially the coast. The agriculture is diversified, in contrast to the situation at the coast where the monoculture of coffee or cocoa predominates, with these two crops occupying 52% of the land, and hardly any food crops are grown. The Andean region also contains 43% of the area of the country used for agroindustrial crops (29% of the area under oil-seed crops and 16% of the area under export crops), which are grown at the lower (subtropical) levels of the western flanks of the Cordillera in the northern and southern sectors of the region (see table 8).

The limitations and the potential of Ecuador's Andean region depend to a large extent on the peasant's capacity to use different ecological levels of altitude in a complementary system which enables them, as they have done, to overcome the difficulties of the relief and the fragility of the ecosystem; under this system it has been possible to diversify food crops and make intensive use of all empty land at an investment cost which would be regarded as very low for the national budget or by private capital. At the coast, in contrast, the ecological limitations imposed by variations in rainfall have not been overcome, and land remains empty both in the arid southeast and in the very wet northeast, preventing the intensification and diversification of their tropical agriculture.

Table 8

ANDEAN REGION OF ECUADOR: AREA AND OUTPUT OF
HIGH-MOUNTAIN ZONE CROPS, 1985

Crop	Area (ha)	Percentage of country	Output (tons)	Percentage of country
Barley	29 444	100.0	26 660	100.0
Broad beans	7 740	97.2	10 340	97.5
Potatoes	36 382	100.0	421 660	99.6
Soft maize	74 472	98.9	214 650	99.0
Kidney beans	52 207	94.3	47 380	85.8
Wheat	17 933	98.9	18 360	99.2
Vegetables	13 302	59.8	137 420	51.3
Fruits	25 814	55.5	296 570	49.7

Source: "Diagnóstico de las estrategias, programas y proyectos formulados para el desarrollo y manejo de las cuencas alto andinas. Período 1980-1985", Ecuador, 1986.

The crops listed in table 9 are grown on 46.3% of the farming area in the Andean region, which amounted to 561 000 hectares in 1985. This proportion varies from basin to basin, depending on altitude, type of valley and ecological level.

The basins of the rivers Carchi, and Guayllabamba in the north of the region are cereal-growing but also very important for export crops, and for oil-seed crops in the lower part of the Guayllabamba river basin. The region formed by the basins of the rivers Patate, Chambo and Chanchán in the central and higher part of the region grows a variety of food crops, especially tubers, vegetables and fruits. The basins of the rivers Cañar, Paute and Jubones in the southern part of the Andean region form the legume-growing subzone, with a high proportion of agroindustrial crops such as hard maize and sugar cane at the subtropical level.

Ecuador's high Andean region has a diverse agricultural potential. Expansion of the crops grown by mountain peasants depends more directly on increasing yields than on extension of the cultivated area. In recent years commercial fruit and vegetable production and dairy farming have been taking over land formerly used for basic crops; this has had an impact on the supply of extra land as a viable alternative for smallholders (see table 9).

Table 9

ANDEAN REGION OF ECUADOR: ACTUAL AND POTENTIAL
YIELDS OF SOME BASIC CROPS, 1985

(Kilograms per hectare)

Crop	Normal output	Improved or mechanized output	Experimental station
Potatoes	11 600	15 000	18 000
Beans	545	900	1 136
Wheat	1 000	2 500	5 000
Soft maize	900	3 000	7 000

Source: "Diagnóstico de las estrategias, programas y proyectos formulados para el desarrollo y manejo de cuencas alto andinas. Período 1980-1985", op. cit.

Increased output has a limiting or multiplier effect depending on the characteristics of each crop. In the case of potatoes, it would cause an even greater distortion in prices policy, which is heavily influenced by the weather at harvest time and by the lack of infrastructure for post-harvest processing. Reallocation of part of the area occupied by potatoes to other crops such as broad beans, peas or wheat would render the increases profitable. Increased production of beans, which could amount to 70% of current output, could be used to encourage the consumption of this item as a substitute for meat by reason of its high protein content, and it might be exported. Wheat imports are so large that even if current yields could be increased five-fold in the medium term, the larger volumes would offset only 30% of imports. It has been proved that providing training for peasant communities in the high-mountain zones, i.e., cultivated zones lying between 3 000 and 3 500 metres above sea level, and supporting them with certified and improved seeds can raise yields from 800 to 4 000 kg/ha. The increased production of soft maize (by 70% to 100% of the region's current output) would produce a large increase in peasant incomes, for the profit rate is 80% of costs. This would require widespread introduction of adequate amounts of fertilizer, organization of small producers into co-operatives which would retain and reinvest the surpluses, and zoning of the crop, for at present it is rather widely dispersed over 15% of the region's farming land.

4. Peru

In the Andean region of Peru, known as the sierra, farming activities are carried on over only a small arable area --a common situation throughout the

country. Only 6.8% of the 33.5 million hectares of the Andean region, i.e., 2 280 523 hectares is used for agriculture with crop rotation, and about 18 to 20 million hectares (42.7%) are grazing land. Most of the grazing land is located in plateau areas and is more suitable for llamas and sheep (with shelters) than for cattle. The density of sheep is under 0.6 head per hectare; this results in extensive grazing to which is attributed much of the degradation of pastures and the serious erosion which occurs when hillsides are used and the natural vegetation is destroyed, causing damage to the soil which is difficult to recover.

The land suitable for cultivation in the Andean region is usually on steep slopes and dispersed in a mosaic of small plots. Most of it needs irrigation to supplement the insufficient rainfall, which follows a pattern of drought in alternate years. Systems of terracing, stabilization of hillsides and training of rivers and run-off are also required. It is estimated that up to 30% (60 000 hectares) of the arable land in the sierra could be irrigated, as against the present irrigated area of 250 000 hectares. The grazing land lies at a high altitude and is suitable for camelidae and sheep. The upland cattle graze loose, except in the central valleys, and in many places they exhaust the hillsides and encourage erosion.

The yield of the land used for agriculture in the Andean region declines with altitude above sea level and varies with the degree of irrigation and mechanization. The average annual area harvested or cultivated is below 60% of the arable area owing to fallow periods and neglect. At the coast and in the selva the figures are 71.8% and 70.3% respectively. Every year some 700 000 hectares are left uncultivated for various reasons; on the other hand, only about 10 million hectares under natural grass are considered suitable for this use. The sierra region contains 62% of the country's farmland, 95% of the natural grazing and 65% of the cultivated grazing; and it has 94% of stocks of sheep, cattle, camelidae and goats.

The most important crops are soft maize, potatoes, wheat, barley and quinoa, which are produced mainly in the high-mountain zone on small plots administered by Indian communities which work about 30% of the farming land and natural grazing with very low per hectare yields. These crops account for 38 to 45% of the national output (see table 10).

Table 10 indicates a rather irregular output pattern with a downward trend for potatoes, wheat and barley in both area and output. This performance has been influenced by the removal of these crops from irrigated to unirrigated land under the influence of market conditions and prices which make it more profitable to use the water for maize and fruit and for pasture land in the dairy-farming river basins. There are considerable differences in average per hectare yields between the irrigated and unirrigated systems, so that it is difficult to measure or quantify the real or potential output capacity of larger areas. For this reason the output data for the region's main high river basins has been broken down by levels of altitude (see table 11).

Table 10

ANDEAN REGION OF PERU: AREA AND OUTPUT OF MAIN
BASIC CROPS, 1981 AND 1984

Crop	Area (ha)		Output (tons)	
	1981	1984	1981	1984
Soft maize	173 563	172 539	196 936	207 029
Potatoes	190 064	164 440	1 475 838	1 377 000
Wheat	102 273	81 468	118 551	88 113
Barley	89 864	89 290	99 506	95 977
Quinoa	13 297	13 732	7 661	8 655

Source: Evaluación y diagnóstico de las estrategias, programas y proyectos utilizados o formulados para el desarrollo y manejo de cuencas de alta montaña y/o zonas alto andinas del Perú durante 1980-1985 y su proyección hacia 1990, Peru, 1986.

The yields decrease with altitude. In addition, the output of potatoes, soft maize and wheat is clearly influenced by the introduction of irrigation in the low and middle zones and the use of less-eroded land and farm technology. Recent research and surveys indicate that about 80% of peasant farmers use teams of oxen to plough the land; 39% use fertilizers and 30% pesticides. The gap between the actual output of the river basins and their farming potential is very wide (see tables 12 and 13).

Increased milk output will depend on the use of irrigation and fertilizers as well as on improved grazing; this implies higher-cost techniques, and rates and periods of return will have to be calculated very carefully.

The potential density of sheep and cattle will depend on the introduction of soil management and conservation programmes and reforestation programmes with a view to combining livestock-raising and forestry on smaller areas using intensive techniques.

Improved farm output must be based in the end on higher yields, and this will require an intensive effort to conserve soils and water, regulate local techniques and involve the mountain peasant in the regional market and decision-making process.

Table 11

ANDEAN REGION OF PERU: MAIN CROP YIELDS BY ALTITUDE AND RIVER BASIN

(Tons per hectare)

Crop	River basins											
	Santa			Vilcanota			Mantaro			Cajamarca		
	Upper		Middle		Lower		Upper		Middle		Lower	
	7.2	14.7	-	-	5.3	4.9	6.3	9.0	-	5.0	20.0	-
Potatoes	0.97	-	1.06	-	-	0.81	0.95	-	-	1.1	-	1.6
Barley	0.97	-	1.07	-	-	0.89	0.90	2.5	-	1.5	-	-
Wheat	0.54	-	-	-	-	-	-	1.5	-	1.9	-	-
Quinoa	-	2.0	4.1	-	1.2	-	-	1.0	-	-	1.9	2.4
Soft maize	-	-	-	-	-	-	-	-	-	-	-	-

Source: Evaluación y diagnóstico de las estrategias, programas y proyectos utilizados o formulados para el desarrollo y manejo de cuencas de alta montaña y/o zonas alto andinas del Perú durante 1980-1985 y su proyección hacia 1990, op. cit.

Table 12

ANDEAN REGION OF PERU: ACTUAL AND POTENTIAL OUTPUT OF MAIN
CROPS IN THE HIGH-MOUNTAIN ZONE

Crop	Actual output (tons/ha) ^{a/}	Potential output (tons/ha)	Potential increase (percentage)
Potatoes	9.05	25.0	178
Maize	1.85	6.0	224
Barley	1.04	2.09	2.3
Wheat	1.28	2.0	56.2
Quinoa	1.36	2.5	83.8

Source: Evaluación y diagnóstico de las estrategias, programas y proyectos utilizados o formulados para el desarrollo y manejo de cuencas de alta montaña y/o zonas alto andinas del Perú durante 1980-1985 y su proyección hacia 1990, op. cit.

^{a/} The average for the river basins weighted by their relative land areas.

Table 13

ANDEAN REGION OF PERU: ACTUAL AND POTENTIAL MILK OUTPUT
BY TYPE OF PASTURE

	Natural pasture actual	Cultivated pasture potential	Cultivated pasture and improved livestock
Milk (1/cow/day)	2	10	15
Sheep/ha	0.5	3	6

Source: Evaluación y diagnóstico de las estrategias, programas y proyectos utilizados o formulados para el desarrollo y manejo de cuencas de alta montaña y/o zonas alto andinas del Perú durante 1980-1985 y su proyección hacia 1990, op. cit.

The Peruvian sierra also has a great potential for vicuña, alpaca and llama farming. It is estimated that the area could sustain a million head of vicuña alone. Current stocks are about 50 000 head. Other important assets are tourism, fish-farming and controlled forestry exploitation, not to mention the resources already exploited such as minerals and hydroelectric power.

5. Bolivia

In 1974 the total area of land with farming potential amounted to 6 535 000 hectares, i.e., 21.2% of the total geographical area. A little over 155 000 hectares was cultivated in 1984 —only 2.38% of the potential area. Estimates by the Ministry of Peasant and Agricultural Affairs indicate that 4.6 million hectares is used for livestock or is difficult land, indicating that about 1.8 million hectares is awaiting development for agricultural use. The main difficulties are the lack of irrigation, the precarious state of the soil, and the lack of diversification of species which can adapt to the region's habitat.

The lack of irrigation is the main constraint, for Bolivia's Andean region is arid; not only is there little water but it is poorly distributed, and this is reflected in the per hectare yields and the annual cultivated areas. The irrigated area does not exceed 100 000 hectares, representing 8% of the total cultivated land. However, 76% of the irrigated land is found in the valleys; in the Altiplano the proportion of cultivated land is 14.8%, although much higher in the northern zone where intensive farming is practiced. The peasants estimate that yields increase by 100% with irrigation; other estimates place the increase at 60%. Irrigation projects registered with the Ministry of Peasant and Agricultural Affairs cover an

area of over two million hectares, but most of these projects exist only on paper.

In the Altiplano, where most of the peasant population lives, farm output is for self-consumption and subsistence. Commercial agriculture is located on the eastern plains and in the sub-Andean valleys, which are less arid and more fertile. In the cold and temperate areas of the Altiplano and in the inter-Andean valleys the peasants grow mainly soft and hard maize, potatoes, wheat, barley, broad beans and quinoa (see table 14).

Table 14

HIGH ANDEAN REGION OF BOLIVIA: AREA AND OUTPUT OF
MAIN CROPS, 1984

Crop	Area (ha)	Output (tons)
Maize	39 250	97 770
Potatoes	17 392	226 905
Wheat	10 835	44 500
Barley	10 987	23 030
Broad beans	3 807	23 135
Quinoa	36 646	21 143

Source: Bolivia, 1986.

Despite the trend in recent years towards a relative increase in the area cultivated in the Altiplano (7 310 hectares between 1980 and 1984), the per hectare yields of the region's main crops have tended to decline, affecting the supply of food output not used for self-consumption. This situation is connected with the cycles of natural phenomena (droughts and floods) in this area and the total lack of protective infrastructure (irrigation, drainage ditches, dams and soil treatment).

The drops in per hectare yields between 1980 and 1984 affected mainly the items produced primarily in the Altiplano, such as potatoes (-3%), vegetables (-30%), fodder and animal feeds (-44%), and fruit (-44%); the only improvement was in cereals (+14%); the main reason for all this was the amount of maize grown mainly in the enclosed or inter-Andean valleys and in the valleys of the north Andean zone.

The unfavourable performance of Bolivia's farm output in the Andes has meant that the peasant has had to sacrifice increasing proportions of the foodstuffs intended for his subsistence and place these products on the market to supplement his income; this has raised poverty levels and lowered

living standards. In the last 10 years, self-consumption levels have fallen by an average of 50%, a drop which also indicates the impossibility of obtaining increased output from the exhausted soil.

The possibility of increased output in the Altiplano basin depends on extension of the agricultural frontier (1.8 million hectares available) and on the introduction of irrigation, which would increase the volumes by 80%. This would raise subsistence levels and lower the cost of marketed goods.

Although no actual figures are available on the livestock subsector in the Altiplano, it must be concluded that, in view of the large area of suitable land, livestock-raising is practiced on an extensive basis with low productivity for the area of land used. According to estimates by the Ministry of Peasant and Agricultural Affairs, stocks of sheep and cattle fell by 9.4% and 6.1% respectively between 1980 and 1985; llamas and alpacas underwent an even greater decline. The country's stock of alpacas fell from 3 290 000 in 1967 to 2 444 000 in 1976, and to 2 401 805 in 1980. This decline was due to several factors, including the introduction of sheep. In the northern Altiplano alone the alpaca population fell from 2 150 000 in 1967 to 1 600 000 in 1971, to 1 200 000 in 1976 and to 1 128 000 in 1980. However, alpaca-farming in this sector is more important than sheep-farming for the local people and for the management of the ecosystem. In the central Altiplano, in areas of punas, crops are at the mercy of the weather, and although the grazing is poor, the raising of llamas, alpacas and sheep remains the main activity.

Most of the land used for livestock is under native grasses which are becoming exhausted by the introduction of exotic species and inadequate management as a result of the destruction of the traditional systems of peasant organization. Fodder is scarce, especially in the dry winter period, and the peasants have not yet been given access to technological inputs and genetic improvements. However, some progress has been made in upland irrigation and in camelidae research in the south. Nevertheless, even greater State support is needed.

Fishery output capacity is fairly high, especially at the mouths of the rivers flowing into Lake Titicaca. Studies estimate the lake's fish resources at 150 000 tons a year; this would allow bilateral development which would increase present catches five-fold, even using only 20% of that annual capacity. So far, however, apart from establishment of a few fishing stations and stocking of rivers and lakes with trout, not much has been done. Most of the fish eaten in the sierra comes from the coast. The output of the fishing stations is canned for export and not placed on the local market.

III. GOVERNMENT STRATEGIES IN HIGH ANDEAN ZONES

1. Venezuela

In the past 15 years Venezuela has taken the approach of regional development and river basin management. The main objectives in the first years of the 1970s were the extension and regulation of the geographic and economic territory of the Andes with a view to opening up the high valleys and promoting output and urban-industrial development. The process of agrarian reform was also stepped up in priority areas and in accordance with the suitability of the land as a supplementary strategy to overcome conflicts in the peasant subsystem which was relocated to the Andean foothills. With regard to resource use, emphasis was on the farming sector (intensive fruit-farming and livestock-raising) and on the tourist areas of the high river basins of the Motatán and Santo Domingo rivers.

By the end of the 1970s, regional development of the Venezuelan Andes was following a strategy focused within the area, with emphasis on the rural sector. The redistribution of the rural population was to be achieved within the regional boundaries. The policy of expansion of the economic area assigned an important role to agriculture, with priority for intensive programmes of agrarian reform and irrigation designed to increase employment, incomes and productivity. Dairy-farming and programmes for improvement of coffee-growing were proposed as basic components in the development of the river basins in Mérida and Trujillo states while, in Barinas state, priority was given to industrial development through metal-working projects.

