PROJECT BRIEF

1. IDENTIFIERS:

Project Number:	P057479
Project Name:	**Chile: Water Resources and Biodiversity Management Project**
Duration:	5 years
Implementing Agency:	World Bank
Executing Agency:	Ministry of Public Works
Requesting Country:	Chile
Eligibility:	Chile ratified the Convention on Biological Diversity in 1994
GEF Focal Area:	Biological Diversity
GEF Programming Framework:	Coastal, Marine and Freshwater Ecosystems (OP 2), with significant impacts on OP1, OP3, and OP4

2. SUMMARY:

The project' s main objective is to conserve aquatic biodiversity of global significance through mainstreaming biodiversity considerations in the management of water resources in Chile. The project will allow the GOC to: (i) incorporate biodiversity considerations in water management within 8 river-basins of global significance; (ii) enhance capacity to manage biodiversity within water management regimes, (iii) strengthen tools, policies, and technical baseline information required to manage aquatic biodiversity in Chile, and (iv) demonstrate successful models for mainstreaming aquatic biodiversity within integrated water management regimes.

The project builds upon an IBRD loan designed to help Chile manage water resources holistically and in a decentralized way. As such, the project has been designed to maximize mainstreaming and long-term sustainability.

3. COSTS AND FINANCING (MILLION US$):

GEF:	-	Project	10.00
		PDF B	0.33
Cofinancing:		IBRD	150.00
		GOC	160.00
Total Project Cost:			**320.00**

4. OPERATIONAL FOCAL POINT ENDORSEMENT:

Name: Adriana Hoffman Jacoby — Position: Directora Ejecutiva
Organization: CONAMA — Date: January 18, 2001

5. IA CONTACT:

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THE WORLD BANK/IFC/M.I.G.A.

OFFICE MEMORANDUM

DATE: January 31, 2001

TO: Mr. Ken King, Assistant CEO, GEF Secretariat
Att: GEF PROGRAM COORDINATION

FROM: Lars Vidaeus, GEF Executive Coordinator 

EXTENSION: 3-4188

SUBJECT: **Chile: Water Resources and Biodiversity Management Project**
Work Program Inclusion – Resubmission

Please find enclosed the electronic attachment of the above mentioned project brief for work program inclusion. The proposal is consistent with the *Criteria for Review of GEF Projects* as presented in the following sections of the project brief:

- Country Drivenness: section D4 (indications of government commitment)
- Endorsement: Attached
- Program Designation & Conformity: Section B2.
- Project Design: Section 6 (page 6), and Annex 2.
- Sustainability: Section F.
- Replicability: Section F (sustainability, page 15) and section D3. The project is highly innovative, as it seeks to mainstream biodiversity considerations in water management regimes in Chile. As such, its demonstration value is very large, given the lack of similar experiences in Latin America and around the world.
- Stakeholder Involvement: Sections E5, E6 and E7, and Annex 5.
- Monitoring & Evaluation: The project includes an explicit monitoring and evaluation system that incorporates biological monitoring. A summary can be found in section C1, and Annex 2.
- Financing Plan: IBRD cover page.
- Cost-effectiveness: Section E1.
- Core Commitments and Linkages: The project is an integral part of an IBRD loan that support the strengthening of water management regimes in Chile. As such, there is IBRD co-financing estimated at $150.0 million, and GOC counterpart financing in the order of $160.0 million.
- Consultation, Coordination and Collaboration between IAs: Section D2. The project was developed after consultations with UNDP, and based on the clear guidance received from Chile' s GEF focal point at the time of Block-B approval.
- Response to Reviews: Addressed in project brief. With particular reference to the request for a specific component as a vehicle for public participation, this issue has been addressed in Component 1: Institutional Development. The focus of the activities under this

component are to promote a participatory process that leads to the development of a new decentralized institutional model for the planning and implementation of water and biodiversity-related activities, utilizing the watershed as the primary unit for planning and decision-making purposes.

The draft has been revised taking into account the comments received from the GEF Secretariat on January 25th, as follows:

1. Overall Policy Framework. A full institutional analysis commissioned for this purpose was presented to the Secretariat and discussed at the bilateral. The report is now on the project files ("Analisis Juridico-Institucional para Insertar la Proteccion de la Biodiversidad en el Manejo de los Recursos Hidricos" by Sergio Praus G., December 2000). The following sections have been strengthened accordingly: B2, B3, C1 (components 1 and 2), and Annex 2 (components 1 and 2).

2. Information regarding the IBRD Loan. New paragraphs have been inserted in section C1 and in Annex 2.

3. Root Causes and Stakeholder Issues. Annex 5 has been strengthened, summarizing the following information for each watershed: ecological characteristics, root causes, threats, impacts, and conservation priorities. In addition, a new 60 page attachment has been submitted with the baseline information supporting project selection (in Spanish). Regarding stakeholder issues, a new full annex (Annex 4) has been inserted summarizing the results of the social assessment studies.

4. Clearinghouse Mechanism Linkages. The M&E and information system will be developed in conjunction with CONAMA, thus ensuring that all information flows back and forth with Chile' s CHM.

5. Biodiversity Components Linkages. Addressed as explained in point 3 above. In addition, a copy of the following document (which is the basis for prioritization of activities) was shared with the Secretariat and is available in the project files: "Perfiles Ecologicos de las Cuencas de los Rios Lluta, San Jose, Huasco, Elqui, Limari, Petorca, La Ligua, Mataquito, Itata, Imperial y del Lago Budi by H. Torres et al., Diciembre 2000, 240 pages, including 4 CDs with the GIS."

6. Absorptive Capacity. The results of the report mentioned under point 1 above is the basis for the design of component 1, which will determine specific capacity building needs for biodiversity conservation. New paragraphs have been inserted in section E4 (institutional issues).

7. M&E. A full description is included in Annex 2.

8. Endorsement Letter. Attached.

9. STAP Reviewer Comments. Adjustments have been made as explained above. Remaining issues will be discussed and solved at appraisal, as agreed with the Secretariat.

Please let me know if you require any additional information. Many thanks.

Distribution:

cc w/o attachments: Mmes. Serra (LCSES)

cc: Messrs./Mmes. Tlaiye, Carroll, Bradley (LCSEN), Castro , Khanna, Aryal (ENV); ENVGC ISC, IRIS2

Chile

Water Resources and Biodiversity Management Project

Project Appraisal Document

Latin America and the Caribbean Regional Office
Argentina, Chile, Paraguay and Uruguay Country Department

Date: January 5, 2001	Task Team Leader/Task Manager: Michael Carroll
Country Manager/Director: Myrna Alexander	Sector Manager/Director: John Redwood
Project ID: P057479 Sector: Environment	Program Objective Category: Environmentally Sustainable Development
GEF Supplement ID: P067979	Focal Area: Biodiversity
Lending Instrument: Specific Investment Loan	Program of Targeted Intervention: [ ] Yes [x] No

Project Financing Data [x] **Loan** [ ] **Credit** [ ] **Guarantee** [ ] **Grant** [X] **Other** Global Environmental Facility Trust Fund Grant (GEF)

For Loans/Credits/Others:

Amount (US$m/SDRm): US$ 160.0 (Bank loan of US$ 150 million and a GEF Grant equivalent to US$ 10 million)

Financing plan (US$m):

Source	Local	Foreign	Total (US$m)
IBRD			150.0
GEF			10.0
GOC			160.0
Total			320.0

Recipient: Republic of Chile
Responsible Agency: Ministry of Public Works (MOP)

Estimated disbursements (Bank US$M/FY):	2002	2003	2004	2005	2006
Annual	15	30	40	45	20
Cumulative	15	45	85	130	150

Estimated disbursements (GEF US$M/FY):					
Annual	1.0	3.0	3.0	2.0	1.0
Cumulative	1.0	4.0	7.0	9.0	10.0

Project implementation period: 5 years

A. Project Development and Global Objective

1. Project development objective and key performance indicators (See Annex 1)

The main objective of the proposed Water Resources and Biodiversity Management Project is to support efforts to achieve integrated water management at the watershed level within a sustainable development framework. The project would assist Government efforts to: (i) improve water resources management through the development of an institutional framework to implement a decentralised management system, which would take the watershed as the basic management unit and would guarantee full participation of all water users; (ii) improve protection of freshwater biodiversity by integrating biodiversity considerations into the new water resources management approach; (iii) strengthen water markets to improve water allocation; (iv) promote, within an appropriate framework of environmental and biodiversity conservation and protection, the development of new water resources through both a more efficient utilisation of public funds and an increased participation of private resources ; (v) develop and rehabilitation of sustainable irrigation infrastructure within the framework of the new integrated water resources management structure; and (vi) establish a comprehensive monitoring and evaluation system including ecological aspects.

2. Project global objectives and key performance indicators (see Annex 1):

The project' s main global objective is to conserve aquatic biodiversity of global significance through mainstreaming biodiversity considerations in the management of water resources in Chile. The project will allow the GOC to: (i) incorporate biodiversity considerations in water management within 8 river-basins of global significance; (ii) enhance capacity to manage biodiversity within water management regimes, (iii) strengthen tools, policies, and technical baseline information required to manage aquatic biodiversity in Chile, and (iv) demonstrate successful models for mainstreaming aquatic biodiversity within integrated water management regimes.

GEF resources would be reserved for those activities addressing biodiversity conservation which are incremental to the baseline sustainable development program to be financed by the IBRD loan in support of holistic water management. There would be two broad types of intervention financed by the GEF grant: "cross-cutting" interventions, targeted at incorporating biodiversity concerns into the framework of water resource management nationwide; and specific biodiversity conservation interventions to protect particular habitats in each of the project' s 8 watersheds.

Cross-cutting activities, aimed at mainstreaming, will be national in nature. Geographically-based activities are expected to be located in the eight watersheds selected for activities to be financed under the baseline investment program, (i.e. Lluta-San José, I Region; Huasco, II Region; Elqui and Limari, IV Region; Petorca-La Ligua, V Region; Mataquito, VII Region; Itata, VIII Region; and Imperial, IX Region) thereby maximizing the integration of biodiversity considerations into the management of water resources at the watershed level through action and demonstration.

B: Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project :

The CAS for Chile has not been updated since 1995. However, the Government of Chile' s (GOC) policy, which is fully consistent with Bank' s policies and best practice, aims at rationalising the use and development of water resources in the country through the preparation and implementation of integrated and ecologically sound water resources management programs that take the river basin as the basic management unit. This approach is based on full participation of stakeholders in the decision making process and promotes the development of strengthened water markets to improve the allocation of water resources. With budgetary constraints increasingly becoming a permanent feature of public finance, government must seek to rationalise the use of their financial resources as well as to incorporate the private sector in the development of new water works. At the same time, the policy responds to

increased societal pressure for cleaner and more sustainable ecological systems.

An integrated river basin approach to water resources management would enable the Government to adopt a more comprehensive strategy for public investment in water resources development, including surface and groundwater interactions, and address inter-sectoral water conflicts in an efficient, economic and equitable manner. Furthermore, by including water users' associations in the new river basin institutions or authorities, it is expected that the real participation of users in the decision making process and investment financing would be ensured and that the participation of other sources of private investment in the water sector would be encouraged. A comprehensive river basin development approach would also facilitate solutions to water quality problems and promote better natural resource management and conservation in general. Finally, an integrated approach will ensure that water allocation decisions incorporate biodiversity considerations in a cross-sectoral way compatible with mainstreaming.

b. GEF Operational Strategy/program objective addressed by the project:

The project explicitly supports article 6 (b) of the Convention on Biodiversity by promoting "the integration, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes, and policies." It also supports articles 8 a-c, 8d, 8e, 8f, 8l, 9, 10, and 14. It further supports decisions II/7 and III/9 (consideration of articles 6 and 8 of the Convention), III/18 (incentive measures), and IV/4 (status and trends of the biological diversity of inland water ecosystems and options for conservation and sustainable use).