The strategy for the Andean region contained in the Sixth National Plan for the period 1981-1985 can be regarded as sectoral-integrated, but it did not define territorial units; the aim was expanding agriculture (which remained the basic sector in the region's development) to levels which would transform the Andean region in the medium term into the main producer and processor of agricultural and livestock products, surpluses of which would be exported to the rest of the country and abroad. An attempt was made to implement this strategy by means of a set of programmes on irrigation water and drainage, road infrastructure, technical and loan assistance, producer organization, and agroindustrial processing. The aim was also to open up opportunities for integration with other urban or extra-regional sectors such as the food industry, non-metallic mining and the generation of hydroelectric power.

The upgrading and preservation of the environment and renewable natural resources were also included as an important strategic element, and measures were introduced for management and control of the high basins of the main rivers and for the formulation of plans for the regulation of the forestry reserves and water resources of the alluvial plains. These programmes contributed to the development of the region's tourist potential, improvement of the people's living standards and education, health and housing services, and institutional co-ordination in the promotion of the region's development.

In the case of water resources, Venezuela centered its attention initially on erosion control in the upper river basins in order to promote the farming activities of small and medium-sized producers. For this purpose it used a conservation subsidy, the aim of which was to encourage the peasants living in eroded areas to co-operate in the programmes on conservation and use of renewable natural resources, with concomitant improvement in their socioeconomic situation as a result of training. The peasants of the Grita, Motatán, Torbes and Táchira river basins took an active part in the implementation of more than 14 projects carried out under the programme between 1970 and 1973.

Between 1973 and 1977 priority was not given exclusively to erosion control and the conservation subsidy, for attention was also given to prevention, restoration, reforestation, control of landslides and sedimentation, and torrent training. The soil and water conservation activities were not concerned solely with peasant agriculture but also with the hydrology of the upper river basins as such. During this period, river basin management plans were formulated for the Chama and Macoties, Negro and Boconó, and Uribante and Caparo rivers. Although these plans were not implemented, they did create awareness of the importance of river basin management and conservation.

These plans were part of the Plan for Regulation and Integrated Management of National River Basins prepared in 1975 by the Ministry of Agriculture and Livestock. This strategy did not prosper owing to the structural change in 1977 which saw the creation of the Ministry of the Environment and Renewable Natural Resources (MARNR) which assumed the same functions in the area of water resources but took a different approach. The conservationist subsidy programmes aimed at the peasant have continued to operate but on a selective basis in priority zones of the upper Andean river basins and with reduced coverage in terms of both area and population.

Since 1977 priority has been given to multiple use of water by means of hydraulic installations backed up by conservation management of the upper river basins in the form of activities such as soil and water conservation, reforestation and maintenance of the existing infrastructure. The aim is to control erosion and sedimentation in upper river basins, regulate the hydrological régime of the watercourses, control the flood levels of the rivers, and build defenses against floods, all with a view to reducing the amounts of sediment carried down to the river beds in the valleys and lower parts of the region and preventing clogging of the water storage installations. This approach has been backed up by the conservationist subsidy programme to ensure that the integrated use of the river basins resources result in the production of goods and services without damage to the soil and other environmental resources. The aim is to correct practices which impoverish and destroy the resources, practices for which the peasant sector is supposedly responsible.

2. Colombia

Regional development strategy began to play a considerable role in Colombia at the end of the 1950s with the establishment of the Cauca Valley Regional

Corporation (CVC). The various departmental development plans and programmes formulated since then have focused on natural resource use and management. However, these first initiatives were frustrated by financial difficulties, lack of institutional continuity, and administrative defects; accordingly, the regional development measures introduced in the 1960s were fragmented, random and sporadic, sustained only by the activities of the CVC and the Autonomous Regional Corporation of the Sabana de Bogotá (CAR) with respect to generation of hydroelectric power.

The national economic policy was clearly sectoral and designed basically to promote urban industrial development and reform of the landholding structure in the countryside; this exacerbated imbalances in the distribution of production activities and population in the country.

By the end of the 1960s the concentration of population in the big cities made it essential to incorporate the regional aspect in national plans. New regional development corporations were set up and became established as executing agencies of programmes and projects in smaller areas; in the early stages they were concerned mainly with solving problems of natural resource management, usually within the ambit of river basins, with a view to the subsequent incorporation of regional development activities as such.

By the mid-1970s the regional development approach had produced departmental plans whose objective was the integration of marginal zones by means of investment programmes carried out by decentralized institutions or institutions within the departments themselves. What was taking shape was the planning of integrated regional development based on strengthening of the administrative and institutional structure by bringing together townships and urban development corporations and designing and implementing integrated rural development programmes.

In the period 1978-1982 the priority goals of integrated regional development in Colombia were economic decentralization and regional autonomy. The policies were based on upgrading of the road network, creation of storage and supply centres, and introduction of investment programmes in depressed peripheral regions. Decree 1527 of 1981 made these measures mandatory, and departmental-regional development plans were prepared, with sponsorship and co-ordination provided by the existing regional development corporations.

The 1983-1986 development plan gave emphasis to the creation of instruments for financing regional autonomy by means of a fiscal reform which strengthened and updated departmental and townships income and accelerated the political/administrative decentralization permitted under Law 76 which created the planning regions in 1985. The aim was to reach beyond the limits of existing territorial subdivisions through the formulation of subregional plans covering non-contiguous areas and designed to meet the needs of regions with common problems, with priority given to the relatively less developed zones.

Colombia has some 40 years' experience of river basin management with broad institutional coverage. Although different approaches have been taken, constant progress has been made towards an increasingly clear understanding

of the problems of integrated river basin development. There are still no specific methodologies which would make it possible to formulate river basin regulation plans for the whole country (although the National River Basin Regulation Law was enacted in 1981), merging and consolidating the existing approaches to the management of these specific physical areas.

From 1950 to 1965 the approach was protectionist, centered on reforestation to conserve soil and watercourses. Programmes were carried out which introduced conifers and eucalyptus trees in critical areas of catchment basins in order to regulate and increase the flow for aqueducts. The Cauca Valley Corporation (CVC) also took the protectionist approach and began to select river basins with energy and water-supply potential for the big cities; this led to the formulation of the first river basin management plans.

From the mid-1960s until the late 1970s the concept of protection of biophysical factors led to the consideration of multiple use, pointing out the need to regulate the river basin's resources by making detailed analyses which would provide guidelines for their development. However, emphasis remained on the biophysical characteristics of the river basin and increased control by the main regional corporations of forestry exploitation and the use of forestry products. This period saw the first studies on regulation of the basin of the Sinu river and the upper basin of the Lebrija river which already included the use of various multi-purpose conservation and development practices.

In the last 10 years the focus has shifted to integrated river basin development or management based on recognition of the fact that regulation demands the incorporation of economic, social and administrative factors and must operate with the support and participation of the community. It then becomes necessary to combine the management plans into a regulation plan and, as the next step, to relate the integrated development of the resources to the socioeconomic and administrative structure of the regional and national plans. Since 1978 the CVC has prepared 11 river basin regulation and development plans covering an area of 544 500 hectares.

The vision of integrated use of natural resources combined with regional development and environmental maintenance or conservation for the benefit of the population is clearly expressed in the project for the upper basin of the Magdalena river (PROCAM). The river basin is defined as the basic unit of resource protection and integrated management in view of the capacity of the water resource to furnish supplies for human consumption and energy and for agricultural and industrial development both within the region and for the country at large. The river basin is subject to planning by means of multidisciplinary and interinstitutional activities within specific regional areas in the promotion of conservation, development and welfare.

3. Ecuador

In Ecuador the tendency has been to encourage concentration around urban-industrial development poles such as Quito and Guayaquil, one located in the Andean region and the other at the coast. Agroindustry, intermediate

industry and exports have received special attention, together with marketing for the direct consumption of farm goods.

This bias has produced acute regional imbalances manifested in the lack of integration and the relative undersupply of intermediate or smaller political/administrative units such as provinces and townships, whose management has been subordinated to global sectoral policies. The lack of institutional co-ordination among these units has accelerated the degradation of the natural resources and living conditions in these areas, especially in the rural sector.

As a result of the conflicts between the users of the resources and the increasing marginality of the peasant subsystem, the regional approach has been altered in the past 10 years and systems of regional subdivision have been proposed which are based on the grouping of geographically related provinces. Regional development bodies were created or strengthened and, in conjunction with other institutes of the central government and sectoral agencies, they took over the function of formulating integrated regional development plans. The thrust of their effort has been to: create basic services for soil, mountain and wildlife conservation and research; promote the multisectoral development of specific zones using integrated rural development projects and settlement projects as the main tools; stimulate the directly productive sectors such as agriculture, agroindustry, industry, handicrafts and tourism; and establish an economic infrastructure of irrigation and transport, and social services such as housing, drinking water and sewerage, education, health and training.

The difficulties of institutionalizing the regional subdivision are impeding the execution of the plans; various regional and sectoral bodies have assembled the most useful programme and project measures and have begun in the 1980s to outline a regional strategy which emphasizes three aspects: the deficient production and social conditions of the rural population, especially in the Andes; the use of water as an integrating factor in regional development; and the conservation and rehabilitation of renewable natural resources. These criteria do not stem from development policies which form a general framework, but rather from partial views of the national situation which are accepted to the extent that the sectoral or regional institutions have succeeded in securing financial resources or the approval of the central government.

The current strategy seems to be moving towards a synthesis of approaches which, in sectoral terms, can be seen in the integrated rural development projects --which result in selective subdivision into microregions-- or in the water plans which are being included in the regional economic development plans, or even in the recent plans for integrated river basin management and conservation.

For the past 20 years Ecuador's water policy has been concerned with the use of water for irrigation and generation of hydroelectric power. Commercial investments in irrigation works have been fairly small, with preference for smaller installations to supply small farming zones. The impact of these uses of the water and the conflicts which they generate are rarely appreciated until the construction of large water installations begins, for this sets in

motion the formulation of management plans to control erosion, sedimentation, floods and landslides, despite the fact that technicians and intellectuals have been worried about the problem of erosion for decades, not because of its effect on big installations but because of the increasing decline in the subsistence capacity of the mountain peasant population.

By the end of the 1970s national development plans were referring explicitly to conservation of renewable natural resources as essential for ecological balance and efficient production. The next step was therefore to select the river basins to be the subjects of the management plans, which included programmes of conservation and restoration of eroded land, promotion of reforestation, and introduction of integrated agriculture, forestry and livestock production systems, with the Andean region indicated as the priority implementation zone.

This is the approach of the sectoral public institutions responsible for each renewable natural resource, but it is other bodies which are responsible for the construction and management of reservoirs, dams and hydroelectric installations. The institutions prepare plans for natural resources, especially water. As a first step they deal with the rationalization of water use as a fundamental factor of economic and social development, but the specific objectives are confined to evaluation of water supplies, conservation of the resource and establishment of reserve stocks to meet future demands. The management of other significant renewable natural resources such as the soil and vegetation is not included.

In the next stage (Jubones river water plan) the attempt is already made to achieve integrated river basin development by means of: multiple use (irrigation, hydroelectric power, domestic supplies, flood control, regulation of peak water levels); conservation and protection of all the renewable natural resources in the basin; development of food production in the middle and upper reaches; assistance in sectors such as health, housing and education; and training and technical assistance for peasants and small producers.

In the past three years increased attention has been given to control of erosion and sedimentation in the upper river basins where the main hydroelectric installations are located. This has meant the formulation of natural resource management and conservation plans for these places, which could be expanded in the medium term into integrated development plans by means of programmes on river basin regulation, diversification of production, and organization of peasant communities.

4. Peru

The criteria for the development of the Andean region of Peru have been related in the past 20 years to the integration of the territory and its population and to more efficient extraction of resources from the sierra to supply energy, water and cheap food to the urban centres of the coast.

The regional strategy centered around decentralization of administration and deconcentration of production in order to reduce the

imbalance caused by the rapid growth of Lima. The functional economic weakness of the sierra in comparison with the urban subsystems of Trujillo, Lima and Arequipa meant that agrarian reform must be the main tool. The aim was to use this tool to increase the participation of the inhabitants of the sierra in decision-making and to transfer ownership of rural land as a factor affecting income distribution both intraregionally and interregionally. It was believed that increased public and private investment would be channelled to the sierra once the public sector entered the region to provide the marginalized groups and new owners with social services and economic infrastructure.

This concept of creating regional growth poles was underpinned by the establishment of departmental co-ordination committees and a number of autonomous regional development bodies which operated from departmental capitals and in heterogeneous areas of jurisdiction. Public investment was made in zones which offered the best return from the extraction of natural resources and construction of urban economic infrastructure.

This regional policy of urban decentralization led to the preparation of regional or departmental development plans for the sierra, the main goals of which included the need to: exploit and develop mineral resources to the maximum; increase yields and extend the agricultural frontier; promote tourism; encourage the development of the road system and establishment of intermediate urban centres; and promote the exploitation of hydroelectric resources. This resulted in sectoral regional development plans, to which were added the various national plans designed to regulate natural resource use and conservation and improve the living conditions of the inhabitants of the sierra with regard to energy, regulation of water resources, reforestation, road infrastructure, health and housing. In all of these plans the sierra seems to take second place to national concerns, for the region is needed as a generator of foreign exchange and economic surpluses, as a source of migrant labour for the cities or the settlement projects in the selva, and as a supplier of direct-consumption and agroindustrial goods.

However, it proved necessary to redefine the concept so as to take into account the peasant subsystem formed by the rural population of the Andean region which exploits the resources for self-consumption and subsistence, especially when it was realized that the social-development agricultural associations (SAIS), peasant-owner organizations created by the agrarian reform, were beginning to suffer from the same old problems which had existed up to the end of the 1960s: seasonal labour, small-scale farming and marginalization of Indian communities.

The new policy was expressed in the formulation of integrated rural development projects (PIAR) which had jurisdiction over the SAIS and peasant communities. The PIARs constituted integrated development zones, an instrument of rural development designed to subdivide the sierra into zones of different levels of crisis which required different incentives to secure involvement of the population. The programmes introduced in each zone were usually of the multisectoral or assistance type.

Other public development programmes for the sierra have been carried out in the past 10 years, using the criteria of regional integration of the rural

areas. They include: the programme for community development and integration of the indigenous population; the integrated rural settlement programme; the programme for jobs creation in rural areas; and, more recently, the microregional development programme which incorporates the goals of improving the standard of living and quality of life, and integrated development with participation of the local people. Each microregion is a small area subject to planning and administration for the development of the natural resources, the environment, the production sectors and the population. The demarcation and ranking of microregions are based on the previously established order of priorities for high Andean zones in a state of economic and social emergency.

These programmes, especially the microregional development programme, are based on agriculture, for the agrarian problem is regarded as the main problem requiring solution. There is little farming and forestry land in the Andean region and the ground has poor water-storage capacity. This means that agricultural development in the sierra must turn on improved use of water and land, scarce resources which require careful conservation management and protection owing to the inevitable intensity of their use. The aim of microregional development is therefore to: satisfy at the right time the water needs of agriculture, livestock-raising, mining, industry and domestic use; lay the foundation for rational protection against the harmful effects of water; safeguard the quality of the resource from depreciation by man; and guarantee flows of water for other purposes, especially power generation.

It must be said that the General Water Law of 1969 is constantly violated and preservation activities are obstructed by the effects of mining in the sierra, for the tailings and waste water are discharged directly into the rivers without prior treatment. Attempts to regulate ground water in the Andean valleys face obstacles to proper management in several upper river basins; this is damaging to medium- and long-term investments designed to achieve integrated management of all the resources, not only water. These two problems have delayed the diversification of agricultural and livestock production and the improvement of yields.

5. Bolivia

The strategy for the development of the Bolivian Altiplano has not produced many concrete results in the past 10 years, despite the frequent statements of interest on the part of the public sector in matters affecting river basins and the farming sector. This sector has the lowest percentage share in the national budget of all the sectors, and its share has been declining in recent years: from 2.68% in 1980 to 0.61% in 1984.

Special attention has been given to water, and this effort has produced a national network of hydrological stations, although the information which they furnish is still insufficient and fragmented. The planning of water use requires enactment of a general water law, for the legal régime governing water use is too dispersed: the legal regulations are contained in 14 current laws, and 52 institutions are involved in water management.

The lack of a specific policy on the use, management and conservation of soils and water consistent with the criterion of integrated use on a river basin basis, and the lack of sectoral bodies to regulate and direct the planning activities have resulted in: 1) low levels of technical assistance in the use and management of renewable natural resources; 2) little or no involvement of the mountain peasant in the solution of problems connected with the use and conservation of these resources; 3) increased soil and water degradation as a result of erosion, flooding and salinization; 4) contamination and degradation of these resources by mining operations, all of which are located in the high Andean region; 5) the low level of financial support and assistance with the management of programmes and projects for the development of irrigated agriculture.

Since 1980 the continual shifts of policy in the decision-making centres of the public sector have resulted in a number of different strategies and policies for the high Andean region and its natural resources. Up to 1982 there were no measures designed specifically for preservation of the renewable natural resources and encouragement of their productive use; up to 1985 the public sector's concern was with assistance in the application of isolated measures designed to benefit the poorest rural groups, especially the smallholders of the high Andean region; since then the strategy has been sectoral and it has given an important place to the farming policies contained in the so-called "agropower" programme.

In no case has the public sector tackled effectively the problems inherent in the development and management of the river basins and watersheds of the high Andean region. All that has been produced is a few analyses and strategy proposals which have not been put into practice. The reasons offered in justification of this relative neglect of Bolivia's high zones include: lack of experience of the technical units; lack of political will; shortage of funds; and lack of interinstitutional co-ordination in the attainment of minimum objectives and targets with regard to soils, irrigation, agriculture, forestation and other aspects of river basin management.

The sectoral farming policy governing public sector intervention in the high Andean region since 1985 is based on the establishment of small integrated rural development units called "operational centres" (centros operativos). The aim is to secure in these centres a shift from traditional to modern agriculture, with mining, metallurgy and industrial activities acting as suppliers of capital to the rural sector in view of the great profits which they make.