The proposed project is consistent with the GEF Operational Strategy of supporting the long-term protection and sustainable use of biodiversity by (i) integrating the conservation and sustainable use of biodiversity within national and, as appropriate, sub-regional and regional sustainable development plans and policies, (ii) helping to protect ecosystems through targeted and cost-effective interventions, and (iii) providing a practical organizing framework for the design and implementation of cohesive systems of national actions involving coordination of international, inter-sectoral, and interagency activities to achieve agreed global biodiversity benefits.

The project supports GEF's Operational Program #2 (Coastal, Marine and Freshwater Ecosystems). In the context of an integrated approach to water resources management, however, some project interventions also support OP #1 (Arid and Semi-Arid Ecosystems), OP #3 (Forest Ecosystems), and OP #4 (Mountain Ecosystems). It would promote in-situ conservation and sustainable use of globally important biodiversity, and support participatory management mechanisms at the local level for integrated management of water resources, including biodiversity. The project supports all four project output categories under GEF's biodiversity OPs: (i) threat removal, (ii) sectoral integration, (iii) sustainable use, and (iv) institutional strengthening. The project emphasizes the integration of biodiversity conservation and sustainable use objectives in water and land use, and natural resource use management plans.

2. Main sector issues and Government strategy:

As the economy continues to develop and population expands, the competition for water resources continues to increase, creating development constraints and leading to inter-sectoral conflicts. Over the next 50 years, it is estimated that, in response to increased demand, the irrigated area with high irrigation security (85%) would more than double, from its present 1.2 million hectares to some 2.5 million hectares; hydroelectric capacity would increase five-fold; and industrial, mining and urban water consumption would double.

An integrated river basin approach to water resources management would promote a better coordination of all aspects of management, currently dispersed between several institutions, and enable the Government to adopt a more comprehensive strategy for public investment in water resources development, including interactions of surface and groundwater, and address inter-sectoral conflicts over water rights in an efficient, economic, environmentally sound, and equitable manner. Furthermore, by including all water users and their respective associations in the new river

basin institutions or authorities, it is expected that the real participation of water users in the decision making process and investment financing would ensure improved water use efficiency and higher returns to investment, while at the same time encourage the participation of other sources of private investment in the water sector. A comprehensive river basin development approach would also facilitate the solution of the problems of water pollution and quality control and natural resource management and ecological conservation in general.

The project is also closely linked to GOC' s environmental policy agenda.. With regards to biodiversity, the 1980 Constitution explicitly declared that it is the duty of the State to promote nature preservation. It contains three dispositions that are directly related to the environment. This implies that, the environment must be approached as a State duty and consequently, specific legal restrictions shall be established for the exercise of determined rights and liberties, such as the conservation and protection of the natural heritage. In 1994, Parliament approved the General Environmental Framework Law (Law 19,300), which created CONAMA as a decentralized Public Service agency, whose objective is to promote environmentally sustainable development and coordinate policy-driven actions and strategies defined by the government on environmental matters. The aforementioned law explicitly mandated the State: (i) to administer the national system of protected areas (SNASPE), (ii) to encourage and promote the creation of protected wildlife areas in private property (to be subjected to the same obligations and duties as those belonging to the SNASPE), and (iii) set forth procedures for the classification of species in accordance to conservation categories, i.e. extinct, endangered, etc. The country' s interest in biodiversity conservation was further demonstrated through the issuing of the 1996 Law for the Regulation of Hunting (*Ley de Caza*), whose principal objective is to limit hunting to sustainable levels thereby permitting the conservation of species.

Currently, the 1998 National Environmental Policy for Sustainable Development is the GOC' s major policy instrument for dealing with biodiversity conservation and land degradation control. Among the principles of this policy are the participation of civil society in environmental management and the country' s responsibility before the international community, reaffirming its commitment to maintain ecological services in conformity with the international treaties and conventions to which it is a party.

Furthermore, Chile' s Water Law explicitly mandates the General Water Directorate (Direccion de Aguas) to incorporate and mainstream ecological considerations into all regulations leading to water allocation decisions. Some of the tools that the Water Directorate may use include defining minimal ecological flows, identifying key aquatic habitats and ecosystems, and administering the "national system of environmental assessment" in such a was as to fully incorporate biodiversity aspects. B y incorporating biodiversity considerations into water resources management decisions, it is expected that conservation of biodiversity, in particular aquatic biodiversity, will be improved, thus reducing the current threat to species of global importance and ecological integrity at the river-basin level. Therefore, and even though these goals are explicit in current governmental policy (e.g. through the definition of ecological flows), a lack of technical and financial resources have prevented the full implementation of such an approach.

3. Sector issues to be addressed by the project and strategic choices

The proposed Water Resources and Biodiversity Management Project aims at assisting the Government in its efforts to improve water resources management and the conservation of biodiversity through the development of an institutional framework to implement a decentralised management system, which would take the watershed as the basic management unit and would guarantee full participation of all water users. The project's strategy to attain its aims implies several strategic choices:

a) to abandon the current centralised system and promote the transfer of responsibility for water management to the regional and local authorities and to water users;
b) given the budgetary constraints faced by Government, the promotion of private sector investment into the water sector becomes an essential feature of water resources development and management;

c) although the agricultural sector accounts for almost 90% of total water demand in the country, it is no longer feasible to design irrigation development projects, with an exclusive focus on the irrigation sector alone; future irrigation development would have to take into account the rapid growth in demand for water resources for competing uses and inter-sectoral conflicts;
d) the increasing conflicts between water availability and demand that will be faced by the various economic sectors can only be addressed in an equitable and economically efficient manner through an integrated river basin water resources management scheme;
e) in a decentralised water resources management scheme, measures to strengthen local water markets become an essential feature of the overall strategy.

Regarding biodiversity, the country is rich in biological resources of global significance but a number of species and ecosystems are under threat. The country has shown in the past its commitment to the protection of critical biodiversity through the promotion of in-situ conservation, primarily through a national system of protected areas. The Sistema Nacional de Areas Silvestres Protegidas del Estado (SNASPE) was created in 1984 [1] with the following objectives: protection of the nation's biological diversity, preservation of nature, and conservation of the nation's natural patrimony. The system protects around 14 million hectares which cover 19% of the national territory. It covers 92 Protected Areas (PAs), which are broken down into the following categories: 32 National Parks, 47 National Reserves, and 13 Natural Monuments. In addition, there are proposals to establish 73 additional PAs on private property, to be subjected to the same obligations and duties as those belonging to the SNASPE.

Despite these achievements, 20 ecosystems (out of a total of 85) are not represented in the SNASPE. This disparity is particularly significant with respect to the country's aquatic ecosystems, more specifically those located along the coast and in the bio-climatic Mediterranean regions. In addition, the inclusion of both coastal wetlands and Andean aquatic systems (including "*salares*") in the SNASPE would be of particular importance for the protection of migratory birds, including globally important and highly threatened species such as flamingoes.

Although quite effective for conserving terrestrial biodiversity, a protected area system is a necessary but not sufficient condition to conserve aquatic biodiversity. Aquatic biodiversity cannot be addressed in isolation, but needs to be part of an integrated water resources management system, which incorporates fully biodiversity concerns into the decision making process regarding water allocation, thus the emphasis of this project on mainstreaming.

Based on the above considerations, the project supports the following strategic choices regarding biodiversity:

a) Promoting the conservation of aquatic biodiversity cross-sectorally, through the strengthening of tools and institutions responsible for integrated water management.
b) Incorporating biodiversity conservation in water resources management planning at the watershed level.
c) Promoting the conservation and restoration of key aquatic habitats and ecosystems in each of 8 watersheds of global significance.
d) Mainstreaming aquatic biodiversity in the plans and activities of the Ministry of Public Works.
e) Supporting the establishment of selected protected areas to enhance the representation of aquatic ecosystems in the SNASPE.

[1] Although the SNASPE was legally created in 1984, the first two protected areas were established in 1906 and 1927, respectively.

C. Project Description

1. Project components (see Annex 2)

Component	Category	Indicative Costs (US$M)	% of Total	IBRD Financing (US$M)	GEF (US$M)	% of Bank-financing
Institutional Development , would promote the process of developing a new decentralized institutional model for the planning and implementation of water and biodiversity-related activities, utilizing the watershed as the primary unit for planning and decision-making purposes.		14.6	4.5	14.0	0.6	100
Development of Water Resources Management Instruments , aimed at assisting MOP and decentralized agencies in establishing a modernized and integrated system of water resources management that includes ecological considerations (mainstreaming), including the implementation of a comprehensive set of instruments linked to three main categories: (i) Knowledge, Information and Monitoring; (ii) Planning of Water Resources Utilization; and (iii) Environmental Management of Water Resources.		40.1	12.5	31.0	4.1	85
Watershed Development and Conservation Investments, to support the implementation of the integrated investment plans developed for the eight selected watersheds, as proposed in the respective Watershed Master Plans to be developed and implemented through of the new institutional framework promoted by the project, and as a result of detailed ecosystem profiles.		262.3	82.0	103.0	4.3	40
Monitoring and Evaluation, providing resources for the overall coordination and supervision of project activities, as well as the mechanisms to measure and assess project results, performance, and impact, including a biodiversity module.		3.0	1.0	2.0	1.0	100
	Total	320.0	100	150.0	10.0	50

The Water Resources and Biodiversity Management Project (WRBM) would promote and implement national and regional strategies aimed at establishing the technical and institutional framework required for the integrated, participatory and decentralized management of water and biodiversity resources utilizing the watershed as the basic planning unit. Under the project, the approach used by MOP and other relevant public agencies in the definition of priorities and execution of development programs would gradually shift, incorporating the regional and local governments, as well as the Water User Organizations (WOUs) in the decision-making process.

The WRBM project would be implemented in eight selected watershed, representative of the various ecological and hydrological conditions of Chile. The experience obtained by the implementation of project activities in these eight representative watersheds is expected to provide the instruments required for the dissemination of the new institutional and operational model at a national level. During the first year of the project, activities in three watersheds (Elqui, Mataquito, and Itata) would be initiated, while the additional five watersheds (Lluta-San Jose, Huasco, Limarí, La Ligua-Petorca, and Imperial-Lago Budi) would be incorporated in subsequent years of project implementation. The activities to be supported by the project in each watershed would result from the preparation of highly participatory Watershed Development Master Plans, defined as indicative planning instruments contributing to orient and coordinate public and private sector decisions aimed at optimizing the economic, environmental and social role of water and biodiversity resources.

The project would be implemented through four main components, all of which would integrate activities related both to water resources management and biodiversity conservation. Project design has taken into full consideration the objective of mainstreaming the technical, operational and institutional elements of biodiversity conservation into the implementation strategy. This would involve not only the specific activities that the project would finance in relation to the conservation of aquatic biodiversity, but also the interventions in relevant protected areas located within the eight selected watersheds.

Project components are:

- Institutional Development and Strengthening
- Development of Water Resources and Biodiversity Management Instruments
- Watershed Development and Conservation Investments
- Monitoring and Evaluation

Component 1 . The **Institutional Development and Strengthening Component (total cost of US$ 14.6 million, including US$0.6 million from GEF)** represents the key element of the project, as it would promote the process of developing a new institutional model for the planning and implementation of water and biodiversity-related activities in the country, within the existing legal framework. This would be achieved through the adoption of the watershed as the primary unit for planning purposes, as well as a comprehensive reorganization of roles and responsibilities of public and private sector institutions. More specifically, through this component, the project is expected to develop and implement a gradual process of decentralization from the central to the regional level, involving the establishment of mechanisms aimed at promoting the participation of regional and local government agencies, as well as private sector organizations, in the joint development and operation of activities included in the Watershed Development Master Plans. For this, technical assistance and training, covering various aspects of planning, administration and management of water resources and biodiversity would be provided to existing water user organizations and participating institutions at the central, regional, and local level. The component would be initially implemented in the three priority watersheds, and subsequently expanded to the additional five watersheds selected to be supported during project implementation.

Regarding the GEF-financed components, numerous actors including public and private institutions intervene in the planning, administration, regulation, control, and inspection of water in a way that affects areas of high

environmental value, generating effects (positive or negative) on the quantity and quality of biological diversity. These actors participate fulfill the indicated project objectives through various instruments, corresponding to:

· Inter-institutional management and coordination, and mechanisms of public-private cooperation. These activities are financed through this component (component 1).

· The development of approaches and methodologies for the incorporation of the ecological considerations in the management of water resources (such instruments as ecological flows, water environmental demand, classification of water bodies and courses, plans of prevention and cleaning of pollution, economic instruments, rising of in situ uses of water, rules for the evaluation of impacts on biological diversity, etc., (component 2).

· The design and execution of plans and activities associated to protection processes, restoration and prevention of deterioration of the biological diversity in critical basins. (component 3).

· The development of monitoring mechanisms of biological diversity (control and pursuit) and basic studies. (component 4).

Component 2. The **Water Resources Management Instruments Component (total cost of US$40.1 million, including US$ 4.1 million from GEF)** is aimed at establishing the logistical and operational framework for the operation of a modernized and integrated system of water resources management, within the context of the decentralized institutional model to be supported by the project. The project would assist MOP and decentralized agencies in the implementation of a comprehensive set of instruments linked to three main categories: (i) Knowledge, Information and Monitoring; (ii) Planning of Water Resources Utilization; and (iii) Environmental Management of Water Resources. Specific instruments to be supported by the project would include the development of water and biodiversity resources inventories, as well as Master Plans; the improvement of criteria and procedures to ensure adequate dam safety; the definition of ecological flows; preparation of hydrological, biodiversity, and irrigation management simulation models; water utilization and water market development plans, water quality control programs, strengthening of biodiversity in environmental impact assessment processes, and strategies for private participation in water resources development.

The main purpose of the GEF contribution to this component is to develop approaches and methodologies that allow the conservation of the biological diversity and to incorporate ecological considerations in the administration of the water resources. The GEF will finance the development of tools and mechanisms to ensure the mainstreaming of biodiversity considerations within key agencies of the government, with emphasis on the Ministry of Public Works. The project will develop management instruments that will allow the coordination the multiple uses and the necessity of conserving biological values of the water environment, which implies a more efficient use of the water resource. These instruments seek to establish the bases of a modern administration of the water resources in the pilot basins; therefore, it will be necessary to create and strengthen instruments that allow to carry out this task. These management instruments will supplement current ones, but, in particular, they will incorporate biological diversity explicitly, developing procedures and analysis methodologies that today are not available in the country (even though they are contemplated in government policy).

Component 3. The **Watershed Development Investment Component (total cost of US$ 262.3 million, including US$ 4.3 million from GEF)** would support the implementation of the integrated investment plans developed for each of the eight watersheds to be included in the project. Such investments would finance infrastructure proposed in the respective Watershed Master Plans to be developed, endorsed, and implemented through of the new institutional framework promoted by the project. This would include the establishment and/or rehabilitation of ecologically and environmentally sound infrastructure in each watershed for flood control and river training, rural water supply, irrigation and drainage systems, soil erosion control, and conservation of aquatic and terrestrial biodiversity.

GEF funds allocated to this component will support strategic actions that promote the conservation of biological diversity in the selected basins by means of immediate actions in favor of habitats, ecosystems, and species of conservation concerns. This responsibility will be shared by the National Forestry Corporation and numerous local community groups, indigenous communities, and NGOs. Sub-components were prioritized based on in-depth development of Ecosystem Profiles. The set prioritized includes a balanced approach to conservation through protected areas, single-species management, sustainable use, and habitat restoration.

It is important to emphasize that all decisions to be made regarding infastructure investments will be based, a priori, on information contained in the ecosystem profiles for each of the 8 project watersheds, and taking into account all ecological information and the application of environmental tools (explained in detail in Annex 2, component 2), thus generating effective mainstreaming via the holistic management of water within each watershed, and full consideration of globally-important biodiversity.

Component 4. The **Monitoring and Evaluation Component (total cost of US$3.0 million, including US$1.0 million from GEF)** would provide resources for the overall coordination and supervision of project activities, as well as the mechanisms to measure and assess project results and performance, primarily through indicators of water utilization and quality, the impact of project activities on environmental and biodiversity resources within the selected watersheds, and the technical, economic and social impact of the project. With regards to GEF, t he objective of the activity is the generation of a specific information system for the basins of the project to gather, store, process, analyze, monitor, relate and diffuse information on keys and indicative environmental variables of the state of the biological diversity, as well as of other hydrological variables, in various space and temporal scales. This system will be structured in computer systems of Geographical Information Systems (GIS), linked to databases, so that it will be possible to use them as a source of information and work platform in successive projects.

2. Key policy and institutional reforms supported by the project:

The project would build on existing water users organisations and regional government institutions to develop watershed management authorities, in which stakeholders would have full participation and inter-sectoral conflicts in water use and water quality as well as biodiversity conservation could be adequately addressed. It would strengthen the Government decentralisation process and would promote a gradual delegation of water management responsibilities from the central to the local levels.

From an environmental perspective, the project would strengthen a shift in environmental management from a system that relies on ex-post environmental impact assessments ("do no harm") to an ex-ante system, in which critical ecosystem features and needs would be defined at the watershed level before investments are planned, thus reducing the occurrence of conflict and improving decision-making.

3. Benefits and target population:

The project would create 8 watershed authorities and, in the process, it would strengthen central and regional governments and institutions dealing with water resources management and biodiversity conservation, around 8 River Water Authorities (*Juntas de Vigilancia*) and some 1,000 Canal Users' Associations (*Asociaciones de Canalistas*) and Water Communities (*Comunidades de Aguas*), which would group some 100,000 water users. These River Water Authorities and water users' organizations would include agricultural users as well as hydro-electrical, urban water supply, industrial and mining companies.

The project would provide technical and financial assistance both to guarantee water quality and biodiversity conservation, and to implement an investment programme for ecologically appropriate river training and flood

control, using ecosystem rehabilitation when necessary, which would protect agricultural production and urban centres located in the lower areas of the watersheds.

Within the framework of the proposed water resources management system in each watershed, the project would also provide technical and financial assistance to implement an investment program for each river basin to rationalise water resources development, including development and rehabilitation of irrigation works, covering some 200,000 hectares and benefiting around 50,000 farmers.

Economic benefits of the project would be the result of: (i) a more rational water allocation and distribution, allowing a more productive use of that resource; (ii) prevention of flood damage to agriculture production and small towns in the selected watersheds; (iii) capturing global environmental benefits through the protection of biodiversity of global importance; (iv) improved efficiency in irrigation water use and irrigated agriculture production in some 200,000 hectares; (v) increased income of some 50,000 farmers; and (vi) improved water quality and pollution control.

In terms of biodiversity and GEF's role, it is key to mention that Chile is a biogeographical "island" within South America's southern cone. To the east, it is isolated by the Andes Mountains; to the north by the Atacama Desert; and to the west by the Pacific Ocean. In addition, it comprises extensive latitudinal and altitudinal ranges that result in immense climatic variability. In part, these characteristics have contributed to the country's rich biological diversity and high levels of endemism (77% of amphibians, 58% of reptiles, 51% of higher plants and 37% of mammals are endemic).

Chile contains an extensive complex of rivers (about 230 watersheds), Andean, coastal wetlands, and other aquatic resources. The "Directory of Neotropical Wetlands" lists 34 Chilean aquatic environments (lakes, bays, lagoons, estuaries, *salares*, etc.) as sites of greatest importance according to the criteria of the Convention on Wetlands of International Importance [1]. In addition, a recent analysis of freshwater biodiversity conservation priorities for the Latin American and Caribbean region recognizes the very high degree of biological distinctiveness (measured in terms of endemism rates and species richness) as well as high degree of threat of Chilean freshwater ecosystems. The combination of these two characteristics (high biological importance and high degree of threat) implies that the totality of the freshwater ecosystems found in Chile are either priorities or high priorities for conservation action for the LAC region. Noteworthy among these are the following freshwater ecoregions: (i) Valdivian; (ii) Chiloe island; (iii) North Mediterranean Chile; (iv) Arid Puna; and (v) South Mediterranean Chile. [2]

Global environmental benefits to be generated through this project include in-situ conservation of areas of high aquatic biological importance through threat removal, sectoral integration, establishment of conservation areas, habitat restoration, and institutional strengthening. The eight areas chosen for project implementation have important biological characteristics and are all significant from a global biodiversity perspective. These 8 watersheds were the subject of intensive ecological studies as part of project preparation. As a result, a detailed "ecosystem profile" was prepared for each watershed with the input from local and national scientists,

[1] Other indicators of Chile's unique contribution to global biodiversity include the following: (i) Central Chile has been classified as one of the world's 18 regions or "Hot Spots" of plant endemism [In total, these 18 regions contain approximately 49,955 endemic plant species, or 20% of the world's plant species, in just 746,400 km ^{2}, or 0.5% of the Earth's land surface (Source: Myers, N. 1990. The biodiversity challenge: expanded hot-spots analysis. **The Environmentalist** 10:243-256)]; (ii) in terms of biological diversity, the country has an estimated 32,000 species (approximately 1,800 species of vertebrates, 16,000 species of invertebrates, and 12,000 species of plants, fungi and lichens) (Source: Simoneti et al. (editors), 1995. Biodiversidad Biológica de Chile. Comité Nacional de Diversidad Biológica, Santiago); and (iii) the estimated 1,027 fish species (5.3% of the world's total), 456 species of birds (5% of the world's total), and 147 species of mammals (3.6 % of the world's total illustrate Chile's rich faunal diversity).

[2] Source: **Freshwater Biodiversity of Latin America and the Caribbean** (WWF / USAID / Biodiversity Spupport Program / Wetlands International, 1998).

conservationists, and government officials. These documents served as the basis for prioritizing the investments under the GEF-financed components of the project. A summary of the main findings is presented in Annex 5. The entire ecosystem profiles, including detailed GIS maps, are available in the project files, and are attached to this PAD for GEF's review.

4. Institutional and implementation arrangements:

Implementation Period : 5 years

Executing Agency Ministry of Public Works

Local Executing Agencies : the Watershed Development Investment component would be implemented in each of the eight selected watershed in a decentralized way through the newly created Watershed Authorities. Given the participation of water users in these Authorities, the investment process is expected to be demand-driven and decisions regarding investment priorities are expected to be taken with the full participation of stakeholders. The technical supervision of work construction would be with the Department of Hydraulic Works (*Dirección de Obras Hidraúlicas, DOH*) within the Ministry of Public Works. The Ministry of Agriculture would be responsible for technical assistance to irrigation farmers in the selected watersheds. The implementation of the Institutional Development component would be the responsibility of both the Department of Water (*Dirección General de Aguas, DGA*) and the Department of Hydraulic Works of the Ministry of Public Works. GEF-financed activities would be implemented by DGA and CONAF, through its regional offices, in close coordination with CONAMA. The implementation of the water resources management instruments component would be the responsibility of DGA.