The policy proposals for the various actions by means of which this strategy is implemented can be summarized as: establishment of a river basin administration based on the concept of integrated water management; promotion of an investment policy based on small projects in specific rural areas; halting the creation of smallholdings and encouragement of the regrouping of smallholdings; relocation of plots to areas of ecological protection or farming potential; implementation of the plans for conservation, use and management of soils and water; promulgation of a water law to encourage the rational use of the country's water resources; creation of a national water resource institute for integrated river basin management; strengthening of

the high Andean research centres; establishment of forestry nurseries and provision of financing for Andean communities with a view to the forestation of the region; establishment of a research infrastructure to facilitate the development of alpaca, llama and vicuña farming and use of appropriate technology for the genetic improvement of these animals; prevention of the depopulation of the Altiplano region by promoting migration within the region; promotion of the ecological rationalization of farming in the high zones, expanding the irrigated area and preventing desertification and erosion.

The rural development policies for the high Andean region seek to: furnish appropriate technology to underpin the irrigation projects with the introduction of modern inputs; strengthen the community organizations which form the link with public and private institutions inside or outside the region, with a view to establishing the "operational centres of agropower"; create a machinery for institutional co-ordination of social services such as education and health and prevent the duplication of functions; introduce forms of association which will enable the peasants to obtain loans; and provide technical and financial support for the consolidation of intermediate urban centres in rural areas in order to facilitate the provision of basic and social services for farming communities in the high-mountain zones.

6. Conclusions

The five Andean countries have acquired much experience in sectoral regional development projects which have given priority to farming activities as generators of goods which can easily be traded in extraregional or international markets; the areas most favoured by this policy have been those which practice modern agriculture, i.e., the flat or low zones of the river basins and the very fertile valleys and hillsides.

The high parts of the Andean region have been neglected with respect to their internal development but they have received large investments in mining or energy production which have served as the basis for utilization of natural resources to meet the global objectives of urban-industrial development or to strengthen the external sector. This kind of strategy has accentuated regional imbalances and the deterioration of natural resources exploited with little concern for rationality; and this has resulted in conditions of extreme poverty in the region's rural areas and in the exhaustion of the resources, as well as making their restoration more difficult.

In all cases there has been a move towards the concepts of deconcentration and decentralization of development by means of regional planning on a multisectoral or integrated sectoral basis accompanied by control of the harmful effects of the indiscriminate use of the natural resources, especially the soils and water of the upper river basins of the Andean region.

The attempts to rationalize resource use and the introduction of conservation and protection techniques have moved beyond considerations of maintaining investment profitability and have secured the participation of

the people. Using different approaches and instruments, such as the conservationist subsidy in Venezuela, river basin regulation in Colombia, integrated rural development in Ecuador, and integrated microregional development in Peru, the regional planning strategy seeks an integrated approach involving the users of specific areas.

This approach is based in most cases on the formulation of management plans for high-mountain river basins. The use of resources, especially water, becomes the fulcrum of development in defined natural areas in which joint action by the users is easier to obtain once their local problems are known.

The public sector's institutional policy in the most recent period has also tended, with varying degrees of integration, to direct the development of the high-mountain zones of the Andes through organs or corporations whose main concern is the conservation, protection and rehabilitation of the overexploited renewable natural resources, the restoration of ecological balance, and the provision of social infrastructure and technical production and financial assistance for the marginal population of the high-mountain zones; it is thus left to the global sectoral policy to take the necessary initiatives for agricultural, mining, hydroelectric and tourism development. This specialization by the public sector in its management of the high-mountain zones of the Andean region has caused imbalances between the budgetary resources allocated and the policy statements, or between the measures taken at the sectoral level and the functions assigned to the regional development bodies, as is the case in Venezuela, Colombia and Bolivia; these imbalances exacerbate the lack of co-ordination and make it more difficult to formulate integrated proposals.

The experience of Colombia and Peru in the integrated development of river basins or microregions in the Andes warrants close attention; although things are still at the experimental stage, the results obtained will be a very useful guide for the creation of integrated information and management systems which could be used as models for other situations where viable solutions can be found for the problems, given the will of the users of these areas to take an active part in decision-making.

IV. PUBLIC SECTOR INSTITUTIONAL SYSTEMS FOR THE DEVELOPMENT OF ANDEAN ZONES

1. Venezuela

The strategy tools used by the Venezuelan State have been shaped both by the regional application of national development plans and by the policy guidelines of the various sectoral institutions responsible for the management of renewable natural resources in high-mountain zones.

The 1970-1980 national plans assigned responsibility for the implementation of the strategy for the Andean region to the Andes Development Corporation (CORPOANDES). These plans proposed: decongestion of overpopulated zones and resettlement of the population in the Andean foothills; acceleration of the agrarian reform; incentives to promote local public participation in development; promotion of tourism; and land use regulation of the Andean region.

Various programmes were prepared for the implementation of these plans. The subregional integrated development programme was designed to deconcentrate economic activity and strengthen the urban centres in order to adjust imbalances in employment and physical assets within the region and in relation to other regions of the country. In the case of agriculture, the main aim was to carry out the necessary research to alter the farming pattern of the Andean valleys, encouraging specialization in high-yield fruit-farming and livestock-raising. The aim of the industrial programme was to formulate a set of metal-working projects for small and medium-sized industries which would receive training and technical assistance. An agrarian reform programme was also prepared, with a view to enlarging the area of farming land, raising the efficiency and coverage of irrigation systems, and improving the state of coffee-growing. The basins of the Motatán and Santo Domingo rivers, the city of Mérida and a number of frontier zones at Lake Valencia were chosen as priority areas for the promotion of tourism in the Andean region. Lastly, the programmes were designed to achieve the planning of the region's physical space so as to attract rural dwellers from the high-mountain zones to urban centres where there were more jobs and higher incomes.

The instruments used in the development of the Andean region in the 1980s are identified in the 1981-1985 national development plan. In turn, CORPOANDES has formulated two consecutive development plans (1977-1980 and 1981-1985) designed to achieve integrated resource use and the planned occupation of the productive physical space.

The 1981-1985 national plan introduced a set of sectoral programmes for the region's internal development. They make agriculture the priority sector in the region's development and industry a support sector at the urban level, with priority given to agroindustry in order to generate jobs and improve income distribution. Mining and the energy subsector would provide the capital for the region and the financing for the strategy, while education, health and housing are regarded as priority services in improving the living standards of the region's population. Preservation of the environment and the

renewable natural resources is to be achieved by management and control of the watersheds, regulation of forestry reserves, and water resource management; tourism is proposed as a complementary activity for the region's development, for it encourages better use of resources and produces financial surpluses.

Various programmes have been formulated for implementation of the strategy. The environmental programme includes subprogrammes on soil and water conservation and watershed management. The first is the responsibility of the Watershed Management Department of the Ministry of the Environment and Renewable Natural Resources (MARNR) and is designed to control erosion and sedimentation in watersheds in order to protect the channels and storage installations, especially those of the Uribante-Caparo hydroelectric complex. An important prop for this subprogramme is the conservationist subsidy established 20 years ago to help the peasant population of the region's high zones.

The watershed management subprogramme is designed to achieve optimum use of the water by means of development projects based on conservationist criteria. The implementation of this programme has included the formulation of the plans for conservation management of the watersheds of the Uribante and Santo Domingo rivers which MARNR has been carrying out since 1983. The two plans set out their goals and targets in three priority programmes: regulation of the hydrographic unit; conservation infrastructure; and natural resource management.

With respect to agrarian reform, the proposal is to transform the country's agrarian structure and incorporate the rural population in the national development process. Between 1959 and 1972 the programme reached almost 40% of all the families requiring land. This performance has been maintained in subsequent years.

The agricultural development programme consists of subprogrammes for the agricultural development of the high valleys, coffee-growing and fruit-farming. The first programme forms part of the CORPOANDES plans and includes basic measures such as the organization of producers into irrigation committees and peasant associations; formulation of subprojects on soil conservation; irrigation projects; crop planning; technical assistance for farm production and marketing; and local public participation in the improvement of basic services. The achievements since 1985 include the construction of 20 small and medium-sized irrigation systems for the cultivation of vegetables and tubers on 2 500 hectares of high-zone land.

The coffee-growing programme dates from 1977; its goal is to raise the productivity and incomes of small and medium-sized producers by improving their organization and constructing small processing centres. The targets include: renovation of about 23 000 hectares of coffee plantations; rehabilitation of a further 10 000 hectares; construction of 22 processing centres and 22 kilometres of farm roads; and the creation of 8 700 jobs.

The fruit-farming programme furnishes technical assistance; the aim is to establish new production zones and organize the producers, promote agroindustry and open up new marketing channels.

The upland cattle-farming programme, also sponsored by CORPOANDES, consists of three subprogrammes: dairy farming over an area of 265 000 hectares in the upper and middle reaches of the Uribante and Boconó basins with the aim of increasing milk output and improving land use; promotion of upland livestock-raising over an area of 20 000 hectares on experimental farms, based on improved genetics and on pasture and herd management; and organization and financial participation of medium-sized and small producers in livestock companies.

The trout-farming programme is based on the production of young fish for stocking and restocking and it will be carried out in the peasant settlements in the high Andes with a view to improving their techniques and incomes.

The tourism programme includes two projects for the upper reaches of the Motatán and Boconó basins. The main goals include: promotion of handicrafts; rehabilitation of the urban infrastructure and buildings of Andean villages; construction of Indian museums; and preservation of the remains of ancient civilizations. All these activities will improve the incomes of the local population and generate jobs.

The hydroelectric development programme is designed to produce energy to supply western Venezuela and foreign countries and establish development poles in the Andean region which will generate jobs and encourage the consolidation of industries. The main project is the Uribante-Caparo hydroelectric complex constructed in the foothills in the basins of the Uribante, Caparo, Dorados and Camburito rivers. It has a flow of 240 m³/s and will have an average annual generating capacity of 4 900 GWh, equivalent to a saving of 7.5 million barrels of oil a year.

The study and research programme is directed to solve the ecological and environmental problems resulting from inappropriate exploitation of renewable natural resources and to identify critical zones with preference given to emergency measures. Twenty-one studies are being conducted, particularly of the feasibility of incorporating lands with agricultural potential, which are presently underused, of evaluation of the traditional systems of agricultural exploitation and management in mountain areas, of sediment control in the various Andean environmental recovery and protection areas, and of the social and environmental impact of mineral exploitation in various subregions.

2. Colombia

The tools for implementation of the development strategies for Colombia's Andean zones are chosen and used by the regional development corporations. In recent years other sectoral institutions directly involved in natural resource management have also been active in this field: for example, the Hydrology, Meteorology and Land Improvement Institute of Colombia (HIMAT) and the National Institute for Development of Natural Resources and the Environment (INDERENA), which have formulated integrated management projects for the upper basins of the Lebrija and the Magdalena.

Forty-five per cent of the CVC's budget for its natural resources activities is financed by transfers from the sale of the electricity produced in the basin; a further 45% is provided by the property tax surcharge; and the remaining 10% comes from the sale of services and from charges for management and use of the renewable natural resources.

River basin activities are divided into river basin management, conservation and control of renewable natural resources, and surveying. The river basin management programme is continuing to increase the supply of water for various uses, expand the output capacity of farming and forestry without damaging the renewable natural resources, and improve the living standards of the inhabitants of the basins. There are seven basic subprogrammes: 1) erosion control and soil conservation; 2) reforestation with an eye to environmental regulation and satisfaction of the demand for forestry products through the conservation of 220 000 hectares of natural forest and the establishment of 120 000 hectares of planted forest; 3) infrastructure development, with special attention to rural health, sanitation and electrification; 4) monitoring and surveillance of natural resources; 5) parks and reserves --to conserve and improve the areas designated as natural reserves by means of research, environmental education and rural development; 6) modification of land use, and planning of properties with a view to crop diversification and increased output and incomes; 7) social promotion to improve the inhabitants' health, nutrition and housing standards, especially in the rural sector of the high-mountain zones.

Following the expansion of its area of jurisdiction (2.2 million hectares including flat and hillside zones) the CVC has divided the big Cauca basin into 28 sub-basins, also known as management units, with a view to regulation of their heterogeneous natural and human resources.

A three-stage regulation and development plan is formulated for each sub-basin: 1) biophysical and socioeconomic analysis including, inter alia, aspects of hydrology, climate, soil and erosion, agrarian structure, land use, means of production, manpower, credit and provision of services; 2) management of the planning and development project with regard to administration, legal regulations, community involvement, social promotion and basic studies; and 3) formulation of the strategy, zoning of the sub-basin into priority areas, and the project execution.

The main strategic tools used by the Tolima Regional Corporation (CORTOLIMA) in the development of the Saldaña river basin are contained in the plan prepared in 1985. A second group of projects for 1982-1985 is currently being carried out under CORTOLIMA's management.

In the current plan the measures have been divided between three sectors: production, social and physical infrastructure. The production sector includes agriculture, livestock-raising, industry and the environment; the social sector covers such matters as housing, education, health and social welfare; and the physical infrastructure sector deals with roads, electricity, sewerage, urban and rural development, and tourism.

The projects for the production sector are designed to increase the output of foods and primary materials for the establishment of agroindustries in the region and to raise the level of employment. The project's investment component favours the livestock subsector in the short term, with the establishment of experimental farms. The programme includes projects on: plot integration; experimental cattle and pig farms; demonstration programmes for poultry- and fish-farming; and increased cultivation of annual crops for basic consumption.

The most important of the projects in the social sector are those concerned with housing, owing to the large urban deficit and the poor physical conditions of rural construction. These projects will be implemented by means of self-construction programmes, employing idle manpower in order to keep costs down so that the housing will be within the means of the river basin's inhabitants.

Priority is given in the physical infrastructure sector to the plan for urban centres in the Saldaña river basin, with a view to: regulation of land use and communication routes; construction of the Chaparral aqueduct as far as the treatment plant, in order to supply drinking water to all the inhabitants of the basin; and preparation of an integrated rural development programme designed to improve the peasant's output and living standards.

Since 1982 the following projects have been executed in the Saldaña basin, taking up most of CORTOLIMA's investment:

- . Study and integrated management of river basins, concerned with the improvement of roads and bridges, flood control, torrent training, construction of channels and clearing of landslides. This project took up an average of 29% of investment between 1982 and 1985.

- . Rural electrification, executed in conjunction with the electricity corporation of Tolima Department, involving the construction of works and substations. CORTOLIMA assigned 8.5% of its investment in the period to this project.

- . Integrated rural development programme (several projects executed jointly with the national organs involved in this programme), including: reforestation; renewable natural resource management; construction of works; and establishment of demonstration plots. The resources assigned to the Saldaña basin represented 16.8% of the total.

- . Environmental development plan for the design and construction of a sewerage system, taking up 3.7% of investment.

- . Monitoring and surveillance of renewable natural resources, with training of the local population in rational resource use. The investment amounted to 3% of the total.

- . Promotion of forestry and erosion control, based on reforestation to protect the soil, taking up 4.2% of the investment.

. Fish-farming output and promotion, concerned with the construction, enlargement and improvement of tanks in several of the river basin's townships. This project started in 1984 and attracted 2% of the total investment into two years.

. Guamo irrigation district, begun in 1984 and allocated 51% of CORTOLIMA's 1985 budget; these resources were used for soil study, preparation of plans and an inventory. This project has taken up an average of 32% of the investment.

. Systematization of the farm work and services of the townships of the Saldaña basin. This project began in 1985 and has therefore attracted only 0.8% of investment in projects executed in the period 1982-1985.

3. Ecuador

Two kinds of method are used in Ecuador's Andean region to implement the development strategies. Firstly, there are the plans, which are divided according to their objectives and the institutions responsible for them into regional plans, water use plans and river basin management and conservation plans.

Secondly, there are the sectoral projects administered by ministries or autonomous organs and connected with management of renewable natural resources, especially water; these projects stem from the programmes contained in the national development plans.

In the 1980-1984 national plan the specific policies and global targets for renewable natural resources are set out in the programmes on soil conservation, water resources, irrigation and drainage, and forestry. The first programme is aimed at long-term increase of the farming area through application of measures of soil conservation, restoration and fertilization. It is based on analysis and mapping of the various processes of actual and potential erosion, modification of land use, and integrated management of watersheds. The water resources, irrigation and drainage programme includes a hydraulic systems plan, an irrigation and drainage subprogramme with its respective projects, and big projects being undertaken by regional and sectoral bodies. The implementation of the programme began with the first steps in the construction of 23 irrigation works in the Andean region, which are intended to irrigate 82 000 hectares. In order to prevent problems of competition between various water uses, the programme formulated a plan for rationalization of water resources. The forestry programme includes forestry management and use and river basin conservation. The first component has centred around the training of technicians and forestry workers and studies on the adaptation or restoration of species. The aim in the river basin conservation component is to control run-off in basins which have lost their vegetation cover and produce an inventory of river basins throughout the country in order to establish which stand is in most urgent need of protection and rehabilitation. The total reforestation target for the various projects is 85 000 hectares in the Andean region.

The following programmes affecting the Andean region are contained in the 1985-1988 national development plan:

- . Rural development, with 11 projects designed to benefit 620 000 persons over an area of 1 425 000 hectares.

- . Agrarian reform and settlement, with the aim of completing the legalization and delivery of land titles. The projects in the Andean watersheds are related to the projects of the rural development programme.

- . Water resources, with the aim of achieving multiple water use, halting the deterioration of sources of water and protecting them with measures to upgrade the natural resources. This programme has recently been incorporated in the big water or hydroelectric projects such as: the Jubones multiple-use project; the Tahuín project on storage of irrigation water; the Paute project on generation of hydroelectric power; the Agoyán project on construction of dams and generation of electricity; and the Toachi project on reservoir collection for electricity generation.

- . Natural resources and the environment, where the aim is to preserve and rehabilitate the resources. It includes encouragement of rational use of natural resources in projects in the Andean region and in the watersheds such as: management and conservation of the watershed of the Pastaza and Paute rivers; land use in rural Andean communities; and soil conservation for increased farm output. It also includes the inventory and description of the natural resources with a view to their conservation, protection and development by means of projects on: crop zoning, agrarian regionalization; research on erosion and soil and water conservation; study of integrated river basin management; and inventory and evaluation (quantification) of renewable natural resources.

The following plans formulated since 1980 relate to one extent or another to Ecuador's Andean region:

- a) Development plan for Region I (provinces of Esmeraldas, Carchi and Imbabura). The latter two provinces form the northern sector of the Andean region. The main aims include physical redistribution of the inhabitants of the high-mountain zones to improve conservation and use of renewable natural resources; integration of marginal urban and rural groups in the use of basic social services; promotion of agriculture by reforming the land-ownership structure and supporting the integrated rural development programmes by locating them in zones where the ecological balance can be preserved. The plan includes programmes on: conservation of forestry soils and wildlife; integrated rural development; settlement; agriculture and livestock; agroindustry and handicrafts; irrigation, road transport and construction of local roads; housing, health, education and training; and drinking water and sewerage.

- b) Regional development plan for southern Ecuador (one of the provinces covered by this plan is Loja, located in the south of the Andean region). The development is to be based on: modification of the production structure, with priority for community enterprises; income redistribution to reduce marginality and small-scale farming and reactivate depressed zones;

construction of roads to fill the gaps in the network between the high zone of subsistence farming and the low zone of agro-export farming; ecological rehabilitation and control of the exhaustion of natural resources. The most important programmes and projects are those on irrigation and energy, sanitation, reforestation, agrarian reform, rural development, livestock and timber.

c) Preliminary water plan for the middle and high basins of the Cañar, Paute and Jubones rivers. The main goal is rationalization of water use. The plan includes programmes on: irrigation, where the policy is to reorganize the existing infrastructure and introduce modern techniques on land of limited use in smallholding areas; water supply and sewerage, using springs by preference; energy and hydroelectricity, with an eye to completion of the big installations such as the Jubones and Paute projects, elimination of small power stations, and harmonization of the activities with the guidelines of the electrification master plan; river basin management and conservation, involving the implementation of reforestation projects, construction of water regulation installations where necessary for the rehabilitation of river basins, and preparation of management and conservation plans, with priority for the Paute and Jubones basins.

d) Jubones water plan. The plan's strategy centres around water management as a tool capable of achieving integrated regional development. It includes irrigation programmes for the high and middle reaches of the Jubones basin, with the construction of new systems and restoration or improvement of irrigation ditches and canals in areas where the conditions are precarious. The Jubones multiple project includes agricultural development in the low zone, control of peak flows, hydroelectric development and irrigation channels controlled by dams, and flood control in the lower reaches of the basin. The target of the drinking water and sanitation programme is to provide drinking water supplies for 80% of the rural population, and sewerage and latrines for 30% of the rural population living in settlements. The aim of the river basin conservation project is to regulate the sub-basins and smaller watersheds of the high and middle parts in the light of their potential land use, and in the low part to protect the mangrove swamps with conservation and drainage works. The flood control project combines the construction of works to protect the towns, the river banks and farming area of the lower reaches of the basin, with construction of the Minas dam to control the torrents and flood waters which occur in the upper reaches.

e) Project on conservation and management of the Paute river basin. The formulation of this project was completed at the end of 1985, and its purpose is to reduce the present levels of erosion and the sedimentation of the reservoirs of the hydroelectric plant which is being built in the middle reaches of the basin, to devise forestry, agriculture and livestock techniques to improve land management and increase the output of the peasant population, and to improve these people's living standards. Priority is given to: reforestation of 20 000 hectares around the critical dams and in the degraded sub-basins which deliver most of the sediment; management and training of torrents and streams in these critical zones; peasant training and extension programmes; and research on local erosion. These projects are incorporated in general programmes on management of agricultural areas,

regulation of the basin, and community organization and integrated development.

f) Project on management and conservation of the watershed of the Pastaza. The analysis and basic studies phase of the project began in 1985; the phases of selection of priority areas and formulation of the plan for management and conservation of the watershed's natural resources should have been completed in 1987.

The specific goals for 11 sub-basins are: rational use of the natural resources and improvement of land use; protection of the irrigation, sanitation and road infrastructure and of the installations of the Agoyán hydroelectric project located at the Andean source of the Pastaza river; protection of water resources for domestic use; and promotion of the involvement of the rural population in the use and conservation of the renewable natural resources. The analysis takes a conservationist approach; the problems were identified by means of a matrix of regional indicators which made it possible to classify the hydrographic units on the basis of their degree of crisis.

4. Peru

A number of bodies are active in Peru's Andean region, performing functions related to: natural resource management; agrarian reform; peasant training; agricultural research and promotion; health and sanitation; mining; the financial-banking system; and meteorology. Activities are also carried out by multi-functional global development institutions such as the departmental development corporations, or academic institutions such as the universities.

The extent of coverage provided by these institutions depends on the approach taken and the way in which the various laws enacted for the development of high Andean zones and watersheds are applied. The main laws include:

1. The national budget law, which authorizes the departmental development corporations to sign investment agreements for both works and studies on the basis of direct administration. Most of these agreements have been concerned with reforestation, farm output and transport. The priority given to the forestry subsector has limited the possibility of carrying out an integrated management policy for water, land and vegetation.

2. The general water law, which is concerned with the efficient use of water for agricultural purposes, especially irrigation. Attention has focused on reforestation of watersheds, channelling of river beds, and anti-erosion measures, and on the establishment of a machinery to regulate the maintenance of water quality. In practice, however, the water protection provisions have not been given effect owing to the lack of prior treatment of tailings and waste water by the mining companies operating in the region. The law contains no measures to correct the damage caused to the ground water of the valleys by the faulty management of the watersheds.

3. The land classification law, which is designed to secure proper use of the land in the light of the ecological characteristics of each subregion;

this has required the quantification of the ecological factors and determination of techniques for classification in groups by water-use capacity. These groups have been defined in terms of their suitability for farming in clearings, permanent crops, grazing, forestry production, and agricultural protection and promotion. This classification must be more widely disseminated among the inhabitants and the institutions in order to prevent the excessive subdivision of the land into small plots which is responsible for the destruction of productive forests and aggravates erosion.

4. The forestry and wildlife law, which regulates use and conservation of these resources, for which purpose the territory is subdivided into forestry districts corresponding to river basins and not to natural regions. The law contains five regulations, covering inter alia the extraction and processing of forestry products and the conservation of forest flora and fauna. Financial restrictions have limited the scope of this law to surveillance work, with the postponement in many cases of specialized activities such as monitoring of forests and preservation of their quality.

5. The agrarian reform law, which encourages increased farm output and productivity through reform of the system of ownership, tenancy and use of the land. In order to attain these goals, regional agrarian reform offices and peasant-farming research and training centres have been set up. Their work has resulted in the formation of agricultural co-operatives and social-development agricultural associations. However, many of these bodies are undergoing reorganization or are collapsing, mainly because of lack of continuity in the training of the peasants and insufficient assistance in the business management of the organizations which have been created.

In addition to these institutions and laws, there are plans, programmes and projects for the development of the sierra and the Andean watersheds of Peru. The regional or departmental development plans formulated since 1971 specify a number of goals which can be summed up as: promotion of small- and medium-scale mining; maximum exploitation of mineral resources; increased agricultural productivity; extension of the agricultural frontier; development of tourism; consolidation of intermediate urban settlements; and promotion of the development of hydroelectric resources.

Natural resource conservation and improvement of the living conditions of the inhabitants of the high-mountain zones are included as goals in several plans of national scope, such as the plans on regulation of water resources, reforestation, health, housing, and road infrastructure.

The programmes and projects for Peru's high Andean region began with the aim of first providing assistance in critical areas and then continuing with sectoral activities. They subsequently moved towards the integrated planning of smaller areas with local public participation.

The following are the main current programmes with projects executed since 1970:

- . The small ruminants project is designed to improve the production systems for goats, sheep and domesticated South American camelidae, including a national inventory of the available natural resources and using techniques

suited to the social and economic conditions of the stockmen ("La Molina" National Agrarian University, the Veterinary Institute for Tropical and Mountain Research (IVITA) and other bodies are participating in the project, which is financed by USAID).

- . The plan for improvement of irrigation in the sierra (Plan MERIS, Stage I) is designed to combine and improve farming units (13 500 hectares), boost farm productivity and output in the departments of Cajamarca and Junín, and raise the living standards of 10 600 families living in the project area. Stage II of the Plan covers the Vilcanota river basin.

- . The project on new irrigation areas in the sierra is concerned with new irrigation studies in priority zones with a view to extending the agricultural frontier and reducing migration to the cities. Lines of financing will be created for the construction of works and farm development. As far as possible, the subprojects will form part of the plans of the departmental development corporations (CORDES).

- . The project on assistance to forestry plantations for energy-production purposes and for development of rural communities in the Peruvian sierra promotes forestry regulation and the efficient use of timber by Andean peasant communities; a vital component is community training in forestry consumption and commercialization. The project has the support of FAO and the Government of the Netherlands and is being implemented by the National Forestry and Wildlife Institute (INFOR).

- . The national programme on river basin management and soil conservation is concerned with promoting soil and water conservation techniques in river basins in order to check erosion, increase the region's production capacity, and raise the living standards of rural dwellers. The physical targets of the programme's first stage (called national project for water and soil conservation in river basins) were the establishment 6 684 evaluation areas and 26 treatment sectors. The first stage was supported by USAID. The current programme was established in January 1988 by Supreme Decree 002-88/AG.

- . The programme on rational use of hillsides applies exclusively to Ancash department. The aim is large-scale training of hill farmers to improve their capacity to provide enough food for their families and prevent the erosion of hillsides; this is to be achieved by introduction of crop rotation, construction of stone walls and creation of fields to facilitate permanent conservation and increase the yield capacity of the pastureland by producing organic matter.

- . The programme of the Forestry, Agriculture and Livestock Service (SESA) of Cajamarca National University has among its objectives the establishment of a permanent link between the restoration, use and conservation of renewable natural resources and integrated rural development. This link will be established by means of multisectoral measures with organized community participation over 10 000 hectares in Cajamarca department.

. The Centre for Audiovisual Training Services (CESPAC) carries out training projects using audiovisual methods designed to impart techniques to raise output and productivity in the farming and forestry sector; audiovisual methods will also be used to try to involve the peasant in the conservation and rational use of renewable natural resources. The project is supported by UNDP and FAO.

. The programme on agricultural revival and food security was formulated only recently and its aim is to offer greater economic and financial incentives for the production of basic consumer foods. It is based on the introduction of measures to raise the production capacity, generate rural jobs and diversify the diet. The measures include: the establishment of guaranteed prices as incentives; the reduction of interest rates on farm loans; elimination of import surcharges on farm inputs; creation of a fund for agricultural revival and establishment of reserve food stocks.

. The national programme on Andean farming systems also came into operation only recently. It complements the previous programme and is designed to improve the living standards of the rural population of the Andean zone by identifying and adapting improved farm production techniques. It covers four ecoregions --homogeneous production zones with similar characteristics in terms of ecological, farming and livestock patterns.

. The programme for the development of microregions in a state of economical and social crisis of the National Planning Institute is the most significant strategy for the Andean region at the present time. The approach is based on the generation of higher value in the most depressed rural zones in order to enable producers to play a more active part in the small local markets and subsequently in the regional and national markets; this will strengthen the community organizations.

The aim is to transform the traditional role of the marginal peasant by improving equilibrium in the geographical distribution of production by means of modifying primary production within the sierra; the driving-force of the revival of rural areas is their intrinsic natural, economic and sociocultural potential represented by water, land, mines, hydroelectricity, handicrafts, and man's interaction with his environment.

Implementation of the strategy will require identification of the less dynamic zones in the sierra which are impeding the effort to develop the country, i.e., critical zones for the achievement of integration.

The revival of these critical zones will be achieved on the basis of microregions defined as areas within a critical or strategic zone whose boundaries are determined naturally by the socioeconomic dynamics which are generated, for this approach will gradually incorporate other areas in the process until a whole river basin has been covered. The river basin will be the basic unit of the horizontal integration of the revived microregion to be achieved through the joint action of services, production and the people.

The aim of the microregional development programme is to direct the development strategy for the sierra towards three basic areas: the land, involving the creation of strategic zones of concentrated action (ZEAC); the

institutions, involving the reorganization and decentralization of institutions to make the management of the strategy more efficient; and technical measures, with the proposal of new or remodelled methods of programming, implementation and evaluation.

This development "from the inside" is a gradualist strategy, since the redirection of the resources used in the coastal region cannot be automatic or sudden; it must be selective, for the use of the resources and the different approaches taken will be determined by the heterogeneous nature of the Andean region; and it must be long term, since the state of degradation of the region's physical environment implies a long recovery process. Other projects include: the pilot project on Andean ecosystems based at Cajamarca and implemented with UNDP assistance; the agreement between Peru and New Zealand on technical co-operation to increase the output and productivity of high-yield and low-cost fodder crops. This agreement is concerned particularly with improvement of the sheep population, which is in contradiction to the local need to raise native animals, especially alpaca. The vicuña project began in 1965 on 6 500 hectares of grassland at Galeras in Ayacucho department, with about 1 000 head of vicuña. With the help of the World Wildlife Foundation, the International Union for Conservation of Nature and Natural Resources and the Government of the Federal Republic of Germany, as well as of hard-working Peruvian and German scientists and park rangers, the vicuña population had increased by 1979 to 43 000 head on 500 000 hectares. At this rate the population will reach one million in 30 years.

5. Bolivia

The legal and institutional tools used for the development of the Bolivian altiplano are many and dispersed, especially those related to water management. The lack of a national organ with authority to regulate the use, development and conservation of renewable natural resources has obstructed the formulation of coherent regional strategies; the programmes and projects have usually been responses to ad hoc policies resulting from institutional changes, financial crises or natural disasters.

Three developments since 1980 have produced a fuller picture of the functioning of Bolivia's high Andean region: the creation in 1980 of the National River Basins Department in the Ministry of Peasant and Agricultural Affairs (MACA); the government's emergency plan for 1982-1983; and the MACA investment plan for 1987-1990, which contains a number of programmes and projects in operation administered by decentralized bodies in the farming sector.

The National River Basins Department is responsible for subdividing the territory into river basins and sub-basins with a view to regulating and planning the development, management and conservation of renewable natural resources and formulating and co-ordinating multidisciplinary projects for the revival and development of river basins and sub-basins and of policies for land and water use and management.

The programmes and projects on river basin management in the altiplano

described below were identified and co-ordinated by the National River Basins Department.

The main irrigation projects include: the Taraco project in La Paz department for the exploitation of the water of Lake Titicaca by means of four pumping stations and reservoirs and canals which will irrigate 4 000 hectares and benefit 1 600 families; the Tacagua project in Oruro department for the rehabilitation and improvement of national irrigation system No. 2, covering an area of 4 100 hectares and benefiting 700 families; and the Ulloma project in parts of the departments of La Paz and Oruro, for the irrigation of 36 000 hectares and benefiting 7 000 families. In addition, two national projects are being carried out: one on the inventory of water resources, and the other on control of water and land pollution.

The national emergency plan (April 1983) proposed a programme of winter crops for 24 000 hectares in the Andean region and gave priority to animal health care in the altiplano. The aim of the plan was to secure the rapid recovery of output capacity, especially in the altiplano, and to control and reduce the abandonment of rural land and migration to the urban centres.

For implementation purposes the plan was subdivided into five programmes:

- Credit to finance sowing and harvesting in 1983 and 1984, as well as inputs and seeds.

- Farm production, especially of basic foods, with extension of the area sown and provision of technical assistance to raise yields. The altiplano departments (La Paz, Oruro and Potosí) received 15% of the programme's total investment.

- Seeds, for the purchase, storage and distribution of seed potatoes.

- Livestock, to preserve the genetic potential and reduce livestock mortality in the altiplano by means of assembly and distribution of dietary inputs and vaccination against diseases.

- Food supply, based on the 1983 output, for distribution to the rural population, and imports for the urban consumption centres.

The plan also included short- and medium-term irrigation programmes. Seventeen projects for the altiplano were identified in the three departments, involving the construction of 200 storage tanks, 1 300 kilometres of canals, 1 100 kilometres of local roads and 425 wells --the infrastructure required for the irrigation of 30 000 hectares benefiting 26 500 families.

From 1984 the regional development corporations of the altiplano departments took charge of the operation of programmes and projects with a longer time horizon and began to implement several rehabilitation programmes in various areas and sectors.

In 1986 Bolivia's Ministry of Peasant and Agricultural Affairs formulated the agricultural policy and an investment plan for 1987-1990. This document was drawn up on the basis of a macroeconomic sectoral analysis and it lays down strategy guidelines on the institutional framework, agrarian structure, natural resource development, development of new land and internal migration, rural development, output and productivity, prices, domestic and foreign trade, farm credit and investment. The investment plan contains a group of projects currently being carried out by MACA and 10 other institutions concerned with the farming sector. The Andean section has the following projects:

- Rural development of inter-Andean valleys in La Paz department to introduce and adapt natural resource conservation and management techniques and build marketing and production infrastructures, all with the aim of improving the living conditions of the Andean population.

- Rural development of the Copani river basin, a complement to the previous project, to rehabilitate 600 hectares of the Chuma irrigation system and stabilize the soil on 300 hectares.

- Agricultural development of northern Chuquisaca, a multi-institutional project covering the high parts of the Andean departments of Chuquisaca and Potosí. It is divided into four subprojects: sheep production, development of technology, farm credit, and forestry development, each in the hands of a different institution. The goals are genetic improvement, transfer of technology to communities, and diversification of forestry species as a means of improving erosion control.

- Agricultural development through small irrigation works, covering a vast area of the altiplano in the three departments. The aim is to build and bring into operation small irrigation systems, using sources of surface and ground water, and to rehabilitate other existing systems. The irrigation area totals 2 000 hectares.

- The altiplano and valleys irrigation programme covers low areas in Cochabamba department and the La Paz altiplano. The aim is to introduce new irrigation systems and control soil humidity with a view to developing 15 000 hectares for peasant production. The works include earth dams, diversion dams, intake installations and canals.

- The cattle improvement project in the La Paz altiplano proposes to increase the cattle population of the altiplano with dual-purpose animals and to raise output of meat and milk. Herds will be formed for peasant communities, which initially will work with native stock, receiving training in genetic improvement and livestock management; fields for annual fodder crops and permanent pasture will also be established.