Accounting, financial reporting and auditing arrangements : A financial expert joined the Bank task team and conducted a thorough assessment of MOP's accounting and financial reporting systems, and the eventual adjustments required to address Bank policies, as well as the specific requirements of administering the two sources of external financing for the project (Bank and GEF).

Procurement: A comprehensive Procurement Capacity Assessment, following OCSPR guidelines, was carried out by the Procurement Specialist of the Bank Team during project preparation. Given the nature of the project, and the significant experience of MOP in implementing Bank financed infrastructure projects, no major procurement issues are envisaged.

Monitoring and Evaluation : given the highly decentralized nature of the project, adequate monitoring would be essential to guarantee an effective project execution. Thus the project is developing a comprehensive Monitoring and Evaluation System at the central level, to be operated by the Department of Water of the Ministry of Public Works, and to be linked with Monitoring and Evaluation Systems developed and operated at the level of each of the selected watershed authorities.

An explicit biological monitoring and evaluation module will be integrated in the overall M&E system. Given the importance of biological monitoring to the project, this module will be executed as a project component, and is explained in detail in Annex 2.

D: Project Rationale

1. Project alternatives considered and reasons for rejection:

The World Bank-financed Irrigation Development Project (Loan 3528-CH) ended in mid-1999 and, therefore, the first alternative considered was the preparation and implementation of a second phase of this project. However, as the ICR of that project indicated, future irrigation development projects in Chile could no longer be prepared and implemented in isolation from the rest of the sectors of the economy demanding water resources. Instead, irrigation

development projects would have to adopt a much broader approach, taking into account the rapid growth in demand for water resources for competing uses and inter-sectoral conflicts. Hence this alternative was rejected in favour of more comprehensive approach to water resources management and development, including irrigation.

Activities to improve aquatic biodiversity conservation were initially discussed as a self-contained GEF-financed project addressing biodiversity conservation through the establishment of new protected areas. However, it was subsequently agreed that the impact on conservation of biodiversity resources would be much larger if biodiversity considerations could be incorporated (mainstreamed) into the water resources management decision making process and by working primarily with the Ministry responsible for the the largest infrastructure investments and water allocation decisions (Ministry of Public Works). It was thus decided to favour a single water resources and biodiversity management operation.

2. Major related projects financed by the Bank and/or other development agencies (completed, ongoing and planned):

Sector issue	Project	Latest Supervision (Form 590) Ratings (Bank-financed projects only)	
		Implementation Progress (IP)	Development Objective (DO)
Bank-financed			
Development and Rehabilitation of small and medium scale irrigation projects	Irrigation Development Project (Loan 3528-CH)	S	S
Development and Strengthening of Environmental, Legal and Institutional Framework	Environmental Institutions Development Project (Loan 3529-CH)	N/A	HS
Environmental Management and Biodiversity Conservation	Conservation of Valdivian Forests (GEF MSP) under preparation		
	Conservation of mountain ecosystems around Santiago (GEF MSP) under preparation		
Other development agencies			

IP/DO Ratings: HS (Highly Satisfactory), S (Satisfactory), U (Unsatisfactory), HU (Highly Unsatisfactory)

3. Lessons learned and reflected in the project design:

Several important lessons have either been learned from, or reinforced by the experience of other projects. These include the following:

- Increased demands for water from different sectors of the economy are leading to conflicts over scarce supply, which can be best addressed at the level of the river basin and catchment area. Consequently, future irrigation development should be an integral part of a broader water management strategy.

- There is a great advantage to be gained by working closely with the potential beneficiaries of public sector investment in irrigation infrastructure. Their involvement and "ownership" from the beginning of the project cycle is essential, particularly where cost recovery of investment is a requirement, and contributes significantly to on-farm development.

- Efficient operation and maintenance of infrastructure is best achieved by paying close attention to the organization of water users. Institutional development of these organizations, if properly planned and implemented, is not a costly exercise and pays handsome dividends. Particular attention should be given to institutional development and to the training of participants when the beneficiaries are small farmers.

- It is essential to work closely with sub-national governments, even if these are not the principal source of the investment funding in the case of Chile, they could nevertheless contribute important investment resources through the Regional Development Funds. Decentralization facilitates farmers' participation in demand-driven projects.

- The development of irrigation infrastructure should only be undertaken as a public investment when it is consistent with priorities defined in the respective watershed development master plans and when pre-investment analysis demonstrates that it will form the basis for financially-sound agricultural development. It should then be axiomatic that investment costs should be recovered, and that beneficiaries should be fully responsible for operation and maintenance under agreed procedures.

- Experience has demonstrated that the integration of production support services with investment in infrastructure and the strengthening of water users' organizations are essential if the benefits are to be realized in terms of agricultural development. Support services must be carefully designed and integrated.

- Experience under the project demonstrates the value of developing (and adhering to) transparent and coherent selection criteria for sub-projects, especially when an investment project is to be demand-driven.

- The process of project preparation should recognize explicitly the difficulty, or even the impossibility, of coordinating the allocation of budgetary resources to multiple implementing agencies. In this project, many of the needs for budgetary resources to undertake individual sub-components or activities under the project were not met. Fragmentation in budgets, allocation to different ministries, with no way of making sure that budget was earmarked and therefore treated as a project whole.

- Increased demands for water from different sectors of the economy are leading to conflicts over scarce supply, which can be best addressed at the level of the river basin and catchment area. Consequently, future irrigation development and ecological conservation should be an integral part of a broader water management strategy.

- Aquatic biodiversity conservation cannot be addressed by establishing protected areas alone; instead, it needs to be addressed at the watershed level and taking into account competing needs for water allocation.

- Biodiversity conservation outside protected areas is most effective when it is internalized into decision-making processes within a broad set of sectors (e.g., infrastructure, agriculture, etc.), i.e., "mainstreamed."

4. Indications of borrower commitment and ownership:

The project is an integral part of the Government decentralization strategy and the restructuring and modernization program of the Ministry of Public Works, which aims at decentralizing the decision-making process of the Ministry's investment program, using the watershed as the management unit to allocate investment

resources. The water sector would be the first one to adopt this new decentralized approach to management and investment decisions, which would guarantee full participation of all water users. The project concept and objectives were fully endorsed by the new Administration, which took office in March 2000.

Chile has assumed major international commitments related to biodiversity conservation. It has ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1975, the World Heritage Convention in 1980, the Convention on the Conservation of Migratory Species of Wild Animals in 1981, the Ramsar Convention in 1981, the Desertification Convention in 1994, and the Convention on Biological Diversity in 1994.

Also, the following concrete on-going actions demonstrate the country's commitment to biodiversity conservation: (i) promoting the creation of protected wildlife areas in private property in order to increase the representation in the SNASPE of ecosystems of national and global importance; and (ii) the significant strengthening of the EIA system, whose objective is the incorporation of environmental considerations into new investment projects and activities in the country. In addition, the 1998 Environmental Policy declares that, among the priority actions to be taken by the State to conserve biodiversity is the strengthening of the current system of enforcement and compliance of conservation laws and regulations.

The project has been endosed by CONAMA, Chile's GEF focal point, as an activity of a national priority.

5. Value added of Bank and Global support in this project:

The Bank, with its extensive experience in both water resources management and biodiversity conservation as well as decentralized, demand-driven rural investment projects, is well placed to support the Government of Chile in its efforts to improve water resources allocation and use through the adoption of a decentralized water resources management system, with strong stakelholder participation and clear biodiversity conservation objectives. Bank participation in the project would complement central and local government expertise, bringing lessons and insights from related projects in other countries to ensure the design of an effective program of technical and financial assistance for the adoption of a decentralized water management system that will integrate fully biodiversity considerations into the decision making process.

The project would benefit also from the Bank's involvement in the recently completed Irrigation Development Project (PROMM), which included actions to strengthen water users' organizations and improve their participation in project design and implementation. Additionally, Bank experience would contribute also to the design and implementation of a comprehensive monitoring and evaluation system, leading to improved provision of financial and technical assistance to farmers and other stakeholder in the areas of water resources management and biodiversity conservation.

GEF support would enable the Government to incorporate biodiversity considerations into the new water resurces management system and create awareness of the significance of aquatic biodiversity of global importance and promote biodiversity conservation activities among water users.

This support will also enhance the application of environmental policies related to aquatic biodiversity (e.g., maintenance of ecological flows, definition of aquatic ecosystems, etc.) by supporting the technical studies needed to refine and apply these concepts, as already recognized in official policy.

E: Summary Project Analysis

1. Economic :

Given the program nature of the proposed project and the demand-driven approach to its investment activities, it is not possible to determine *a priori* the exact composition of investment to be financed under the project.

However, a full Cost-Benefit Analysis of the relevant components would be finalized at appraisal. In addition, the Incremental Cost analysis related to GEF financing is included in Annex 3 of the present document.

[x] Cost-Benefit Analysis : NPV=US$ million; ERR= % [ ] Cost Effectiveness Analysis:
[x] Incremental Cost [ ] Other(Specify)

2. Financial: NPV=US$ million; FRR= %

Not applicable for GEF activities.

3. Technical:

The project includes rehabilitation and modernization of irrigation canal intakes located in places with high risk of destruction by swollen rivers. The project will developed general norms to ensure the security of these structures and will pay particular attention to their design

The project foresees the introduction of certain water measurement and canal flow regulation structures and the promotion of improved irrigation systems that are relatively unknown to most small farmers. The technical assistance and training program that will be executed under the project would ensure a smooth transition to the new systems of structures and irrigation methods.

The project relies on biodiversity conservation through both direct and indirect means. Although some of the interventions have proven feasibility elsewhere (such as the establishment of protected areas), others rely on innovative methodologies for mainstreaming, including cross-sectoral planning and enhanced information as a way for achieving project impacts. A biological monitoring system will measure both the outputs and outcomes of these activities.

4. Institutional:

(a) Institutional capacity of local governments and water users organizations to participate in a decentralized water and biodiversity resources management system.
(b) Potential unforeseen legal constraints to delegate water management responsibilities to the watershed authorities.
(c) The multisectoral character of the proposed water resources management approach will require the full participation not only of irrigation farmers but also of other users such as municipalities, hydroelectric companies, industry, and mining companies.
(d) The implementation of some of the proposed water works investment projects could be delayed if no agreement is reached between the owners of consumptive and non-consumptive water rights.
(e) The multiple interests of various stakeholders vis-à-vis institutional mandates that under some instances could conflict.
(f) Absorptive capacity for biodiversity components. A full institutional analysis (available in the project' s files) analyzed the capacity of all agencies involved in implementing the biodiversity components, and identified capacity building needs to be supported via component 1 of this project.

5. Social:

a) Definition of a decentralized environmental impact assessment and monitoring system for water sector investments that can be implemented by each of the watershed authorities
b) The rehabilitation and/or construction of hydraulic infrastructure are an important environmental issue related to this project. This component has both direct and indirect impacts, which will have to be considered in order to ensure that possible negative impacts are identified during the early stages of project design and that adequate mitigating plans are developed and accounted for as an integral part of the project.
c) The establishment of protected areas through participatory means needs to ensure the meaningful consultation of all stakeholders.

6. Environmental:

Environmental category: [x] A [] B [ ] C

The project is designed to improve the utilization of water resources and their quality. The country' s environment legislation and the guidelines applied by the National Environment Commission (*Comisión Nacional del Medio Ambiente, CONAMA*), which was strengthened by a World Bank-financed project, provide adequate instruments to protect the environment. With a project-strengthened environmental impact assessment mechanisms in place to screen all investment proposals that are presented to the respective watershed authorities for financing, and the strengthening of watershed authorities to control water pollution and monitor water quality and biodiversity conservation.