- Forestry research in the Bolivian altiplano is aimed at the identification of species well adapted to the Andean zone; research coppices have been established where the growth and adaptation indices will be recorded; fast-growing species have been selected.

- The altiplano fish-farming centre is concerned with saving the trout from extinction and restoring it; fish-farming techniques will also be diversified by means of transfer of specialized technology, with a view to increasing the production of proteins and thus improving the people's state of nutrition.

- The rural development programme covers small community and intercommunity projects in the departments of La Paz and Oruro and the Andean zone of Chuquisaca. The aim is to improve the incomes and living standards of rural Andean communities through sectoral activities such as construction of production infrastructure, small-scale industries and handicrafts. There are 100 projects in various stages of formulation and implementation, and it is thought that they might serve as models for future projects on rural community development in the altiplano.

V. EVALUATION OF PROGRESS ACHIEVED IN THE DEVELOPMENT OF HIGH ANDEAN ZONES

The main objective of the development of the high-mountain zones is to meet the needs of their inhabitants and users while at the same time conserving their natural resource base. Satisfaction of the inhabitants' needs can be expressed in terms of living standards: for example, standards of health, nutrition, housing, security or employment. On the other hand, satisfaction of the needs of the users, who do not necessarily live in the place, is usually expressed in terms of output, foreign exchange or social stability. Account must also be taken of both current and future demand, for the satisfaction of needs must be consistent with the principles of environmental protection and conservation. Accordingly, one way of evaluating the development of the high-mountain zones is to compare the current level of satisfaction of the needs of the inhabitants and users of the place with the level which they themselves desire.

Another important method of evaluation is to compare the current use of the resources of the high-mountain zones with their potential use; this will indicate what is required and what can be achieved with respect to use and conservation of the available resources in order to raise output and productivity. The parameters are usually obtained from the productivity achieved on experimental stations or in places where a given output is better than the average for the areas evaluated. For purposes of these assessments it is essential to know the total potential of a given output, multiplying the productivity per unit of area by the total area suitable for the item in question. Taking this result as the reference point, it is possible to calculate the investments and operations needed for improving output and productivity in a given zone up to the desired level and to estimate the probable impact on the improvement of the inhabitants' living standards. In Peru, for example, studies indicate that the current vicuña population of the high pampas or plateaus is about 50 000 head. Given the per hectare distribution of this population and the fact that there are 18 million hectares, it is possible to establish a maximum potential capacity of 3 million vicuña on the high plateaus. In the light of this theoretical maximum, it is reasonable to set a target of 0.5 million head, subject to market conditions and other factors of competition. It is then possible to

formulate vicuña management programmes and set annual targets for increases in stocks and their utilization, with a view to achieving the global target in 20 or 30 years. The same can be done in the case of land suitable for irrigation, which is thought to be 25 to 30% of the Peruvian sierra. The same calculations hold good for the areas of terraces requiring rehabilitation in Peru, estimated to be as much as 750 000 hectares.

With this information it is possible to establish which action options are advisable and what contribution each option being carried out today is actually making to narrowing the gap between the current and potential uses of the resources. These strategies can be evaluated not only in terms of achievement of specific targets but also with respect to satisfaction of the needs of the inhabitants and users. It is likewise possible to determine whether the current projects and programmes are all that is required.

So far, however, owing to the scarcity of information about the high-mountain zones it has not been possible to make a full evaluation of the effectiveness of each programme and project. Although many of them have quantified targets, for example to irrigate 20 000 hectares in the sierra in five years, there is not necessarily any subsequent assessment of the results obtained. Other projects and programmes do not have quantified targets, so that it is almost impossible to know how their implementation has worked out. There is even less information about the relative impact of each project or programme on the attainment of the resources' use potential or the desired improvement in the inhabitants' living standards. As a rule, the statistics merely indicate how many health posts, schools or kilometres of road have been built in a period, but nothing is said about what remains to be done to keep pace with the growth rates of population and demand, or about the obstacles encountered. Nor is it possible to determine whether the projects and programmes in operation are properly co-ordinated with each other and whether they were in fact the best available options in the conditions in which they were formulated and implemented.

This lack of data is being corrected as detailed studies are carried out on the natural resources and socioeconomic conditions of specific areas such as watersheds and microregions; as a result, evaluation of the effectiveness of State action to benefit these zones may be gradually improving. It might even be possible to establish how the policies, laws and regulations enacted by the State to benefit the high-mountain zones are being translated into concrete activities on behalf of their inhabitants and users.

For the present and until more information is available, the following evaluation is confined to a list of achievements and constraints with respect to the main activities undertaken by the Andean governments in the high-mountain zones.

1. Venezuela

a) Achievements

The continuity of the watershed conservation programmes with the projects on conservationist social infrastructure and stream and torrent training in the watersheds of the rivers Boconó, Chama, Uribante and Motatán has promoted interinstitutional co-ordination and facilitated agreements on institutional co-operation with regard to budgetary allocations and execution of projects in such sectors as health, transport and communications, and electricity.

In the High Valleys farm development programme the irrigation committees have joined with the institutions of the farming sector to solve the problems of obtaining credit and access to marketing channels in each area of influence of these committees.

The technological adaptation of the irrigation infrastructure to the various types of farm production has led to a degree of integration in the high Andean zone (High Valleys farm development programme); renovation, use of fertilizers and control of pests and weeds have been improved on the coffee farms which cover a large part of the productive area of the Andes (coffee-growing programme). Demonstration plots have been established and the peasants have been involved in the preparation of projects on cultivation of temperate fruits.

There has been a significant decline in the sedimentation of the basins of the rivers Boconó and Motatán (watershed conservation programmes). Coffee processing and collection centres have been established in Táchira and Trujillo states (High Valleys programme), and five trout-farming stations have been set up in Mérida state, resulting in a 75% production increase between 1981 and 1985. A large number of marginal zones have been developed for intensive dairy farming through the establishment of 170 pilot production units.

The watershed conservation programme has been fully implemented with respect to investments in the Uribante watershed, 85% implemented in the Boconó (conservationist social infrastructure) and between 70 and 75% in the Chama watershed. The proper use of the irrigation installations of the High Valleys farm programme raised productivity by 12% for vegetables and by 33% for potatoes in the period 1977-1985.

The conservation subsidy programme has enabled the inhabitants of the high zone to increase their output and incomes and thus to improve their housing. Under the agrarian reform programme a large number of families have been relocated to peasant settlements in the past five years; in every case, technical assistance has been provided and road access improved. The soil rehabilitation and conservation projects of the High Valleys farm programme and the provision of social infrastructure have helped to slow down the rural exodus, to concentrate the peasants on the most suitable land, and to extend the agricultural frontier, as well as rehabilitating the existing farming land.

b) Constraints

The administration has run into problems resulting from the dispersal of decision-making among a large number of central and regional institutions and bodies, which has divorced the planning of policies from their implementation. The following are the main problems:

- Management: watershed conservation activities are widely dispersed and ad hoc in nature owing to the improvised formulation of policies and the relative lack of agreed criteria among institutions on the formulation of coherent conservation and management plans. The natural resources are managed in isolation and from narrow viewpoints by teams of experts; this adversely affects the management of public investment. Knowledge of natural resource management is neither systematic nor explicit.

- Technical: there is very little information about the water resources and socioeconomic conditions of the watersheds and there has been little research into the improved use and exploitation of the renewable natural resources of these watersheds, so that it is impossible to make full use of the plans and projects prepared by the Ministry of the Environment and Renewable Natural Resources. The conservationist measures have focused mainly on river and torrent training; these measures are not properly evaluated, and this prevents adjustment of the original plans or programmes.

Common problems in the main watersheds are: indiscriminate removal of the vegetation cover; overuse of the land; relative neglect of soil conservation practices in vulnerable areas; mining (metallic and non-metallic) using techniques which alter the environmental balance; unregulated extension of the agricultural frontier; chaotic construction of road infrastructure; and insufficient concentration of population and economic activities. These problems originate in the functional structure of the Andean region and in the dispersal of functions and lack of co-ordination among the bodies responsible for regulating the settlement and utilization of the watersheds, and they have resulted in: alteration of the hydrological system; accelerated erosion, clogging and sedimentation of hydraulic installations with considerable reduction of their useful life; flooding; alteration of the ecological balance and serious difficulties in the biological control of the animal population; and reduction of the watershed's production capacity.

The general problems stem from the functioning of the public sector with respect to resource allocation. The State apparatus has tended to strengthen non-productive economic activities, especially in areas of dense urban concentration. The allocation of resources is uneven from the interregional standpoint, and the Andean region receives the smallest budgetary allocations; and the meagre resources have been directed to the least important sectors.

- High Valleys farm development programme: small and widely scattered farms are the rule, making access more difficult and irrigation systems more expensive. Infrastructure works predominate in the irrigated area and there is an imbalance between construction activities and production services. Credit facilities are few and improvised, and this, in conjunction with the

lack of organization of the peasants, results in underuse of the land brought under irrigation and in conflicts over the use and distribution of the water. Little importance is attached to projects on land development and conservation of farmland soil, and this limits the extent of intensive farming.

- Agrarian reform programme: land has been allocated mainly in the flat and more fertile areas, and agrarian reform in the Andean region has received no priority. The peasant settlements are very unlikely to consolidate their holdings as they have been located on low-yield land; this has led to displacement of the farm labour force and emigration to the cities.

- Coffee-growing programme: the predominance of small producers fragments the available credit and dilutes the technical assistance. The planted area is not properly managed and maintenance work is progressively declining.

- Fruit-farming programme: limitations and suspension of the budgetary allocation after three years in operation. The technical assistance activities do not have enough personnel or logistical support in field work. Reduced industrial processing capacity.

- Upland cattle programme: increased cost of the imported stock used on the pilot farms. Cut in budgetary allocation for the technical assistance which is the basis of the programme. Investments surties beyond the means of small producers.

- Trout-farming programme: climatic variations have caused diseases in the trout. There are financial obstacles to the import of the necessary food. Trout consumption is low because the people are unaware of its food value.

2. Colombia

a) Achievements

The Cauca Valley Corporation (CVC) has been responsible for electricity production and distribution which reached 2 272 GWh in 1985, serving 450 000 persons in urban and rural areas.

The stream flow increased by 38% between 1976 and 1985, with 5 071 users in 1985.

The river basin management programme showed the following results in 1985: preparation of control and supervision plans for six sub-basins; farm planning and technical assistance for 1 878 properties with a total of 6 328 hectares; commercial reforestation on 3 934 hectares and protective reforestation on 225 hectares; 61 water projects for 5 035 recipients; rural electrification for 20 000 recipients; and soil studies for 756 000 hectares.

In 1985 the programme of technical farming assistance and conservation completed: land use and management zoning of 212 000 hectares in three sub-basins; erosion studies for 100 000 hectares in two sub-basins; salinity

studies for 1 585 hectares on nine farms; soil fertility studies for 1 722 hectares; updating of land use and landholding system for 878 properties in nine townships; and technical assistance for 700 fish-farming tanks. Primary drainage works were constructed on 5 000 hectares under the land improvement subprogramme.

One of the obstacles to the evaluation of these results is the fact that the CVC operates on the basis of an annual budget, so that the targets are subject to the percentages established for the implementation of programmes in the various sub-basins. This is an important a priori constraint, for there is no long-term development plan covering the area of jurisdiction as a complete physical unit, and the regulation plans prepared for the sub-basins are not interdependent.

b) Constraints

Basic soil information for farming is incomplete for the whole Cauca basin, but especially for the high or hill zone. Present land use in the high zone does not make full use of the potential, owing to the invasion of forestry land by livestock, which impedes the execution of reforestation and forest protection projects. The soil in the high zone is of poor quality, so that it is difficult to raise productivity, a situation exacerbated by the lack of a crop diversification plan which might improve the land's productivity.

The main problem in the low or flat part of the basin is the floods which persist owing to lack of installations to underpin the regulation of the Cauca river and the lack of irrigation in some subsectors.

In the Saldaña basin the achievements of the programmes and projects executed or being executed by CORTOLIMA date to the period preceding the preparation of the plan for the basin's integrated administration and management (1982-1985). There is no systematic and reliable evaluation of the goals achieved in that period. The integrated plan came into operation in 1986, too recently for any assessment of the actions undertaken. The following are the main obstacles to the basin's development, as indicated in the basic studies for the formulation of the plan:

Physical: 77.4% of the area is land suitable only for forestry or for maintenance of the vegetation cover. Eighty per cent of the area is treeless land where grazing and agriculture are established. The forestry resource is of little importance owing to its overexploitation in areas of easy access.

Water is poorly distributed in relation to the demand, especially in places where optimum use could be made of it. The serious erosion visible on most of the basin's land has resulted in a significant deterioration in water quality, with high levels of sediment charge. Chemical pollution resulting from the intensive use of pesticides and fertilizers is high, especially in the sub-basins with greatest development potential.

Infrastructure: the lack of roads in comparison with the departmental and national averages is regarded as a basic constraint in the basin; in

addition, the cost of the works is high owing to the area's rugged topography. The limited coverage of drinking water, sewerage and electricity services, which is a worse problem for the rural population, is illustrated by the fact that only 15% of villages (veredas --the smallest political/administrative unit in rural areas) have piped water, which means only 11.5% of rural households; 98% of villages have no sewerage; and 70% have no electricity supply.

The Saldaña basin has serious deficits in health, education and housing, with the rural sector again the most seriously affected. The indices for health services are less than half the national averages; infant mortality is 73 per thousand, with malnutrition the basic cause of 60% of these deaths; almost 100% of rural housing is built of material considered unstable, as against 50% in the case of urban housing.

Production and technology: the main problem is the lack of research into disease-resistant varieties, pest and weed control, and management of the use of fertilizers, all of which obstructs the faster development of the basin's main crops (rice, sorghum, cotton, sesame, potatoes, plantains and cocoa). The main problems with respect to animal fodder and cattle farming stem from the wetness of the soil and the peasants' ignorance of management and health practices.

In the past two years CORTOLIMA has made a partial assessment of the main programmes executed in the basin, based on a subjective evaluation method which classified the problems by their degree of intensity. This exercise shows that the main obstacles relate to soil conditions and the need to declare the Saldaña basin a regulated area.

3. Ecuador

a) Achievements

The 1980-1984 National Development Plan included inter alia seven priority projects on the exploitation of renewable natural resources of the Andean region. The following are the results of these projects, all of which are in operation:

1) Afforestation project: within the framework of the integrated rural development projects, 60 000 hectares have been planted, using systems of forestry recruitment. The completion rate of the programmed investments is 32.2%.

2) Jubones multiple project: important points were the establishment of a national and regional irrigation fund and the formulation of the Jubones river water plan in 1985. The completion rate of the programmed investment is 51.6%.

3) Tahuín project (storage of water for irrigation): the supplementary works such as access roads, excavation and removal of material to prevent sedimentation of the reservoir under construction have been completed. A

large number of temporary jobs were created; 60.5% of the investment target has been achieved.

4) Integrated rural development programme: seven of the 17 projects formulated have been implemented, consolidating the incorporation of the rural development subsystem in the national public administration system; the supply of farm goods has been expanded and diversified in the project zones, and improvements have been made in the irrigation and road infrastructures. Forty-four per cent of the programmed investment had been completed by 1984.

5) Paute project (generation of hydroelectric power): 50% of the total capacity of 1 000 mW was installed in 1982 and the remaining 50% in 1986. This latter year also saw the formulation of a management and conservation plan for the Paute river basin, as a result of the effects caused and suffered by the hydroelectric project. The sums invested exceeded the programmed amount by 6.3%.

6) Agoyán project: the aim is to harness a large waterfall by building a reservoir to establish an installed capacity of 150 mW which was to come on line at the end of 1987. By 1985 62% of all the civil engineering works were under way; this has had a considerable effect on employment. The investment is 9.2% over the programmed amount.

7) Irrigation systems: up to 1984 13 new irrigation projects were constructed, six average-sized irrigation projects were improved and maintenance work was carried out on 232 small installations. The irrigated area in various Andean subzones has thus been increased by a total of 18 000 hectares, representing 65% of the target programmed in 1980. The programme has included a complete evaluation of the irrigation potential and the basic studies for the formulation of a plan for rationalization of water use; 92.3% of the investments programmed in 1980 had been made by 1984.

Projects on irrigation, integrated rural development, farming development, peasant community development, and agrarian reform and settlement are also being carried out or have been completed in the Andean watersheds. In the majority of cases these projects have been concerned with the realization of the potential and not with the solution of problems and constraints. Most of them have little connection with the formulation of regional analyses or with an integrated strategy for multisectoral development.

Carchi and Chota river basins: here the emphasis is on irrigation projects, and the main constraint is technological. The projects in operation and under construction cover 20% of the farming land in the watersheds. Sixty per cent of this land actually requires attention. Only one integrated rural development project has been carried out since 1985. The ratio of the project area to the recipient population is 2.2 hectares, a low figure in view of the serious overuse of the land in the Chota watershed.

Projects on industrial dairy farming and forestry exploitation are also being carried out in these watersheds. By 1985 1 000 hectares had been reforested out of a total of 5 000 hectares to be completed by 1990.

The targets in terms of area of farmland are high, but the activities will be carried out on plots of an average size of 8.6 hectares, so that the recipient population will be fairly selective.

A large number of hectares have been allocated under the agrarian reform programme, but the average plot size is 15 hectares, which means that the problem of excessive population density will remain unsolved.

Patate and Chambo river basins: the sectoral projects are concerned with natural resource use. There are 11 irrigation projects in operation, and the irrigation target represents 18% of the farming area. The hectares actually irrigated represent 61% of the programmed target. The average plot size of the recipients was reduced from 3.6 to 2.2 hectares, and the cost of an irrigated hectare rose by 7.5%.

These watersheds are the location of 50% of the rural development projects. The size of the properties and the investment per family are consistent with the character of this area of smallholdings with a large production potential. The main achievements have been in forestation, land titles, and service infrastructure. This zone contains 28.7% of the area and 46.6% of the families benefiting under the agrarian reform programme for the whole Andean region. Forty thousand hectares in the basins have been affected; however, the recipient families represent only 4% of all rural families in the provinces in which the watersheds are located.