Following existing practice in the country, environmental analysis and evaluation has been internalized as an integral part of project preparation with the objective of ensuring that alternative technical designs are considered as part of the decision making process and that final design of hydraulic infrastructure will encompass adequate consideration for environmental impacts and mitigating measures. During preparation, it was ensured that terms of reference for these EIA follow standard criteria acceptable to the Bank. As the project will focus on integrated water resources development and biodiversity conservation at the watershed level (watershed as the planning unit), there has been a baseline assessment of the selected watersheds and an examination of the overall development of each basin. At the regional level, it will be ensured that policies and the framework for water resources and biodiversity management encompass environmentally sustainable principles such as efficient use of water resources, water conservation, in-stream rights, permits for effluent discharge, etc.

The required environmental studies, including the Regional Environmental Assessment for the Elqui Watershed, are almost completed.

Local groups and NGOs consulted: (List names):

i) Water users organizations of the watersheds of Elqui, Mataquito and Itata rivers
ii) Water companies of urban areas within the three priority watersheds
iii) Local governments (regional, provincial and municipal) of the IV, VII and VIII regions
iv) Academic and research institutions, including Central and regional Universities, as well as the Chilean Museum of Natural History

During project preparation, there were numerous field visits to proposed project sites and meetings (workshops) were held with the participation of regional government teams, as well as project beneficiaries and other groups of interest (NGOs, water users, etc.).

There is no resettlement envisaged during project implementation in the three priority watersheds to be assisted during the initial years of the project. Nevertheless, and given the demand-driven nature of investment to be financed under the project, it was agreed that a Government resettlement framework, compatible with World Bank guidelines, will be prepared by the local team and agreed during appraisal.

7. Participatory approach

Water users organizations which will form an integral part of the newly created watershed authorities and will thus be involved at every stage of the decision-making process related to the design of both institutional and investment proposals to be financed under the project. Given the participatory approach used during project preparation, water users, regional and local governments have been fully involved in the design of the various components. Water users other than irrigation farmers (hydroelectrical, industrial and mining companies) participated in project preparation through workshops that were organized to discuss project proposals. During project implementation, they will be fully incorporated into the proposed water resources and biodiversity management system through the proposed Watershed Authorities that will be created to include all water users.

A full description of the participatory methodology utilized, and the social assessment of each of the 8 project watershed, is available in the project files. In addition, a detailed assessment of main socioeconimic indicators of the watersheds to be assisted by the project is included in Annex 4.

F: Sustainability and Risks

1. Sustainability:

Biodiversity conservation at the river-basin level is expected to be sustainable through its internalization in the decision-making processes leading to water allocation. By enhancing the knowledge base, institutional capacity, awareness, and definition of ecological baselines and ecological flows, it is expected that the major threats to biodiversity conservation arising from incompatible development initiatives will be largely minimized.

Furthermore, these considerations respond to policies that are already adopted in Chile, even though they have not yet been fully applied because of lack of financial resources and technical know-how. The project will support institutional strengthening and the development of tools and techniques that will support mainstreaming over the long-term. Because the application of these tools is an integral part of the mandate of the Ministry of Public Works, as recognized in the National Water Law, it is expected that their application will be fully absorbed by the Ministry after the project ends.

Regarding the components in each of the 8 watersheds, sustainability is expected through decentralized management and the adoption of these practices at the local level. The direct participation of local stakeholder in the implementation of these activities ensures a high degree of understanding and support for such rehabilitation activities, as well as ensuring that local populations will directly benefit from their implementation.

Risk	Risk Rating	Risk Minimization Measure
Decentralization process continues to be a priority of the new administration Central Government agencies (particularly MOP) acknowledge the benefits of delegation of responsibilities to Watershed Authorities	N N	New administration, including MOP's Minister, has ratified policies and role of project in achieving sustainable decentralization. Project instruments would ensure active participation of regional governments

	M	Selection of watesheds during project preparation, as well as a detailed institutional strengthening component, would ensure establishment of Watershed Authorities is a priority.
Establishment and strengthening of Watershed Authorities occurs early during project implementation		
Budgetary resources are made available on a timely basis and in the required volumes		Financial resources required for project implementation would be within the sectoral expenditure ceilings defined by the Ministry of Finance
Instruments are developed and operated during the first year of project implementation		Some instruments are being developed during project preparation
Demand-driven approach to investment identification and selection is applied		The demand-driven approach is already standard government policy in any investment financed by the state
Farmers and other water users are interested in biodiversity conservation	M	Training and institutional strengthening of water users' associations would increase awareness of biodiversity importance
Investment in erosion control and natural resources conservation is not overshadowed by infrastructure investment		Environmental issues are a Government priority already
Baseline is developed and M&E System is in operation during the project' s first year of implementation		Contracts of consultants for the preparation of the Base Line will ready for project effectiveness and M&E system would be in place by Appraisal
Overall Risk Rating	M	

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N (Negligible or Low Risk)

3. Possible Controversial Aspects (Project Alert System):

Risk	Type of Risk	Risk Rating	Risk Minimization Measure

Type of Risk – S (Social), E (Ecological), P (Pollution), G (Governance), M (Management capacity), O (Other)
Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N (Negligible or Low Risk)

G: Main Loan Conditions

1. Effectiveness Conditions: None

H. Readiness for Implementation

[ ] The engineering design documents for the first year' s activities are complete and ready for the start of project implementation. [x] Not applicable.

[ ] The procurement documents for the first year' s activities are complete and ready for the start of project implementation.

[ ] The Project Implementation Plan has been appraised and found to be realistic and of satisfactory quality.

[ ] The following items are lacking and are discussed under loan conditions (Section G):

I. Compliance with Bank Policies

[x] This project complies with all applicable Bank policies.

[ ] [The following exceptions to Bank policies are recommended for approval: . The project complies with all other applicable Bank policies.]

Annex 1: Logical Framework
Chile: Water Resources and Biodiversity Management Project

Narrative Summary	Key Performance Indicators	Monitoring and Evaluation	Critical Assumptions
Sector-related CAS Goal: Rationalize the use and development of water resources, improve aquatic biodiversity conservation, and strengthen a decentralized water resources management system, with full participation of stakeholders	**Sector Indicators:** • Improve water use efficiency by project completion • Increase stakeholders' participation in water management decisions.	• Mid-term Evaluation • EOP Impact Evaluation	**(Goal to Bank Mission)**
Project Development Objectives • To improve water resources management through the development of an institutional framework to implement a decentralised management system which takes the watershed as the basic management unit and promotes full participation of all water users • To improve protection of freshwater biodiversity by integrating biodiversity considerations into the new water resources management process • To strengthen water markets to improve water allocation • To promote, within an appropriate framework of environmental and biodiversity conservation,	**Outcome/Impact Indicators:** • Eight watershed managed in a decentralized way • Increase in overall water use efficiency by EOP. • 100% of water users organizations in the project area will participate in watershed authorities • Biodiversity issues incorporated in water management decision making by EOP. • Ecological flows for selected areas defined by EOP. • MPW Incorporating biodiversity concerns in water management tools by EOP. • Increased number of water rights transactions • 25% increase in private investment in the water sector	• M&E Reports • End of Project report • Survey and study reports	**(Objective to Goal)**

the development of new water resources through both more efficient use of public funds and increased participation of private resources • To develop and rehabilitate sustainable irrigation infrastructure within the framework of the new integrated water resources management structure • To establish a comprehensive monitoring and evaluation system including ecological aspects	• Biological monitoring system operational by EOP		
Output from each component: *Component 1: Institutional Strengthening* • Development of watershed authorities which incorporate biodiversity values in the decision making process • Strengthening of water users organizations *Component 2: Water Resources Management Instruments* • Development of water management instruments which incorporate biodiversity values *Component 3: Watershed Development and Conservation Investments* • Increased investment in flood control and river training	• Creation of eight watershed authorities by EOP. • Strengthening of 100% of water users organizations in the project area by EOP. • Development of eight simulation and water distribution models by EOP. • 50% of the rivers in project area with flood control infrastructure	**Project Reports** • Annual reports • M&E reports • Annual reports • M&E reports • Technical reports • Annual reports • M&E reports • Beneficiaries surveys	**(Outputs to Objective)** • Decentralization process continues to be supported • Central government agencies (i.e., MOP) delegates responsibilities to watershed authorities

	investments by EOP.		
• Increased investment in biodiversity conservation	• Increase in biodiversity conservation investments in the project area by EOP.		
• Expand current irrigation development programs	• 200,000 ha. of new and rehabilitated irrigation area by EOP. • 50,000 farmers with improved irrigation by EOP.		
• Improve water quality			
Component 4: Monitoring and Evaluation • M&E system established which incorporates biodiversity indicators	• 100% of the project area covered by the M&E system by EOP.	• Biological monitoring sections within M&E reports	
Project Components/Sub-components:	**Inputs: (budget for each component)**	**Project Reports**	**(Components to Outputs)**
1. **Institutional Development** : financing consultants to provide technical assistance and training to government institutions and water users' organizations as well as equipment and studies.	• US$14.6 million total component cost • (US$14.0 million IBRD component cost) • (US$0.6 million GEF component cost)	• Annual operating plans and budgets • Procurement reports • Technical reports • M&E reports • Project supervision reports • Financial system reports • Progress reports	• GOC budgetary resources are made available on a timely basis and in the necessary amounts
2. **Water Resources Management Instruments** : financing the development and operation of water and biodiversity resources inventories, simulation models, environmental impact assessment instruments, and water resources data base	• US$40.1 million total component cost • (US$31.0 million IBRD component cost) • (US$4.1 million GEF component cost)		• GOC budgetary resources are made available on a timely basis and in the necessary amounts
3. **Watershed Development and Conservation Investment** : financing irrigation infrastructure, flood control and river	• US$262.3 million total component cost • (US$103.0 million IBRD component cost)		• Farmers and other water users are interested in biodiversity

training works, measures to control erosion and conservation of natural resources	• (US$4.3 million GEF component cost)		conservation • Investment in erosion control and natural resources conservation is not undermined by non-project infrastructure investment
4. **Monitoring and Evaluation**: financing consultants for the development and operation of a M&E system, training of executing agencies and equipment	• US$3.0 million total component cost • (US$2.0 million IBRD component cost) • (US$1.0 million GEF component cost)		• GOC budgetary resources are made available on a timely basis and in the necessary amounts

Annex 2: Detailed Description of GEF Sub-Components
Chile: Water Resources and Biodiversity Management Project

The Water Resources and Biodiversity Management Project (WRBM) would promote and implement national and regional strategies aimed at establishing the technical and institutional framework required for the integrated, participatory and decentralized management of water and biodiversity resources utilizing the watershed as the basic planning unit. Under the project, the approach used by MOP and other relevant public agencies in the definition of priorities and execution of development programs would gradually shift, incorporating the regional and local governments, as well as the Water User Organizations (WOUs) in the decision-making process.

The WRBM project would be implemented in eight selected watershed, representative of the various ecological and hydrological conditions of Chile. The experience obtained by the implementation of project activities in these eight representative watersheds is expected to provide the instruments required for the dissemination of the new institutional and operational model at a national level. During the first year of the project, activities in three watersheds (Elqui, Mataquito, and Itata) would be initiated, while the additional five watersheds (Lluta-San Jose, Huasco, Limarí, La Ligua-Petorca, and Imperial-Lago Budi) would be incorporated in subsequent years of project implementation. The activities to be supported by the project in each watershed would result from the preparation of highly participatory Watershed Development Master Plans, defined as indicative planning instruments contributing to orient and coordinate public and private sector decisions aimed at optimizing the economic, environmental and social role of water and biodiversity resources.