Cañar, Paute and Jubones river basins: the most important constraints in these river basins are the lack of irrigation and the serious level of soil erosion. The irrigation projects in operation cover 12% of the basin's farming area. They are mostly small projects drawing water from rivers with small flows.

The two integrated rural development projects in operation have produced good results, especially in their coverage both of farming area and of recipient rural families (7 and 11% of the respective totals in the Jubones river basin). The agricultural targets have been exceeded by 40% of the programmed figures and by 50% in the case of livestock (cattle population); the proposals for water, sanitation and road systems have been carried out.

The allocation of land under the agrarian reform programme has met a target of 39 026 hectares in these river basins. The recipient families represent less than 1% of all rural families. The average size of the allocated plot was about 50 hectares, which did not solve the serious problem of fragmented landholding.

The smaller physical targets for health infrastructure were exceeded in 1980-1984 (health posts or clinics) but at the cost of non-attainment of the targets for building of hospital centres. Fifty per cent of the physical targets were met in the case of basic sanitation (drinking water and sewerage). In rural housing only 13.7% of the programmed housing was built or improved, so that about 200 000 inhabitants were unaffected. In rural education, the classrooms built amounted to 66% of the programmed figure; 65% of the literacy target was achieved, which meant that 23% of the illiterate

population became literate, as against the 37% planned for the five-year period.

b) Constraints

The watersheds of the high part of the Ecuadorian sierra share common problems such as overuse of the land, serious erosion, proliferation of smallholdings, lack of irrigation, and precariousness of the people's living conditions. The following are the most important constraints, by river basin:

Carchi and Chota river basins: there is no application of improved cultivation and irrigation techniques which prevent soil exhaustion. There is little irrigation in relation to the irrigation capacity of the farming land. The land is overused and the population overconcentrated in certain high parts of the watersheds. Only 25% of the rural population of the watersheds has basic services. The climate is very dry and the high land is difficult of access.

Patate and Chombo river basins: the vegetation cover has disappeared from most of the land in these watersheds owing to indiscriminate felling of protective and productive trees. Erosion is intense in the upper parts, and the lower parts do not have the infrastructure which would protect them against sedimentation. Run-off is therefore high. Living conditions are precarious in the upper reaches inhabited by Indian communities. Here only 15% of the population is reached by services and the illiteracy rate is about 50%.

Cañar, Paute and Jubones river basins: the main problems are lack of irrigation and insufficient crop diversification, which limit the present resource-use capacity.

Erosion affects about 40% of the soil in the middle and high reaches where large numbers of the smallholdings are located. The pressure on the resources has caused a rapid drop in per hectare yields in recent years. The rural population is widely scattered, and this makes it even more difficult to provide basic services (they reach 35% of the population). Forty per cent of the inhabitants are illiterate.

Loja watershed: the main constraint is the poor quality of the soil, which is not really suitable for agriculture. The per hectare yields are far below the regional and national averages. Only two crops are grown on the cultivated area. The problem of excessively small plots and intensive land use has resulted in the underuse of the land suitable for grazing. The watershed's rugged relief, with its steep mountain ranges and deep ravines, has impeded the execution of irrigation, communication and land-use regulation projects.

4. Peru

a) Achievements

The results obtained in the development and management of Peru's Andean watersheds will be considered in the light of an analysis of the Cajamarca and Condebamba river basins.

The Cajamarca river basin covers 210 000 hectares in the north-east part of the Peruvian Andes; this land is underused, a situation aggravated by a climate which limits the possibilities of cultivation and per hectare productivity. There are sharp contrasts in land use: the flat areas of the valley are occupied by livestock, and the dry eroded hillsides by a proliferation of crops.

The water supply is extremely seasonal; unirrigated farms have low yields and high risks owing to the annual and interannual droughts. Most of the irrigated area is in the lower parts and is used for diversified agriculture with cultivated fodder crops predominating. This is the so-called milk basin of Cajamarca, which obtains its water supplies from the subsoil by means of open-cut wells or springs.

Results have been obtained in farm production through implementation of: the special project for small and medium-sized irrigation installations in the sierra (MERIS); the national programme for river basin soil and water conservation; and the integrated rural development programme for forestry, agriculture and livestock. These three programmes regard the Cajamarca river basin as one of their pilot zones.

i) Farm output: the special project for small and medium-sized irrigation installations constructs small regulation, storage, channelling and distribution installations, by means of which 3 400 out of a target of 10 000 hectares had been improved by 1985. The project has benefited 2 253 families and generated about 900 jobs. On average it has tripled the per hectare yields of basic upland crops such as maize, wheat, potatoes and rye.

The national programme on river basin management and soil conservation promotes conservationist practices in trial zones. In the Cajamarca basin the most effective and sustainable means of erosion control has been absorption terraces. A considerable increase in yields was achieved by this means: 41% for potatoes, 66% for wheat, and 12% for maize.

The programme of the Cajamarca forestry, agriculture and livestock service has resulted in the establishment of a model community which uses the natural resources of hill land in the sierra in the light of the interests and needs of the inhabitants of the high Andes. This model uses intensive farming techniques on land of proved agricultural worth; this reduces the danger of erosion. Some experiments carried out under the programme have raised yields ten-fold over the present output.

Industrial farms have been established in areas suitable for fruit-growing. The programme also plans to establish forestry parks, such as the Aylambo park in Cajamarca, to consolidate the model community. The park

occupies an area of 14 hectares which was formerly unused; the soils have been rehabilitated and the hydrological cycle reestablished by use of conservationist measures (construction of terraces and water collection and distribution systems). Forest occupies 9.5 hectares of the park, with 5 600 eucalyptus on 3.5 hectares and an arboretum of six hectares.

The programme also designed and built a model rural village adapted to the environment and equipped with access roads, drinking water systems, a handicrafts workshop and a community centre, all with the active participation of the community.

ii) Livestock production: an area of 7 500 hectares in the Cajamarca valley supports cattle which deliver 42% of the basin's total milk output. Here "La Molina" National Agrarian University is carrying out a milk productivity monitoring programme, and Cajamarca National University is running a project to develop suitable techniques to increase livestock production. An output of nine litres per cow per day has been obtained, as against six litres outside the area; this has been achieved through the establishment of regenerated meadows and forestry/livestock areas, which should make it possible in three years to increase ten-fold both the animal population and milk output.

iii) Forestry production: a thousand hectares were reforested in the Cajamarca river basin between 1981 and 1984 under the Granja Porcón pilot project. Ninety-five per cent of this area was planted with eucalyptus and pine. For 1986-1990 the national reforestation programme hopes to bring an area of 9 800 hectares back into production.

b) Constraints

- Global policy: the projects affecting the Andean region, especially the integrated ones, have lacked the necessary continuity and their duration has depended on the priority assigned to them by the government. Accordingly, programmes such as the one on community development and integration of the indigenous population, the integrated rural settlement projects and the integrated agricultural development programmes have not produced concrete results, for their useful life has been less than three years and their impact on the high-mountain zones or watersheds has been fairly small, with the exception of the microregional development programme started in 1984.

- Institutional co-ordination: several programmes and projects suffer from a relative lack of correspondence between the goals proposed in the projects and the mandatory functions of the institutions which promote the projects through the economic and social policy of the public sector. As a result, national, regional and sectoral initiatives may not be compatible with the strategies established in the programmes. For example, some programmes include the goal of economic promotion of the food products of the sierra, but this runs counter to the policy of free import of similar or substitute products. There is a similar mutual contradiction between the strategies for revival of the sierra's marginal zones and the urban-rural distribution characteristics of the public sector's investment budget.

- Production support: this constraint is connected with the strategies for development of the agricultural output which is the economic base of the high Andean zones. The defects are clear in the agricultural extension services, which functioned in accordance with the plans prepared for the Costa and sierra regions and with the agrarian reform programme up to the end of the 1970s; subsequently, the methodology discounted the situation in the sierra, for it encouraged the individual treatment of the recipients and regarded extension activities as an ad hoc service, without taking into account the characteristics of the small-scale agriculture of the sierra, which operates with an integrated production system which almost always extends beyond merely farming matters.

- Management and training: implementation of the programmes established in the Andean high-mountain zones has suffered from constraints connected with the quantity and quality of the technical staff administering the programmes, and with the weakness of the interdisciplinary and interinstitutional co-ordination machinery used in the smaller towns or rural microregions. There is no clear-cut approach to the problems of obtaining and maintaining the peasants' participation and to methods of involving them in each programme so as to achieve integrated organization of the strategies. These problems stem from the meagre means of livelihood of the inhabitants of the high Andes and the low salaries earned by technical staff --a factor connected with the climate of financial uncertainty in which many programmes and projects are carried out.

- Physical: the geographical constraints and the effects of the harsh climate of the high Andean zone are factors supposedly already taken into account when the development programmes are formulated and implemented, so that physical constraints are tackled on an ad hoc basis when they occur outside the corresponding annual cycle and have an abnormal impact on farming or roads or on the progress of economic and social infrastructure works. This was what happened in the case of the droughts in the south of the Andean region in 1983 and the serious floods in the same area in 1985.

5. Bolivia

The general goals of the strategies set out in the programmes and projects for the altiplano are to reduce food dependence and relieve the extreme poverty and unemployment in the traditional farm sector. These objectives have been attained to only a very small extent. Although these programmes began only quite recently, the following results can already be indicated:

a) Achievements

Investment in the altiplano for the period 1982-1984 contained a significant social component concerned with integrated rural development. Financing was found for the Omasuyos-Los Andes rural development project and it was implemented; the aim was to increase food production in the northern altiplano to benefit 6 000 poor peasant families. The small irrigation projects have succeeded in consolidating the water infrastructure, with positive effects on the farm output of the departments of La Paz and Oruro.

The bill for a general law on water resources was formulated and presented for promulgation in 1983.

Farm credit was redirected between 1975 and 1985 to give a greater share to traditional agriculture, mainly in the altiplano and the Andean valleys. Lending to the altiplano rose from 1.8 to 25.9%, and to the Andean valleys from 8 to 44%.

In 1980-1984 the area sown exceeded the target by 1.2%, while output volumes fell 15% short of the targets for the period.

Water resource management has remained based on the political/administrative boundaries and in the hands of the departmental development corporations; the territory has not been divided into river basins and sub-basins. Twenty per cent of the targets for irrigation and road infrastructure and natural resource protection has been achieved.

The Agricultural Research Institute of Bolivia (IBIA) produced technology packages for use in the programmes on production of cereals, tubers, quinoa, fodder and livestock. However, these techniques have still not been effectively established in the field, owing mainly to the peasants' low incomes.

The social conditions of the rural population of the high Andes were more precarious in 1985 than in 1980. The active farm population remained constant; unemployment rose from 5 to 15%; real wages lost 10% of their value by 1981 and 30% by 1985; and infant mortality rose from 124 per thousand in 1982 to 142 per thousand in 1985.

The plan for restructuring the farm sector and the Ministry of Peasant and Agricultural Affairs was not carried out although seven studies were made between 1979 and 1985. Nor was the national water authority established --a body intended to manage water resources on a multisectoral basis.

On the other hand, the Watershed Department was set up in 1980, but without overall authority over the use and conservation of renewable natural resources. The Forestry Law was approved, but it was concerned mainly with regulation and monitoring of the exploitation of existing forests, leaving a legal gap with respect to the reforestation of the altiplano.

b) Constraints

The achievement of the objectives set by the public sector for development of Bolivia's altiplano and watersheds has been prevented by the discontinuity of the overall policy and by the critical temporary conditions in the external sector, not to mention the lack of legislation on natural resources, the shortage of trained personnel, and the low level of institutional co-ordination in the farm sector.

In the period 1980-1985 water was the main physical problem for farm production in the altiplano owing both to its short supply and to its irregular distribution over the year. Fifty-five per cent of the land of the

high Andes cannot be used for agriculture, and the land which can be used is extremely dry, with little organic matter and inadequate drainage. Untreated effluents from the region's many mining operations have increased the mineral content of the soil, rendering it unproductive for agricultural purposes.

The lack of a general irrigation plan keeps farm profits low; this factor, together with the high cost of inputs, has caused a decline in the agricultural work force and in the areas cultivated. This goes far to explain the low per hectare yields.

Livestock is raised in the altiplano on an extensive basis and with rudimentary techniques; the natural pasture has undergone rapid exhaustion in recent years, and the shortage of water has impeded its protection and rehabilitation. In addition, the altiplano region is denuded of forest, and the sparse native bushes are used for firewood.

The region's population density (14 inhabitants/km²) is 2.5 times the average for the country. As the agricultural frontier cannot be extended owing to lack of irrigation, migration to the East has increased, with a corresponding fall in the supply of peasant labour.

The illiteracy rate of the rural population of the altiplano increased from 32% in 1980 to 37% in 1985, and only 32% of rural children of school age attend school. Health services are almost non-existent in the poorest rural zones, and the peasants have to turn to traditional medicine using local plants. Drinking water, sewerage and electricity services are unknown in 90% of the rural area of the Andes. The existing drinking water systems were built by the local people and cannot be efficiently managed or properly maintained.

The problems associated with the subdivision of the land into plots and the distribution of water for irrigation have accentuated the splits between the Andean communities, reducing their capacity for organization and participation. One of the main constraints on the region's development is the small size of the plots, for they do not constitute minimally profitable production units. In 1980 22% of properties in the altiplano were under one hectare in size, and 61% under five hectares.

Hyperinflation and the fall in international minerals prices have led to cuts in budgetary support for studies, investment programmes and training, as well as for the continuation of projects in operation in the high Andean zone. There has also been little external financing for these projects.

The low prices for farm goods, the high cost of imported inputs and the fall in peasant earnings have impeded the capitalization of small farmers, this on top of the disadvantageous credit terms available to them and the high proportion of their production used for self-consumption.

The main infrastructural constraint is the lack of irrigation. The irrigated areas represent less than 10% of the irrigation potential. In areas subject to flooding, such as marshes (bofedales), the problem is the lack of drainage systems.

Communication routes are inadequate in absolute terms; they are sometimes permanently cut by damage caused by the weather. This factor prevents the development of areas which could be farmed and breaks links to the consumption centres, for there are no adequate systems of storage and protection of products for long periods.

Where the institutional infrastructure is concerned, the constraints result from the proliferation of decentralized bodies, with the consequent dispersal of functions and responsibilities. In the absence of an integrated administrative structure with a clear chain of authority, and of a law regulating the use and the management of natural resources and river basins, the few attempts at planning and management prove incompatible with the strategies proposed at the regional and national levels.

VI. GOVERNMENT PROJECTS FOR INTEGRATED MANAGEMENT DEVELOPMENT OF HIGH-MOUNTAIN ZONES

The information obtained from the countries is not sufficient for a complete evaluation to be made. The available studies give only a descriptive list of some programmes and projects which have been formulated or implemented or are in operation, without stating the overall degree of effectiveness achieved either by region or by individual area, or indicating what remains to be done. It would be useful if in the future each country produced an analytical list of the programmes and projects implemented by river basin or microregion and a matrix explaining the interrelationships among the programmes and projects in each area.

Information of this kind broken down by river basin or microregion would provide a full picture of the situation in the high-mountain zones of each Andean country. It would be necessary as a prior condition to subdivide these zones into river basins, sub-basins or microregions --something which should in fact be done for the whole country.

Information on the effectiveness of each programme or project is available from national centres which have an investment evaluation and follow-up capacity and from international or bilateral financing bodies which make development loans. Using these sources it would be possible to analyse the effectiveness of the programmes and projects, but this would also require annual statements on the status of the programmes and projects which are being implemented in the high-mountain zones, direct access to the technical staff and administrators for consultation, and practical checks by means of field visits.

This chapter contains basic information about some programmes which are being implemented in the Andean countries; the programmes chosen are those with the greatest likelihood of success. The list is only partial, because in the case studies used as the source material the programmes and projects are not clearly classified in terms of production sectors, tangible or non-tangible results for the inhabitants and users and their degree of involvement in their own development, environmental effects, and definition of the areas in which the programmes and projects operate.

1. Venezuela

The six main programmes and projects in Venezuela's Andean region are described below:

The farming development programme for the high valleys of the states of Mérida, Trujillo and Táchira is an integrated programme designed to secure sizeable increases in output and productivity by means of efficient land use, taking advantage of the region's first-class ecological conditions for the cultivation of potatoes, vegetables and fruits. Under the programme the irrigated area has been enlarged and conservationist management introduced, and access roads have been improved and technical and credit assistance increased.

The programme focuses on the channelling of resources for technological improvement in order to create a greater demand for labour and raise incomes in the rural areas, thereby promoting the social advancement of the peasants of the high valleys. These peasants are integrated vertically in the programme of activities, which includes irrigation and drainage, production services, road building, and price fixing --all activities which are integrated with the policies on agricultural and rural extension, credit and land titles and with marketing subprojects.

The river basin regulation and management programme contains a group of activities which, without constituting specific subprogrammes, are aimed at a common goal --realization of the national plan on land regulation which is the framework for formulation of the national river basin management plan. These activities include conservationist exploitation, agricultural extension, reforestation, conservationist prevention, monitoring and social infrastructure.

This conservationist approach is intended to alter the current patterns of land use and offer the peasants new production possibilities and means of improving their living conditions. On land suitable for agriculture or livestock the activities will centre on erosion control and will be linked to national food production policies. The works for torrent training are designed to prevent human activities from causing sedimentation of reservoirs or aqueduct systems and to control stream flow and protect the road infrastructure.

The farming extension programme, in which activities so far have been isolated and local, will have to give priority to technical assistance and environmental education in a number of branches of farm production in seriously degraded zones in the high and middle basins.

The reforestation programme will be aimed at the production of highly profitable timber and the protection of forested areas, facilitating the involvement of the rural family in forestry exploitation and the self-supply of forestry products.

The prevention and control activities will be designed to prevent any further deforestation and control land use in areas with slopes of over 65%. There is an area of 200 000 hectares occupied by protective forest, most of

it largely untouched, so that special legal regulations must be established for its preservation.

The programme on conservationist social infrastructure has produced good results in some settlements. The aim has been to correct the peasants' disorganization and provide them with technical assistance in such areas as fertilizers, irrigation and erosion control.

The upland cattle programme is concerned with the introduction and promotion of small-scale dairy farming to replace the present extensive production of meat which causes deforestation as every year new land is taken over as pasture as the only means of increasing the herd. Small-scale dairy farming has the advantages of preventing major fluctuations in peasant income, providing animal subproducts for the family table, and reducing the areas used for grazing in the watersheds, especially on slopes of over 65%. The dairy-farming programme could be developed in various areas in conjunction with coffee-growing.

A feature of the coffee promotion project is its conservationist production practices. The project gives preference to improvement of existing coffee plantations, increase of the area cultivated on family farms, and introduction of coffee in areas with actual or potential erosion problems such as the Uribante watershed. As a complement to this project, a crop diversification programme will be carried out in coffee-growing areas for small and medium-sized farmers with the aim of raising the productivity of the coffee farms without exclusive use of the land for coffee, so as to improve the peasants' living standards and root them more securely in the rural area.

The tourism-recreation project is based on development of the scenic and cultural assets of Venezuela's Andean region. Owing to present exchange-rate conditions, large numbers of the country's tourists have been directed towards this region and there will be more of them in the future. It might thus be possible to set in motion a process of capitalization to finance the activities envisaged in the other programmes and projects on integrated development.

The project's main goals are delimitation of the conservation area, promotion of conservation legislation and revival of the area with tourism potential, restoration of the architectural and scenic attractions of the towns and villages, together with their conservation and improvement, and preparation of an investment plan designed to improve and open up the smaller areas of interest in the Andean region.

The Uribante-Caparo hydroelectric complex is regarded as a subregion by virtue of the area which it covers and the regional importance of its targets. The hydroelectric works include four dams, three reservoirs and three hydroelectric stations, with an installed capacity of 2 900 mW and an average annual generating capacity of 4 900 GWh.

The subregion covered by the project consists of the middle-upper basins of the Uribante, Doradas, Camburito and Caparo rivers and the smaller basins of the Pereño and the Bobo. The main problems stem from inappropriate land

use and high population density in the areas adjacent to the reservoirs which have altered the hydrological cycle, increasing the amount of flooding and the serious erosion which is reducing the useful life of the hydroelectric complex.

The proposals for overcoming these obstacles are divided into four groups: urban, agricultural, conservationist and tourism. From the urban standpoint, it is important to relocate excess population to areas with tourism potential in order to provide them with jobs and basic services; in agriculture the aim is to use large areas of the high valleys for vegetable-growing, introducing soil conservation techniques; the conservationist activities are designed to reduce the degradation of the basins forming the subregion; and in tourism, programmes are being prepared for taking advantage of the reservoirs and accommodation and recreation infrastructure of the hydroelectric complex for tourism and to provide a source of employment that will encourage people to switch from farming and thus facilitate the conservation of the watersheds.

2. Colombia

The main programmes and projects on integrated river basin management in Colombia's Andean region are being carried out in the Cauca and Saldaña basins.

The projects for the Cauca basin centre around protection of the lower reaches subject to flooding and the Salvajina multiple-use project. During its 32 years of existence the CVC has given most attention to the flat area in the part subject to flooding. The hill area of the high Andean zone has received relatively little attention in terms of the use of systematic planning instruments.

The programme of supplementary works for the regulation of the Cauca river consists of 19 installations over an area of 82 000 hectares. Several installations have been built and 30 000 hectares are protected. For the remaining area, the project envisages the construction of 313 kilometres of embankments and 248 kilometres of drainage channels. It is believed that the regulation project will alter the suitability of the soil and generate 7 420 new jobs during its implementation.

The project to divert the Ovejas river is designed to raise productivity in the lower part of the Cauca basin by directing the controllable bed of the river to the reservoir of the Salvajina project, the axis of the hydroagricultural development of the zone subject to flooding. The increased flow will make it possible to increase the generation of electricity, and during the construction work use will be made of installations already built under the Salvajina project such as the dam and the hydroelectric power station.

In the flat part of the Cauca basin not subject to flooding, where the good-quality land is used for intensive modern agriculture, supplementary irrigation works need to be constructed in order to raise output. In the hill

area, where the soil is of poor quality and subjected to inappropriate use, the following programmes and projects are recommended:

- Crop diversification programme to offset the limited expansion prospects of coffee-growing, which is subject to national policy regulations.

- Forestry protection and preservation programme to combat encroachment by livestock on forestry land which undermines water and soil conservation and the preservation of natural forests.

- Comprehensive soil studies in the arable zone; the partial evaluation currently available is insufficient for correct planning of land use in the hill area and for the enactment of policies to bring the use of the land into line with its natural aptitude.

- Formulation of an integrated master plan for the high watershed of the Cauca river which will integrate and permanently update the sub-basin improvement plans and secure optimum use of the natural resources which are exploited.

- Formulation of farm policies for the hill area which will enhance its competitiveness in the interregional and external markets through the introduction of specific differentials and other measures such as reduction of tariffs on the inputs used in the area for farm production.

In the Saldaña basin the instrument of integrated development and management is the 1985 Integrated Administration and Management Plan, implementation of which began in 1986.

The plan's priority goal is to secure the welfare of the basin's inhabitants.

The plan was formulated on the assumption that the Saldaña river basin is a microregion consisting of a geographical zone containing a network of urban centres and concentrated and scattered rural communities. This microregion is part of a larger area forming the south-eastern part of Colombia's Andean region. The resources will be developed for multiple use, and the goals in the social sector include: provision of basic services, improvement of levels of employment and training; and establishment of special programmes for the integration of marginal groups. From the economic standpoint, the aim is to rationalize the use and develop the potential of the microregion's natural resources in order to increase its contribution to the regional and national gross domestic product. The intention is also to protect and manage natural resources and the environment and secure the physical integration of the basin by means of proper distribution of activities and services. The departmental administration will become more active in the region, municipal administrations and community organizations will be strengthened, and the people will be encouraged to participate.

The strategy envisages programmes on self-construction of housing, intensive use of labour, provision of hospital services, diversification of food and livestock production, promotion of agroindustry, increased numbers of collection and storage centres, and redirection of technical assistance.

The aim is to control erosion, encourage reforestation, secure integrated water management and consolidate the road system. The basin has been declared a regulated area, and plans are being formulated for urban planning and modernization of municipal administration.

The implementation of the plan will depend on the effectiveness of the integrated investment programme for the whole river basin, the first phase of which (1988-1993) consists of 50 sectoral projects, with financing distributed as follows: production sector 36.7%; social sector 10.8%; physical infrastructure 51%; and priority irrigation districts 1.5%.

3. Ecuador

The sectoral projects for Ecuador's Andean region in the period 1980-1985 are designed either to eliminate constraints of the social and infrastructural type or to expand the local and regional production capacity.

In the Carchi river basin the small irrigation projects (San Isidro and Monte Olivo) can help to extend the agricultural frontier and gradually to solve the water shortage in the watersheds. The projects will cut the present irrigation deficit by 2 000 hectares.

The Espejo integrated rural development project was introduced in 1985 and covers an area of 14 500 hectares; it is concerned mainly with the development of sheep, cattle and pigs and improvement of the marginal living standards of 13 000 inhabitants. In view of the excellent prospects for development of dairy farming, feasibility studies were begun in 1985 for the implementation of an industrial dairy-farming project.

In the Chota river basin priority should be given to continuation of the Tumbabiro project, which is in its preliminary phase. The targets are to irrigate 51% of the farming land in Imbabura Province (to which the Chota watershed belongs) and generate 20 000 kW of electricity for the rural population, which is very poorly served in this respect. The project, whose main and secondary channels and the tunnels for the irrigation installations and the reservoir cover a distance of 232 kilometres, will have an important impact on employment.

The Guayabamba river basin includes Pichincha province where the city of Quito is located. The programme is broad in scope and has financial and administrative autonomy.

The Tabacundo irrigation project is at the prefeasibility stage; its target is to develop 24.5% of the area of the province for basic crops grown on small and medium-sized plots. The intention is to benefit 3 100 rural families.

The integrated rural development project in north-west Pichincha covers an area of 650 000 hectares and benefits 43 550 families, 53% of all the families in the province; the project was planned for the five-year period 1982-1987, and 73.4% of the programmed investment had been made by 1985. The most important subproject is the one on forestry development where the aim is

to prepare a forestry regulation plan, complete the reforestation of 4 000 hectares and establish a timber-processing centre.

A number of farming development projects are planned for the Guayllabamba river basin and they will have to be made compatible with each other. The first project was on seed production and certification, with a production target of 8 900 tons which was fully attained in 1986; the Pichincha-Cotopaxi forestry-production project is now in operation, with 25 000 hectares to be afforested between 1981 and 1990; in the case of the training and soil conservation projects and the erosion control project, the implementation period for which is 1984-1988, 42% of the programmed investment had been made by 1985.

In the Patate river basin the strategic effort must be directed towards integrated rural development and peasant community development; the basin's farming potential has few limitations and it can be utilized. The Tanichuchi, Salcedo and Tungurahua integrated rural development projects will conclude in 1990; they are designed to benefit 33% of the basin's rural families; the programmed physical targets for forestry and farming activities and infrastructure and services were attained or exceeded in 1985. As these projects are located within the river basin, which has rural zones with good market prospects, it would be advantageous to devise joint operating methods with an eye to the area's economic integration as a first step towards subdivision into microregions.

The peasant development projects promote the training of plot-holders with a view to erosion control and rational land use. Individually they are not large but together they reach 19% of the rural families with the worst problems of marginality and insufficient land and 23% of the farming area with the most serious erosion problems. Priority has been given to the cultivation of soft maize, beans and fodder crops, and eight demonstration plots and 30 training courses have been organized for this purpose.

In the Patate river basin there are three agroindustrial projects on meat processing, milk pasteurization and industrial fruit and vegetable farming designed to take advantage of the natural wealth of this subregion which contains 16% of the cattle of the Andean region, 25% of the pastureland, and 25% of the area and output of fruit and vegetables.

The sectoral projects in the Chambo river basin have not been very successful in attaining their targets; there is also a relative disproportion, especially in the integrated rural development projects and the peasant development projects, between the goals and the problems which have to be tackled.

The soil conservation project in the Pastaza river basin (formed by the rivers Chambo and Patate) could become an important factor in development integration in view of the serious problems of erosion, run-off and exposure of the vegetation cover in some of the sub-basins. The project covers an area of 680 000 hectares and is intended to benefit 160 000 families through provision of support services. It was at the pre-investment stage in 1987.

In the Cañar river basin, where the main problems are the lack of irrigation and the serious erosion, the irrigation works under construction will cover only 6% of the farming area; 58% of the programmed investment will have been made by 1987. This means that the emphasis will have to be placed on new sectoral instruments.

The Juval-Azoques project is under study with a view to irrigating an area representing 40.3% of the province's farming land and benefiting 10 000 poor families which have less than two hectares each on average. The multiplier effect may be large in such a depressed zone, for the project envisages the construction of 361 kilometres of water installations. The future development of the Paute river basin depends on the Paute hydroelectric project and the conservation and management plan formulated in 1986 by the Electrification Institute of Ecuador (INECEL). This plan ought to become an instrument of integrated management in this hydrographic area on the basis of three programmes designed to solve the basin's central problems: production management and diversification of crops; watershed regulation, land rehabilitation and water management; and institutional support for the organization of peasant communities.

The instrument which has been regulating the Jubones river basin since 1984 is the water plan formulated between 1982 and 1984. It is designed to achieve optimum use of the water. There is no detailed analysis of means of stimulating regional development of an integrated kind. Programmes which could facilitate the river basin's management are the irrigation programme for its upper and middle parts, which will be carried out by means of 12 irrigation projects involving the construction of new systems, rehabilitation of existing ones and improvement of canals and ditches over an area of about 45 000 hectares, and the watershed conservation programme which, in view of the serious problem of erosion and the river basin's steep relief in its upper and middle parts, zoned the area into sub-basins and minibasins requiring priority attention. Here the aim is to promote conservation practices on hillsides and in drainage areas in order to improve food production and the protection of the lower zones.

The Santa Isabel integrated rural development project is also being carried out in the Jubones river basin in its high Andean part. Up to 1985 this project had produced good results in agriculture, livestock, water networks, health and organization. It covers an area of 9 000 hectares and benefits 11% of the watershed's rural families. The formulation of similar projects in the same area as a complement to the water plan will facilitate the concentration of the currently very dispersed rural population and reduced improper land use in the high parts.

4. Peru

A group of programmes and projects is being carried out in Peru's high Andean region; if they are to succeed, they must be executed within a framework of long-term technical, financial and policy continuity, backed up by permanent evaluation and adjustment.

The agricultural revival and food security programme is of national scope. The aim is to increase the production of basic foods and assure their profitability and continuous supply by means of guaranteed prices, differential interest rates and tariff reductions. These measures have already been put into effect by the Ministry of Agriculture, the body responsible for the programme. The financing was secured by setting up an agricultural revival fund, by intervention in the markets for the priority products (purchase of a percentage of output) and by formation of a buffer stock from domestic production.

The small and medium-sized irrigation projects are concerned with short-term and low-investment actions, each of which can be converted into an integrated instrument of rural settlement incorporating irrigation infrastructure, technical assistance for farm development, and training in water and land management.

The project includes the Plan MERIS (stages I and II) and main irrigation system No. 2, which includes a total of 39 small and medium-sized irrigation works in nine of the country's departments, six of which are in the Andean zone. Plan MERIS (stage I) has completed the work on seven irrigation networks and is constructing a further 10, which will bring 5 000 hectares under permanent irrigation and improve the irrigation of 8 600 hectares, benefiting 10 605 families. Stage II has 13 projects involving simultaneous construction of installations and farm development, with a view to bringing 5 519 hectares under irrigation and improving the irrigation of 3 252 hectares, for the benefit of 5 958 families. In turn, main irrigation system No.2 is building nine medium-sized irrigation networks, with which it is hoped to bring 16 485 hectares under permanent irrigation, improve a further 16 860 hectares, and benefit 6 500 families.

The main goal of the support programme for forestry plantations for energy purposes or for development of rural communities in the Peruvian sierra is to develop the rural areas of the high-mountain zones (sierra) and the upper fringe of the jungle (selva) by means of reforestation measures for soil protection and rehabilitation which will increase agricultural and livestock production. These initiatives are generating new sources of direct and indirect employment which will consolidate rural settlement in marginal zones. The programme is in the hands of the National Forestry Institute (INFOR), which is implementing it through its forestry centres. Most of the financing is provided by the technical co-operation project which INFOR runs with FAO and the Government of the Netherlands, which is concerned with the development of rural communities in the sierra and support for forestry plantations for energy purposes.

The programme has been based on nurseries in communities, schools and forestry centres. The community nurseries are the instrument of peasant training; the school nurseries are for teaching purposes; and the nurseries at forestry centres are intended for large-scale diversified production of seedlings for reforestation.

The aim of the national programme on Andean farming systems is to increase the output and productivity of subsistence farming systems by means of research, programming and training.

Eighty per cent of the farms in the Peruvian sierra have between one and five hectares and they use only 7% of the total area available. This sector is the one with highest population density, lowest incomes and most depressed living conditions in the whole Andean region; it is therefore the programme's priority target.

The programme is in the hands of the National Institute for Farming Research and Development (INIPA), which is carrying it out in zones of concentrated action where there are demonstration centres providing services for peasant communities. In addition to the research and production-promotion activities, the programme is studying alternative methods of community organization for the processing and marketing of farm products, and is working on conservation of seeds of Andean crops, grains and tubers.

The aim of the programme of the Cajamarca forestry and farming service is to balance the restoration, use and conservation of the renewable natural resources with the integrated development of the rural environment. The programme takes a multisectoral and multidisciplinary approach and its implementation requires the organized participation of the community.

The programme is run by Cajamarca National University and covers an area of 10 000 hectares divided into specific operational zones. The criteria for this subdivision are facility of access, socioeconomic characteristics, urgency of corrective measures for water and land use, quantification of the available resources, and aptitude of the peasant population.

The programme seeks to secure development from within over the long term and in stages until the level of non-depressed urban zones is reached. For this purpose it will use encouragement centres which will generate their own production techniques, making maximum use of the available manpower and natural resources.

The objective of the national river basin management and soil conservation programme is to create a system of soil and water conservation and ensure the application of the techniques involved. The first stage of this programme was managed by the Department of Water, Soil and Irrigation of the Ministry of Agriculture, and the activities began in 1981. The target for the end of 1986 was to install 6 684 trial areas and 26 treatment sectors; by December 1985, 5 000 trial areas had been established and conservationist techniques had received wide dissemination.

The target of the programme on rational use of hill land is the mass training of the peasants living on Andean hillsides in Ancash department, so that they will be able to apply suitable soil conservation techniques based on rotation of crops, construction of stone walls, establishment of meadows, and rehabilitation of ancestral terraces and irrigation canals.

The programme, developed by the Ancash Development Corporation, reaches 30 peasant communities in 95 demonstration sectors where such subjects as ploughing techniques, forestry plantation, irrigation techniques and use of improved seeds have been taught.

The goal of the special project of the development programme for microregions in a state of economical and social crisis, also known as the programme for the development of microregions, is to integrate on a gradual but sustained basis the human and financial resources, the sectors of economic and production activity, and the farming projects in smaller areas requiring priority attention. It is a question of realizing the internal potential of the microregions, and the special project is a response to the acknowledged heterogeneity of the Peruvian sierra.

The programme began in 1985 as a special project of the National Development Institute (INADE) and it is now run by the National Planning Institute in collaboration with the departmental development corporations (CORDES).

The investments in microregions have been used to improve the people's living conditions, especially with respect to road and irrigation infrastructure, health posts and school premises; a second stage of investment is envisaged with a view to increasing output.