Project objectives would be achieved through the implementation of four main components, all of which would integrate activities related both to water resources management and biodiversity conservation. Project design has taken into full consideration the objective of mainstreaming the technical, operational and instutional elements of biodiversity conservation into the implementation strategy. This would involve not only the specific activities that the project would finance in relation to the conservation of aquatic biodiversity, but also the interventions in relevant protected areas located within the eight selected watersheds.

Project components are:

- Institutional Development and Strengthening
- Development of Water Resources and Biodiversity Management Instruments
- Watershed Development and Conservation Investments
- Monitoring and Evaluation

Given the primary objective of mainstreaming biodiversity considerations, the GEF-financed components are organized along the same four components as the IBRD loan. Cross-sectoral activities (included in components 1 and 2) were prepared based on baseline studies, a needs assessment, and current institutional mandates based on existing policies, laws, and regulations. Investment activities within the 8 watersheds (component 3) were prioritized based on a detailed ecological analyses of these watersheds (see Annex 5 for details).

Component 1: Institutional Strengthening. Total Incremental Cost: US$670,000; GEF US$600,000.

Numerous actors (including public and private institutions) intervene in the planning, administration, regulation, control, and inspection of water in a way that affects areas of high environmental value and effects (positively or negatively) the quantity and quality of biological diversity. These actors are both "organizations of first coordination level" or "second coordination level," depending on their focus and attention to the protection and conservation of biological diversity.

Those of first order correspond to organizations whose activities are directly related to the protection, use and sustainable management of continental waters. These include the General Directorate of Water, General Directorate of Public Works, Superintendence of Sanitary Services, DIRECTEMAR, CONAMA and, in certain areas, health services, Sub-secretariat of Fisheries, SERNAP, and users organizations.

Those of second order correspond to organizations that, although their area of competence covers other topics, some of their activities impact direct or indirectly on the environmental quality of water resource and their biological diversity. In this category, the Service of Agriculture and Cattle (SAG) and the National Forestry Corporation (CONAF) stand out since they are responsible for managing and protecting agricultural and forest soils, flora resources, terrestrial fauna and ecosystems whose integrity and rational use depends on the conservation of rivers, lakes, wetlands and lagoons.

These actors contribute to project objectives through various instruments, some of which the project will strengthen. These activities include:

- Inter-institutional management and coordination and mechanisms of public-private cooperation. These activities are strengthened through this component.
- The development of approaches and methodologies for the incorporation of ecological considerations into the management of water resources (these instruments include: ecological flows measures, water environmental demand indicators, classification of water bodies and courses, plans for prevention and cleaning of pollution, economic instruments, rising of in situ water uses, rules for the evaluation of impacts on biological diversity). These instruments are strengthened by activities included in component 2.
- The design and execution of plans and activities to protection ecological processes and restore and prevent the of deterioration of biological diversity in critical basins (see component 3).
- The development of biological diversity monitoring mechanisms and basic studies (see component 4).

The success and efficiency of these actors in achieving their objectives depends on the following:

- The legal framework which supports their activities related to natural resources as components of biological diversity. This framework is analyzed in the document titled "Juridical-institutional analysis to include the protection of biological diversity in the management of water resources" which is included in the project files.
- The capacity of each institution to carry out water resources management and biological diversity conservation activities. Prior to appraisal, project preparation activities will identify the strengths, potentials, challenges and gaps in terms of the functionality, administration capacities and inter-institutional coordination of these organizations. This analysis will also define the requirements for a detailed program of institutional strengthening.

Based on these considerations, two sub-components were prepared:

1.A. Design and Implement Mechanisms of Inter-institutional Strengthening at the Water Basin Level. Incremental cost US$230,000; GEF US$200,000.

By law, various organizations are involved in the protection, use and sustainable management of continental waters. Public institutions include the General Directorate of Waters, General Directorate of Public Works, Superintendence of Sanitary Services, DIRECTEMAR, CONAF, SAG, CONAMA, and health services. The key private institutions are the water user organizations. Because of this diversity of organizations involved in the water sector, it is necessary to strengthen a dynamic and collaborative style of management that allows the interaction among the various actors.

The objective of this sub-components is to identify the institutional requirements of these organizations, to strengthen their management capacities and to facilitate inter-institutional coordination. Achieving this objective is critical for project success.

The activities of this sub-component include:

- Analysis of the institutional requirements of the different organizations involved in the water sector and development of a framework to strengthen their management capacities and improve inter-institutional coordination. The analysis and subsequent framework will be based on the institutional changes required by the decentralization process to be financed by the IBRD loan.
- Review and revise the mission and objectives of the institutions working on the management of water resources and/or protection of biological diversity in Chile.
- Design of an action plan to create the institutional conditions necessary for the implementation of the project components.

1.B. Develop a Strategy for Coordinated Application and Integration of Instruments of Environmental Administration. Incremental cost US$440,000; GEF US$400,000.

Revising the strategies that guide sustainable water use is required to achieve the coordination and institutional integration necessary for the conservation of biological diversity associated with water resources. Particular attention needs to be paid to developing norms of environmental quality and pollution emissions, defining water uses, assigning specific water uses, defining ecological and environmental flows, preparing prevention plans and implementing pollution clean-up.

This integrative strategy then needs to be translated into institutional action to ensure the coordinated use of environmental management instruments with the ultimate goal of ensuring both environmental quality and the protection and sustainable use of biological diversity.

The activities of this sub-component include:

- Develop and promote environmental education programs for local communities and public and private actors.
- Promote and facilitate civic participation in preventing and resolving environmental conflicts.
- Revise and propose adjustments to legislation governing biological diversity protection.

Component 2: Development of Water Resources and Biodiversity Management Instruments. Total Incremental Cost US$4.47 million; GEF US$4.1million.

Within the existing programs of the Ministry of Public Works (MOP) and of the General Directorate of Waters (DGA) and based on the existing legal framework, the project will develop management instruments that will allow the coordination of multiple water uses and the conservation of biological diversity. These instruments will allow a more efficient use of water resources and the mainstreaming of biodiversity consideration into water resource management. These instruments are necessary to establish a modern water resource administration in the pilot river basins. The identified instruments are organized in three categories: (1) knowledge, information and monitoring (including hydrological networks, basic and applied research, water quality networks, and information systems); (2) resource planning (including hydrological modeling and management plans); and (3) environmental management of water resources (including determining environmental water demand, pollution control, prevention plans and cleaning clean-up).

These management instruments will support current instruments by explicitly incorporating biological diversity considerations and developing innovative procedures and analytical methodologies. Such instruments are currently not available, although there are identified in existing government policies. Information also will be generated on the current state and trends of biological diversity (something which is currently very scarce).

The main objective of the component is to develop approaches and methodologies that conserve biological diversity and incorporate ecological considerations in the administration of water resources. The component will identify, analyze, adapt and recommend methodologies that incorporate biological diversity impacts. The component also will provide MOP, the General Directorate of Waters (DGA), and the General Directorate of Water Works (DOH) the methodologies to improve their general functions and incorporate the protection of water resources and biological diversity impacts. Also, the component will train personnel of MOP, DGA and DOH in the use of the proposed methodologies. Finally, the component will provide MOP with the resources (e.g., computer hardware and software) necessary to effectively apply the methodologies.

Based on these considerations, eight sub-components were identified:

2.A. Definition of Minimum and Optimal Ecological Flows for Biodiversity Conservation i n Chile. Incremental Cost US$1.1 million; GEF US$1.0 million.

This sub-component will apply the concept of ecological flows to the management of water resources. Studies carried out by the General Directorate of Waters since 1993 indicate that it is necessary to use methodologies based on hydrological data for the determination of ecological flows. This is the case since a systematized summary of biological backgrounds does not exist that can be used to define ecological flows.

Newer methodologies take into consideration various aspects of the water system, not only hydrological and biological aspects, to determine the minimum flow necessary to conserve the biological diversity in the ecosystems associated with the water resource.

The activities of this sub-component include:

- Establishing the methodologies to determine the minimum and optimal ecological flows for the conservation of aquatic habitats with emphasis on the conservation of biological diversity of these ecosystems.
- Adapt these methodologies to the three ecological zones: north, center and south.
- Define the specific monitoring activities (hydrological, hydraulic, and biological) that are required for the implementation of these methodologies.
- Carry out surveys of ecological flows throughout the country and analyze the survey methodology.
- Identify the factors that impact, positive or negatively, the biological diversity of aquatic ecosystems.

2.B. Classification of Water Body Courses. Incremental Cost US$330,000; GEF US$300,000.

This sub-component will determine the natural and current quality of water resources based on ecological considerations. The appropriate quality and quantity of water resources is an essential requirement for sustainable development (these requirements include potable water, aquaculture, irrigation, recreation, and industrial). For this reason, it is necessary to have antecedents and management tools to use the resource appropriately. Furthermore, within an integrated system of water resource management, it is necessary to incorporate environmental issues including the conservation of aquatic communities (which depends on characteristics such as water quality and quantity and river bed substrate).

The objective of *The Standard Rule of Quality for the Protection of the Superficial Continental Waters* is to protect, maintain and recover the quality of the superficial continental waters in a way that safeguards human health, water resource use, the protection and conservation of the aquatic communities and lacustrine ecosystems (and thereby maximize social, economic and environmental benefits). The *Standard Rule* is in CONAMA's project pipeline and is ready to be presented to the Council of Secretaries. The *Standard Rule* establishes that the General Directorate of Water should provide information on the natural and current quality of superficial continental waters as well as to establish the quality objective for water bodies and courses in high-priority basins. This work will be coordinated with the Regional Commissions of the Environment. This sub-component

will allow the Directorate of Water to develop an appropriate *Standard Rule* with full consideration of biodiversity conservation.

The activities of this sub-component include:

- Determine natural and current water quality, define a methodology to assign quality objectives and characterize water courses and bodies.
- Identify water of exceptional quality, water available for high-priority uses (i.e., potable water, agricultural uses, aquaculture and sport fishing) and water for the conservation of aquatic communities.

2.C. Establishment of Minimum Water Requirements for Wetlands. Incremental Cost US$940,000; GEF US$900,000.

There is increased awareness of the ecological value of wetlands and the importance of ensuring their environmental sustainability. The objective of this sub-component is to establish the environmental water demands for wetlands, using methodologies acceptable to the institutions involved in their administration and which ensure that biodiversity values are maintained or enhanced. The General Directorate of Waters (DGA) has developed a series of studies that will facilitate the definition of environmental water demands of wetlands, using internationally accepted methodologies.

Wetlands are very fragile ecosystems and their dynamic ecological balance easily can be upset by sedimentation, pollution and climatic changes. It is necessary to determine, however, the origin of these changes, since they can be produced by either human intervention or by long-term natural changes that would cause wetlands to evolve toward other ecological systems. Therefore, maintaining a wetland's environmental water demand does not, by itself, guarantee the maintenance of the ecological system. Other variables that need to be considered are the size of the wetland, its characteristics (extension and quality) and the transition area between the wetland and surrounding ecosystems. This combination of aquatic and terrestrial conditions makes wetland ecosystems extremely complex. The biological diversity of wetlands is maintained through physical, chemical and biological interactions controlled, to a greater or lesser extent, by hydrological processes which experience daily and seasonal fluctuations (and potentially longer-term fluctuations in connection with the regional climate changes and the geographical location). As a consequence, a high variety of organisms (both plant and animal) have adapted to wetland habitats. However, wetlands with diverse communities and/or impoverished species can lack the ability to adjust to changes or environmental impacts.

Due to strong demand for water resources in northern Chile (for mining development and expansion of irrigated areas), the wetland of the Tarapacá and Antofagasta regions have been heavily exploited. This type of pressure makes it especially important to generate use criteria (i.e., the environmental water demands for wetlands) which incorporate minimum and maximum water quantity and quality levels necessary to maintain the biological diversity in wetlands and surrounding ecological systems.

The activities of this sub-component include:

- Identify the factors that impact, positive or negatively, the biological diversity of wetlands and classify Chilean wetlands based on hydrological, hydrogeological, hydraulic and biodiversity measures.
- Apply methodologies to determine the minimum hydrological requirements to ensure the conservation of biological diversity in wetlands.
- Determine the baseline requirements of biological diversity conservation (compatible with the activities defined in component 4) in wetlands, in order to implement methodologies to determine the hydrological requirements of wetlands.

2.D Establish Minimum Ecological and Hydrological Requirements in L akes. Incremental Cost US$1.1 million; GEF US$1.0 million.

There is increased awareness of the ecological value of lakes and the importance of ensuring their conservation. This sub-component will support the development and application of methodologies to evaluate the impact of lake use on the rest of the water system as well as their biotic and abiotic characteristics. Environmental water demand in lakes (corresponding to the optimum volume of water, of the appropriate quality, necessary to conserve the biological diversity of lacustrine ecosystems) also will be determined.

In Chile, there have been some studies of the quality of the lake water and there is a wealth of information on some groups of aquatic organisms. However, there have been no studies relating variations of lake water levels with the biological community and water quality. Therefore, it is necessary to investigate the impact of the use of these natural reservoirs on the rest of the water system and its biotic (including fish, plankton, flora and terrestrial fauna associated with the lake) and abiotic (including hydrodynamic characteristics, water quality, floor, riverside erosion, and human establishments) components.

The activities of this sub-component include:

- Identify the factors that impact, positive or negatively, on the biological diversity in lakes, including the development of a classification system for Chilean lakes considering hydrodynamic aspects and biological diversity. Generate a baseline of diversity biological present in representative lakes of the country.
- Apply methodologies to determine the minimum hydrological requirements to ensure the conservation of biological diversity in lakes. This includes the application of case studies to learn the impact on biological diversity from variations of the water level of Chilean lakes.

2.E. Survey and Identification of in-situ Biological Uses of Water. Incremental Cost US$230,000; GEF US$200,000.

In-situ uses do not consume the resource and consequently can be carried out by various actors, either simultaneously or sequentially, without allocating rights for these uses. In addition to ecological uses, other in situ water uses that have increased over time include aquaculture, transportation, and the dilution of pollution discharges. In addition to these in situ uses, Chile's socio-economic development has increased the extractive demand for water resources (and this is expected to continue to increase in the future). Finally, Chilean society has been demanding greater environmental conservation and preservation. The DGA has the mandate to plan the development of water resources and is required to explicitly take into account social and environmental demands for in-situ uses of water. This makes it necessary to have information on the potential of demand of such uses. In the future, the DGA also should determine the natural water quality, ecological flows and available flow of the receiving course. This information is especially needed to calculate the effect of pollution discharges on water quality and biological diversity.

This sub-component will allow the preparation and use of information on the demand for in situ water uses and their relation to ecological demands.

The activities of this sub-component include:

- Survey the current information on in-situ uses in all Chilean basins and estimate potential in-situ uses.
- Characterize existing and potential in-situ uses.
- Establish, for each type of in-situ use (e.g., tourism, recreational, sport, landscape), the hydrological requirements to conserve existing biological diversity and identify any existing or potential conflicts among the different uses.

2.F Analysis of the Effects of Human Activities on Hydrological Systems. Incremental Cost US$220,000; GEF US$200,000.

Human uses of hydrological resources include the construction of physical works (e.g. reservoirs), changes in floor use, changes of surface courses, modification of the relationship between surface and underground waters,

changes in the evaporation rates. As a consequence, human activities affect the water cycle (both magnitude and duration) and terrestrial and aquatic biological diversity. To date, Chilean economic development has focused on investments which generate short-term wealth and economic activities and has discounted the effects on the environment in general and water basins in particular.

This sub-component will allow the generation of methodologies to analyze the impact on the environment from human activities, with an emphasis on the biological diversity of aquatic ecosystems.

The activities of this sub-component include:

- Analyze the impact of human activity on river beds and biological diversity in diverse areas of the country. This analysis will focus on the impact of intensive agricultural development and changes in the historical patterns of flows (from reservoir construction and operation, other hydraulic works, and extraction from river beds) on selected water basins.
- Evaluate the effect of urbanization on the temporal distribution of maximum flows, basin levels and biological diversity.
- Evaluate the impact of underground extraction on superficial flows, basin levels and biological diversity.
- Evaluate the effect of land use changes on the sedimentation régime, superficial flows, biological diversity and recharge of aquifers.

2.G. Establishment of Procedures and Methodologies to Incorporate Biological Diversity in the Design and Execution of Water Pollution Prevention and Clean-up plans. Incremental Cost US$330,000; GEF US$300,000.

The General Bases of the Environment (law number 19.300) and its regulations governing the promulgation of pollution prevention and clean-up plans, establishes the conditions and circumstances required to declare areas of latency or saturation from one or more polluting agents. It also establishes the procedures and minimum requirements for the formulation, implementation and follow up of clean-up plans. Areas of pollution latency or saturation, and their corresponding prevention and clean-up plans, can be established both in relation to norms of primary environmental quality (established to protect the health of people) and secondary environmental quality (dedicated to protect or to conserve the environment or to preserve the nature). This sub-component will incorporate biodiversity considerations into the formulation, implementation and follow up of pollution prevention and clean-up plans.

The activities of this sub-component include:

- Analyze the legal, economic, and market instruments available to incorporate the consideration of the biological diversity in the design, implementation and follow-up of water resource pollution prevention and clean-up plans.
- Develop procedures to include the recovery, maintenance and development of biological diversity in the formulation and implementation of water pollution prevention and clean-up plans.
- Analyze available technical solutions for the conservation and recovery of biological diversity associated with water resources.
- Train public and private organizations in the application of the procedures to include the recovery, maintenance and development of biological diversity in the formulation and implementation of water pollution prevention and clean-up plans (this complements activities included in component 1).

2.H. Strengthening Biodiversity Considerations in the System of Environmental Impact Assessments (SEIA). Incremental Cost US$220,000; GEF US$200,000.

Institutions responsible for environmental administration use environmental impact assessments as a tool for making preventive decisions. Its use in Chile has been growing since 1994, when a presidential decree

established a voluntary procedure. In 1997, the promulgation of the Regulation of the System of Environmental Impact Evaluation (SEIA) made such assessments mandatory. Various institutions and organizations have legal and/or technical responsibilities regarding the conservation of biological diversity (especially in continental water bodies) and preparing environmental impact assessments.

Environmental impact assessments (EIAs) require methodologies and techniques that assess (in a predictive way) how projects or activities will affect certain environmental variables. EIAs also quantify these impacts to allow incorporation in the project decision making process. Unfortunately, most existing tools do not specifically consider the conservation of biological diversity. Therefore, it is necessary to develop new methodologies, as well as improve old techniques, to measure the mitigation and restoration of hydrological processes and their associated biological diversity.

This sub-component will establish methodological guides that incorporate biological diversity into the SEIA, focussing on hydraulic works and including diffuse, indirect, second-order, and cumulative effects.

The activities of this sub-component include:

- Establish methodological guides for environmental impact assessments for projects that directly or indirectly affect continental waters of Chile. These methodological guides will cover general conceptual and technical aspects as well as each stage of the EIA process: preliminary evaluation of environmental impact (preliminary both at the concept level and project alternatives); elaboration of EIA documents to present to the SEIA (including identification, prediction and evaluation of impacts, mitigation measures, repair and compensation, estimation procedures for costs of mitigation measures, repair and compensation); revision of EIA documents by the relevant public institutions; civic participation before and after the presentation of the EIA document to the SEIA; decision making for the Resolution of Environmental Qualification; follow up mechanisms; inspection and audits; and closing and abandonment measures in appropriate cases.
- Provide technical and conceptual EIA training for projects that direct or indirectly affect continental waters, to civil servants acting as: a) project coordinators, b) reviewers of EIA documents, or c) decision makers. It will also provide training to local governments (i.e., municipalities) given their technical role in the revision and evaluation of EIA documents submitted to the SEIA and their role as facilitators of civic participation.
- Establish effective and efficient methods and procedures to share existing environmental information related to the aquatic environment for preparing EIAs, providing feedback on the information generated in the production of the EIA documents and monitoring and/or following-up on projects that direct or indirectly affect continental water resources.

Component 3: In Situ Biodiversity Conservation in 8 Globally Important Watersheds. Total Incremental Cost US$4.99 million; GEF US$4.30 million.

This component will support activities that promote the conservation of biological diversity in the selected river basins by protecting priority habitats, ecosystems, and species. Responsibility for implementing these activities will be shared by the National Forestry Corporation and by the Estancia Estero Derecho Community of the Valley of Elqui.

Sub-components were prepared based on results from in-depth Ecosystem Profiles (Annex 5). The following methodology was used to prepare the ecosystem profiles:

(i) Literature review. Foremost Chilean experts in various aspects related to biodiversity in these watersheds (soils, water, ecosystems, flora, and fauna) were contracted directly or through their respective academic institutions.

(ii) GIS. All information was summarized, digitized, and entered into a GIS system which presently

resides within the Directorate of Water at the Ministry of Public works. The following information layers are included:

- Base maps (topography, towns, political divisions, rivers, 1:100,000)
- Soils (1:200,000)
- Potential vegetation (1:200,000)
- Land use (based on landsat and aereal photography, various scales)
- Water quality
- Meteorological information, including temperature and precipitation
- Presence/absence of species of conservation concern
- Ecological formations and forest types (actual)
- Priority areas for conservation based on Chile' s protected area system priorities
- Existing protected areas
- Environmental stressors (mines and other contamination sources).

(iii) Expert consultation. A summary of theinformation gathered was prepared for each watershed, including all data layers, and additional information in the literature that was not possible to incorporate in the GIS. These summaries were discussed at technical workshops with additional experts both in Santiago as well as with local experts via a detailed questionnaire.

(iv) Synthesis. Based on the expert feedback received, a 240 page summary of the main findings was prepared (available in the project' s files). This document includes the following sections:

- Methodology
- Ecological characteristics of each watersheds
- Threats
- Priority actions
- Proposed projects and project profiles
- Four CDs with the entire GIS data set

(v) Priorization. The final step in the process was the ellaboration of specific proposals for action, which form the basis of component 3 of the project. For each watershed, these investments are grouped along 3 main axes of action:

- Habitat restoration (primarily in the riverbed)
- Protected areas
- Flagship species as drivers for habitat conservation.

The twelve sub-components under this component are described below:

3.A Conservation of Bird Habitats in the Lluta River Basin through Afforestation. Incremental Cost US$250,000; GEF US$200,000.

This activity will take place in the bottom of the Lluta river basin, from the outlet until kilometer 45. In this section of the valley there is an important area of land exposed to erosion caused by the lack of vegetable covering in the river bed and by annual course changes and variations resulting from the High Andean winter. The Lluta river basin is also characterized by significant biological diversity. For this reason, the valley and its outlet are identified in the ecological profiles as places of conservation priority.

Since the Valley of Lluta valley is located in an area of extreme aridity, good agricultural land is scarce and of great economic and social value. This increases the need to implement conservation activities. In the last two

summers, there has been an annual loss of agricultural land from 80 to 90 hectares.