This programme represents one of the most significant efforts to take the currently dispersed activities of the State and concentrate them in an organized manner on depressed regions, ensuring at the same time the participation of the local people.

5. Bolivia

In the Bolivian altiplano priority is given to irrigation projects in the arid central and southern parts. These projects must become the driving-force of any proposal for the high Andean region. The development requirements of the peasant population make it essential for these projects to be incorporated in an integrated framework but one which covers a limited area. Mini basins may prove to be suitable units compatible with the operational centres created under current agricultural policy.

In addition to the main project, other projects will have to be formulated and implemented in the areas of health, nutrition, education, training and services, in order to improve the peasants' living standards and facilitate the transfer of technology. It is also important to improve access to the microregions by building a minimum road infrastructure that will enable the marginal producer to reach the market at lower cost; this will also have a multiplier effect on the absorption of local manpower.

The implementation of programmes for the development of renewable natural resources, especially water, will promote the region's ecological protection and rehabilitation, but this will be possible only if trained technicians are available. Research and training programmes will have to be formulated and carried out in order to prepare them.

The current farm policy is to direct investments towards production infrastructure, especially irrigation, encouragement of agricultural and livestock production, development of new land to improve the distribution of the rural population, water resources, especially small irrigation projects,

and rural development to involve the peasants in regional and national development.

A list is given below of projects in operation and new projects included in the investment plan of the Ministry of Peasant and Agricultural Affairs for 1987-1990; these projects are regarded as motors for the development of the altiplano by reason of the volume of the investment made and because they will solve this region's problems.

Project	Place	Percentage of investment made in 1986
<u>Rural development</u>		
Rural development, inter-Andean valley	La Paz	15.6
Agricultural development, northern Chuquisaca	Chuquisaca	50.0
Agricultural construction works	Countrywide	16.8
Omasuyos-Los Andes	La Paz	82.6
Ingavi	La Paz	98.0
Ulla-Ulla	La Paz	93.6
Dairy farming, northern altiplano	La Paz	40.0
<u>Irrigation</u>		
Tacagua	Oruro	-
Agricultural development with small-scale irrigation	La Paz	66.6
Altiplano-valleys	Cochabamba, La Paz	-
Small irrigation projects	Potosí, Oruro	-
Urmiri-Pazña	Oruro	-
<u>Production promotion</u>		
Seed production	Countrywide	21.7
Disease control	Countrywide	6.2
Research and extension	Countrywide	49.0
Production units	Countrywide	33.3
Improvement of cattle, altiplano	La Paz	-
Quinoa production	La Paz, Oruro, and Potosí	30.0

Milk production by small farmers	Cochabamba	29.5
Promotion of cameli- dae and sheep farming	La Paz, Oruro, and Potosí	2.7

Natural resources

Forestry research, altiplano	La Paz, Oruro, and Potosí	-
Construction of altiplano Fishing Centre	La Paz	-
Fishing development centre	La Paz	35.7

Miscellaneous

Institutional strengthening of agriculture	Countrywide	10.7
Land surveying and registration system	La Paz	3.3

VII. CONCLUSIONS AND PROSPECTS */

On the basis of the case studies on Venezuela, Colombia, Ecuador, Peru and Bolivia and the other project documents prepared by ECLAC, an attempt has been made to analyse the situation in the high-mountain zones, with a view to answering a series of questions on the following aspects: 1) characteristics of the river basins and problems of the Andean region; 2) maximum production potential in relation to achievable levels and current resource use; 3) relative importance, both actual and nominal, which each country attaches to the management for development of Andean river basins; 4) the various strategies, in terms of plans, programmes and projects, which have been formulated or carried out for the management and development of these river basins; 5) the effect of the strategies in reducing the gap between current output and productivity and the theoretical maximum achievable potential; 6) the real constraints which have prevented narrowing of this gap and the problems caused by the governmental system which prevent improvement of the management for development in the river basins; and 7) evaluation, in terms of targets and results, of the programmes and projects carried out in each country for the development of the high-mountain zones.

As a rule, the case studies have not given entirely satisfactory answers to these questions because the information on the high-mountain zones which can be extracted is not normally prepared or presented by river basin. There is also insufficient information about and coverage of current and potential forestry and farm output in high-mountain zones with different levels of applied technology. Furthermore, the government strategies proposed or implemented for these zones rarely contain detailed information about how the strategies are to be carried out or how they were carried out, and this makes evaluation difficult. Most of the programmes and projects implemented in high-mountain zones have sectoral or subsectoral goals instead of multisectoral ones. The sectoral projects usually lack co-ordination and their continuity cannot be relied upon. In almost all the cases studied there is insufficient information about the follow-up and evaluation of the programmes and projects implemented in the high-mountain zones. This lack of information makes it very difficult to identify the results or indeed the constraints which must be overcome in order to improve the State's action.

For these reasons, the case studies have been confined for the most part to an analysis of the Andean region as a whole or of two or three main river basins which are regarded as representative of the study's universe. This underlines the need for detailed work to establish more precise knowledge of the exploitation potential of the high-mountain river basins. However, it is hoped that the present contribution will provide guidance for similar works in the future by clarifying what still needs to be investigated. The important results include the following:

The highlands of the Andean region of the five countries studied is extremely heterogeneous owing to its great diversity of climatic zones resulting from variations in altitude, latitude and orientation. This

*/ Comments by Axel Dourojeanni.

heterogeneity has produced the many different types of resource use in the mountain ecosystem which can be and indeed are being developed on an integrated basis but which also render the management of the system complex and subject to change.

For example, changes in the organization, knowledge and existing composition of the population of the high-mountain zones (40 million inhabitants in 1983, representing 52% of the total population of the five countries) have meant that, especially in the past 30 years, the users of the land of the Andes have altered their relationship to the environment which sustains them. The result so far is a rapid deterioration of the resources, documented in many studies by both river basins and country. In the Peruvian sierra alone the National Office for Natural Resource Evaluation estimated that in 1984 there were 1.4 million hectares with severe erosion, 5.8 million with moderate to severe erosion, and 15.08 million with moderate erosion. The severe and moderate categories include 58% of the land suitable for farming and forestry in the sierra. The relative percentages of land affected by erosion in Colombia and Ecuador are similar.

Within the Andean region and specifically in its high parts the population density is inversely proportional to the amount of land available; 61.4% of the production units have less than five hectares of land, and it is the land most degraded by the intensive use to which it is subjected, so that it has a smaller output potential and recovery capacity. Accordingly, the ratio of farming land to people in the high Andean region, for more than 50% of its inhabitants, is between 0.54 and 1.1 hectares. The smallness of these plots makes it difficult to introduce technological and infrastructural improvements. The serious problem is the abandonment of traditional systems of crop rotation among plots and among ecological levels of altitude, without the introduction of new techniques and inputs such as fertilizers which compensate for the more intensive farming and monoculture. On top of this there is the abandonment of terraces and other farmable land in places of difficult access, for the young people prefer alternative work which is less arduous and better remunerated. In Peru alone it is estimated that there are 750 000 hectares of terraces or pata pata, 82 000 hectares of ridge land or waru waru, and 6 000 hectares of artificial ponds or cochas lying unused even though they could be brought back into use. Similar estimates are made for Bolivia. The visible consequences of these problems are the reduction in the amount of land in production and the rapid decline of yields owing to soil erosion and lower fertility. It has been calculated that this has been happening in the past 10 years to 75% of the cultivated land in the sierra and upper fringe of the selva. The increasing trend on directing the use of small plots towards intensive production and monoculture for the market has reduced self-consumption (from 50 to 20% of output in the past 20 years) and has thereby impoverished the diet of 60% of the inhabitants of the high parts of the Andean region.

As a rule, government policy has tended to give this region ad hoc, disjointed, random and intermittent support, which in most cases has resulted in an enormous loss of resources, not to mention confusion among the potential recipients of the aid. It can also be seen that while, on the one hand, the State technicians, the experts and the peasants themselves emphasize the importance of solving the development problems of the

high-mountain zones on the basis of a series of principles and criteria which are "officially" accepted, on the other hand, the State programmes continue to use administrative models which prevent the practical application of these principles. Much of the reason for this is that the State bodies are under pressure from lending organizations, researchers, politicians and influential individuals, as well as from bureaucratic regulations which obstruct their activities and frustrate their good intentions, preventing them from using management systems suited to the needs of the high-mountain zones.

One expert has asserted, for example, that if the efforts of the past 20 years of assistance activities in some high-mountain zones, such as the highlands (altiplano) of Puno department in Peru, had been properly co-ordinated, their agricultural, forestry and livestock production could perhaps have been tripled by today. To verify this assertion it is sufficient to look at the amount of money invested, the technicians who journeyed to the field, the projects and studies carried out, the international agreements and the so-called functional solutions which were not put into practice on the necessary scale. The sad thing is that this situation persists.

In order to overcome this crisis of disorganization, it is essential to reformulate the State administrative system, especially by strengthening its management capacity and authority at the river basin or microregion level, with a view to rationalization and improved organization of its activities and of local participation.

The evaluation of the forestry and farming potential of the high-mountain zones and its relationship to current use has been made only on the basis of samples, for data are not available for all the river basins. This collection of samples has provided some information about the extent to which this use can be improved. It would be possible to derive from this information the degrees of underuse or improper use of the production potential and the deterioration in the living standards of the inhabitants of the high-mountain zones of the Andes.

The production units with less than five hectares of land in the highlands of the Andean region (61.4% of the total) generate on average 60% of all direct-consumption farm goods. The output statistics for the sierra, mainly in Bolivia, Ecuador and Peru, indicate, however, a clear decline in harvested and production areas, as confirmed in the study on the decline and official neglect of Andean agriculture in Peru produced by Michele Eresue of "La Molina" National Agrarian University. This study, which also represents what is happening in Ecuador and Bolivia, indicates a widespread decline in cultivated areas both for tubers and for cereals. At the present time two-thirds of peasant families cannot meet their basic needs and more than half of them (54.6%) in the Peruvian sierra live in extreme poverty. Sixty per cent of children under six years of age suffer from malnutrition.

Most of the land lacks the necessary nutrients and is not subjected to soil and water management and control practices. The result is increased erosion and sedimentation. The uneven distribution of water over much of the high region is a constraint on per hectares yields and the number of harvests per year. For this reason, irrigation works are seen as a clear benefit in

countries such as Bolivia, Peru, Ecuador and even Colombia. In areas of these same countries with better rainfall distribution over the year, the trend is for land to be developed increasingly for livestock, reforestation and cash crops such as coffee, oil-seeds and cocoa.

The increases which can be obtained in farm yields in the high-mountain zones of the Andes range on average between 50 and 200% for basic crops such as maize, beans, potatoes, barley and quinoa. Peru's National Programme on Soil and Water Conservation in River Basins has compared zones where terraces have been built or rebuilt and where crops have been grown with and without fertilizers with zones lacking terraces; this comparison indicates that the following increases can be obtained: 43 and 149% for potatoes; 65 and 13% for maize; 104 and 1 019% for alfalfa; 89 and 200% for radishes; 87% for maize (with fertilizers in both zones); 45 and 28% for barley; and 17 and 85% for ullucu. The first figure indicates the increase in output achieved with fertilizers and terraces. The second figure is the increase in output achieved without fertilizers and with terraces. This information confirms that the potential contribution of the highlands of the Andean region to total farm output in the national economy could be increased by 80 and 100% over the current output without enlarging the areas farmed. This means that the highlands should be regarded as fundamental in the formulation of food-security strategies.

The livestock potential, including camelidae, of the highlands punas is also much greater than the present use. For example, camelidae farming is at present still very far from its potential, more because of political/administrative difficulties than for technical reasons. As pointed out earlier, in Peru alone it is estimated that the plateau areas (18 million hectares) could support about 500 000 vicuña, whereas today there are no more than 50 000. Proportional increases could be achieved with other camelidae such as llamas and especially alpacas, stocks of which have declined owing to competition from sheep.

The constraints of lack of information about the production potential of the high-mountain zones are due largely to the lack of statistics on individual river basins or specific zones and lack of processing of the existing data. These statistics would provide guidance for the officials responsible for State programmes and help them in the management processes to close the gap between current and potential output. For almost every part of the Andean region there are results of pilot and research projects which indicate that greater use could be made of the potential, but very little has been done to transfer this experience to larger areas, owing partly to the same lack of "executive" information.

The peasants' technical matrix, which consists of a diversity of traditional activities, could also be improved, given clear information about what already exists. This would facilitate the introduction of modern forestry and farming management techniques, improved seeds, etc.

Analysis of the various strategic approaches taken by the Andean countries to close the gap between current output (which determines to some extent present living standards) and potential output (which determines to

some extent the potential living standards) in the high regions of their respective territories suggests that:

- In most of the Andean countries farming policy has been concerned with consolidation of land suitable and designated for what is considered a modern type of agriculture or exploitation: for example, areas suitable for coffee, wool production, or irrigation.

- In the marginal parts of the Andean region primary attention has been focused on big investments in mining or hydroelectricity production. In fact, investments in big hydraulic and mining installations represent more than 90% of the total funds assigned to the high-mountain zones. These investments have been consistent with the purpose of using the resources to attain goals of urban-industrial development and strengthening of the economy's external sector.

The marginal highlands have received, in the best of cases, no more than 5 to 10% of the budgetary funds allocated to big projects. For example, the Cauca Valley Corporation in Colombia allocates 10% of its investments to the upper watersheds, and the Uribante-Caparo complex in Venezuela, 5%. The Paute River Basin project in Ecuador has 17% programmed, and this will produce the most balanced situation if it is implemented.

- The neglect of the zones which do not have projects of this kind has been partly offset by the implementation of national assistance programmes. In Peru, for example, there are the National Plan for Irrigation in the sierra (Plan MERIS), the Community Forestry Development Programme, the Land Improvement and Rural Housing Programme (PRATVIR), and many others at the regional or local level. They are usually effective in their own sector. Their major defect is often the lack of co-ordination when several programmes are operating in the same watershed or microregion. At the same time there have been many programmes of integrated rural development, microregional development and the like. Many of these programmes do not have sufficient continuity because they depend on external grants and operate exclusively as projects.

Assistance to highlands has also taken the form of programmes and plans for regulation or management of high-mountain river basins for the main purpose of conservation of the natural resources. As a rule, projects on water resource use have been the focus of the organization or reorganization of the development of many river basins. Despite all these initiatives, the region is still afflicted by the chaos stemming from institutional jealousies and conflicts. This is one of the main obstacles to improved efficiency in State management. It can only be overcome by the establishment of regional subdivisions of the territory, with respected authorities, and by clear definition of the rules of the interinstitutional game.

The strategy tools used to benefit the peasants have not produced tangible results on the necessary scale and many of the benefits from the investments have gone to users outside the region. An excessively high proportion of the investments in projects for the highlands goes on office, salary and travel costs of civil servants living in provincial or departmental capitals, remuneration of outside researchers, and the many

costs of consultancy, supervision, studies and controls which have no tangible reality for the peasant.

The rest of the investment finances field activities. Part of this amount has gone directly to the peasants in the form of tools, food or compensatory wages so that they implement their projects; part has been contributed by the peasants themselves, and part has been invested directly by the administration or in subcontracts. For a better understanding of the distribution of investments in high-mountain zones it would be very useful to have a statement, project by project and river basin by river basin, of how the resources are distributed among the projects and each river basin and what is the tangible result for the local inhabitant. In fact, insufficient progress has been made with many of the programmes and projects implemented so far in the highlands, mainly because they cover only a small part of each country's territory. It is important also to compare the effectiveness of their results in terms of improvement of the living standards of the inhabitants and conservation of the natural resources, to establish the distribution structure of public investment in each system and how it discriminates among administrative levels and geographical areas, and to evaluate the operational capacity of government management systems, so that this information can be supplied to the persons taking policy decisions.

The periodic evaluation of the effectiveness of the governmental management systems used in zones and watersheds of the high Andes is still at an embryonic stage in the countries for which case studies were produced. There were no centres for co-ordination of the many programmes and projects carried out in the sierra. Nor was there a list of these activities. There is a similar lack of information on individual river basins, even the largest ones. The Andean region has no real river basin authorities (except for Colombia's autonomous corporations) to collect and record the local studies, reports and missions. The information is usually kept in the capital and dispersed among several ministries. This could easily be corrected if a decision was taken to establish archives of local projects, including municipal ones, to which would be sent copies of the information available centrally.

Lastly, it must be emphasized that the governments of the five countries know that large numbers of the high zones in their territories lag behind the rest of the country and that they must improve the inhabitants' living standards as a matter of priority. In this they face a triple challenge: to overcome crisis situations; to restore former levels; and to try to make progress towards their improvement.

They also know that they are tackling these challenges with inadequate management systems in which the official is overwhelmed by the *ad hoc*, represented by a multitude of sectoral and multisectoral programmes and projects in the hands of ministries, institutes, foreign missions, corporations, foundations, national and foreign universities, international bodies, religious missions and private investors, each of which operates according to its own motives, interests, timetables and locations. The governments know that they must improve their organization in order to co-ordinate this great variety of activities.

All the countries are making efforts to impose order on this chaos, especially by trying to establish regional or microregional areas and furnish them with authorities and resources. However, this process is making slow progress so far, owing mainly to the difficulties of finding personnel and resources for each locality, to conflicts with the authorities of national and regional bodies, and to problems of sectoral emphasis and centralization.

Integration of the efforts and improvement of the living conditions of the inhabitants of the highlands and of their natural resources will be achieved only to the extent that these conflicts are resolved. The necessary means for attainment of this goal include rigorous studies that assess at least four main areas: the natural or environmental system; the system of users; the system of institutions; and the system of power. The present paper has touched briefly on the interaction between the natural, users' and institutional systems. It has not dealt with the system of power which is represented by a country's policies and lays down the basic rules of the game. Each of the systems has its own driving-forces which go some way to explaining its behaviour. The other forces which consolidate or modify this behaviour are produced by the impact of one system on another. The studies to be carried out will have to analyse these forces in order to see if it is possible to change the roles of the actors who determine the possibilities of improvement of the living standards of the inhabitants of the high zones and the conservation of their resources.

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