Currently, the outlet of the Lluta river has the greatest concentration of birds in the Tarapacá region. In July 1993, it registered the third highest abundance in Chile. Due to alterations of the riversides by human activities, every summer there is a loss of a portion of this habitat. Also, many small farmers have used credit to increase the productivity of their riverside lands which has increased the loss from subsequent erosion. Stabilizing the river bed and eliminating such losses is an associated benefit from the proposed habitat restoration.

The objectives of this sub-component include:

- Conserve riparian beds and high-priority bird habitats in riversides by planting tree species appropriate to the prevailing conditions.
- Minimize annual environmental damage to the riversides and soil erosion caused by summer floods.
- Improve the quality life for the valley' s population by increasing agricultural productivity through preserving lands threatened by soil erosion.

The activities of this sub-component include:

- Restore riverside vegetation through biological-forest interventions and thus recover aquatic birds habitat.
- Identify and characterize the areas of outstanding bird fauna in the selected area.
- Identify threatened areas (considering the location and state of bends and degraded riversides) with the active participation of the farmers.
- Establish measures of habitat protection targeting the areas with the greatest concentration of birds.
- Train beneficiaries in vegetation management and restoration in ensure sustainable results.

3.B. Management of the River Huasco Estuary and the Carrizal Bajo Tidal Area and Lagoon. Incremental Cost US$370,000; GEF US$300,000.

The Huasco river estuary and Carrizal Bajo tidal area and lagoon are the two areas with the highest concentration of aquatic, continental and marine birds Atacama region. The Huasco river estuary has been declared an *Area Free of Hunt* and the Carrizal Bajo tidal area and lagoon border the Llanos de Challe National Park and their annexation to the park has been proposed. Conservation of the bird populations associated with these two areas requires understanding the basic ecological characteristics as well as current human threats causing slow but sustained degredation.

The sub-component seeks to: (1) identify the environmental characteristics of the two areas; (2) establish the necessary management of the species that are part of the structure and composition of the wildlife associated with these two bodies of water; and (3) obtain information about the current environmental situation and future threats facing the area.

These threats include: uncontrolled tourism; clandestine extraction of the northern shrimp (Cryphips caementarius); destruction of the borders of the estuary for fluvial defense works; increased rubble on the riverbanks; expanded pasture and livestock traffic which degrades hydrophitic cover; effects from the Santa Juana reservoir; and construction of a coastal road.

The objective of this sub-component is to incorporate into the Llanos del Challe National Park the Huasco river estuary and the Carrizal Bajo tidal area and lagoon. Together, these areas form the most important wetlands on the northern coast of Chile, both in terms of the diversity and concentration of aquatic birds. Their management will allow the survival of species facing conservation threats that have shifted their distribution toward the southern end of the country.

Their appropriate management will establish the real dimension of the threats facing the wetlands and will

contribute to minimize these threats. Also, the project also will provide benefits to riverside communities by giving them the necessary tools to organize to defend the wetland and benefit from its sustainable use by means of productive activities such as ecotourism and the sustainable use (based on biological principles) of the northern shrimp.

The activities of this sub-component include:

- Determine the structure and composition of the bird communities associated with the Huasco river estuary and the Carrizal Bajo tidal area and lagoon and registering information about their basic ecology. It also will obtain information about current and future habitat threats in order to propose effective management measures to minimize the effects of these threats.
- Register the information, effects and the mitigation of threats such as uncontrolled tourism, foraging by domestic livestock, fluvial defense works, primary effects of the reservoir Santa Juana, domestic waste pollution, and effects of the future coastal road, among others.
- Sensitize the community of local land owners regarding the value of the wetland and provide training on sustainable use of the resources by promoting ecotourism.
- Implement a Plan for the Immediate Protection for the Wetland to coordinate necessary measures minimize current and future damages.
- Complete the steps necessary to incorporate these habitats into the Llanos del Challe National Park.

3.C Creation (with Community Participation) of a Protected Area in the High Alcoguaz Region of the Elqui River Basin. Incremental Cost US$270,000; GEF US$200,000.

The Derecho river valley (the river is also known as the Claro), is located near the town of Alcoguáz in the commune of Paihuano. It is a southern tributary of the Elqui river and has a permanent flow due to its proximity to thaw areas. Although its flow fluctuates, it offers promising opportunities to develop multi-functional economic activities by using its scenic beauties and water resources. The property belongs to the Estancia Estero Derecho Community, made up of 393 *comuneros*. The subsistence of most of these families is based on the community cultivation of vineyards to supply the pisco industry and on the use of high lands for goat and cattle pasture. This area possesses natural characteristics requiring protection and regulated use to ensure the conservation of biological diversity.

The objective of this sub-component is to establish a protected area with community participation in sensitive areas of the Claro river basin, tributary of the River Elqui.

The area has ecological, aesthetic and educational values that, together with low population and human exploitation, motivated the Estancia Estero Derecho Community to create a multi-functional protected area.

Estero Derecho is used as a shepherding reservation, water reserve and recreation area for those that are titled in their *comuneros* and land owners. Access for visitors or tourists is currently restricted. The reasons to limit the access have their origin in the impact caused the unregulated use of the valley (including death of animals, fire, garbage).

Currently, access is restricted to the *comuneros* who cause environmental deterioration but who also appreciate the possibility of developing environmentally sustainable activities. For this reason, they have decided to create a protected area. There is no experience of community participation in the creation and administration of protected areas in community lands. Therefore, this initiative can serve as a model for other river basins included in the project.

The activities of this sub-component include:

- Establish the limits of the protected area based on existing information on the physiography and biota of the area.

- Identify the physical and biological characteristics of the area to establish sustainable use alternatives of its resources.
- Identify and apply the legal mechanisms available for establishing private protected areas.
- Prepare and implement a mid-term management plan.

3.D. Creation of a Protected Area in the Altos de Petorca - Pedernal region of the Limarí and Petorca River Basins. Incremental Cost US$360,000; GEF US$300,000.

This area is formed by the chain of hills that make up this portion of the mountain range. It includes the county of Petorca and it is bounded by the coordinates 32º 22´S and 70º 43´O in the Petorca river basin. It contains: Mountainous Thorny Heath (which has no representation in the SNASPE); Andean Heath (which has less than 5% representation in the SNASPE); and High Andean Steppe of Santiago (which has less than 5% representation in the SNASPE). It is composed of private lands of *comuneros* willing to establish an Agreement of Protection to incorporate it into the system of private protected areas.

The objective of this sub-component is to establish a protected area that conserves these communities of vegetation of great biological diversity value that currently are not represented in the National System of Protected Areas of the State (SNASPE).

This area of the Petorca river basin is important for its flora diversity, with woody species threatened with extinction in the Region of Valparaíso. The species of more interest are *Menodora linoides*, populations of *Porleria chilensis* and *Calceolaria alicahuensis*. It is a place of priority conservation of biological diversity and cultural preservation of petroglyphs that exist in several areas.

The activities of this sub-component include:
- Search for conservation alternatives and shared or private development of identified areas.
- Characterize all flora and fauna species, whether they are threatened or not, that inhabit the area.
- Characterize the biophysical, cultural, and legal resource as well as the state of degradation and conservation aptitude for the selected areas.
- Establish the protected area and its buffer zone based on feasible management proposals.

3.E. Management of the Tricahue Parrot (*Cyanoliseus patagonus*) in the River Claro Colony in the Mataquito River Basin. Incremental Cost US$240,000; GEF US$200,000.

The colony or parrots to be managed is located 15 km from Los Queñes and 55 km to the east of the commune of Romeral (both sectors belong to the County of Curicó, in the VII Region of the Maule). The colony is specifically located in the Claro river basin, an important tributary of the Mataquito river. Currently, the colony has 3 nesting and breeding places at the following coordinates:

(a) La Trinchera: 35º 04' South Latitude and 70º48' Longitude West.
(b) Río Claro: 35º07' South Latitude and 70º44' Longitude West
(c) Manantiales: 35º07' South Latitude and 70º43'30 " Longitude West

The Tricahue Parrot (*Cyanoliseus patagonus*) is one of the 4 species of the family Psittacidae that is present in Chile and whose natural distribution is restricted to the area encompassed the VI and VII regions. This species has faced pressure from illegal trade (the capture and robbery of nestlings for use as mascots) on the one hand and the destruction of its habitat. Chile has recognized these threats by classifying the Tricahue parrot in extinction danger at the national level. For this reason, it is particularly important to protect this colony to ensure the species' survival, especially since this is the colony that presents the greatest number of individuals in Chile, based on current statistics.

The objective of this sub-component is to achieve the effective management of the Claro II river colony in the Mataquito river basin.

The colony of Tricahue Parrot of the Claro II river is one of the most important nesting place in the Maule region and in the country. This colony is in Mataquito river basin and achieving its survival is part of the challenge of the integrated management of the basin with the goal of both conservation and development of water resources.

Increasing knowledge on the biology and ecology of this species is necessary for the sustainable protection of the colony as well as to define future actions aimed at the conservation and appropriate management of this species in other regions (where it is also currently in danger of extinction).

The activities of this sub-component include:

- Prepare and implement a management plan for the Tricahue Parrot in the Claro II river colony.
- Establish an appropriate team to develop management and protection activities.
- Generate the necessary agreements with neighboring communities to achieve their participation in conservation measures.
- Maintain a database with the information resulting from the management of the colony.
- Enhance awareness about the importance and status of this species.

3.F. Management of the Huemul (*Hippocamelus bisulcus*) in the Nevados de Chillán in the Itata River Basin. Incremental Cost US$660,000; GEF US$600,000.

The Nevados de Chillán is an area of the basin of the River Itata river basin characterized a wealth of biological diversity including a high level of endemic species, particularly insects, vascular plants and climbers. This is due to the biogeographical situation of the area, located between the Valdivian forests of the south and the influence of the northern area of drier vegetation.

In spite of the wealth of the area, it is under represented in the National System of Protected Areas of the State (SNASPE). It also is the area facing the greatest threats, including: the substitution of native forest for exotic plantations; the uncontrolled use of natural resources; and the high concentration of human populations in this area. One species in the area facing significant conservation problems is the Huemul (*Hippocamelus bisulcus*). To effectively conserve its populations in this section of the basin requires various and urgent actions. In spite of previous actions that have been taken, this population's decline is dramatic. This decrease is due to the extensive territories this species needs for its survival and to the altitudinal movements it undertakes during the year. Therefore, the habitats it occupies coincide with areas required for the management of water resources and that are outside of the protected areas of the SNASPE.

The objective of this sub-component is to conserve the habitat of the huemul in the Itata river basin formed by the forest ecosystems of mountains of the Nevados de Chillán area. Even though the sub-component focuses on the Huemul, it is used as a "flagship" species to promote habitat conservation and as a tool to increase awareness and public support for conservation.

The Huemul is the heraldic animal of Chile, which undoubtedly increases attention in terms of species and habitat conservation. In addition, the ecological profiles identifies the Nevados de Chillán as one of the high-priority area for conservation in the Itata river basin.

The activities of this sub-component include:

- Enlarge the protection areas administered by the state or by private organizations by incorporating private lands in riverside areas that are used by the species (mainly in winter).

- Establish biological corridors in the mountain area to increase the useful habitat for the population.
- Prepare a integrated resource management plan for this section of the river basin to ensure the sustainable conservation of these populations.
- Implement a plan to transfer animals from the southern area of its distribution (XI Region of Aisén), in order to reach a population size that strengthens the survival of the species in the basin.
- Initiate a program of environmental education to involve local communities in species conservation actions.

3.G. Management of the Black Carpenter (*Campephilus magellanicus*) in the Imperial River Basin. Incremental Cost US$230,000; GEF US$200,000

The Black Carpenter (*Campephilus megellanicus*) is an endemic bird that depends on the temperate rain forests. The Imperial river basin constitutes its typical habitat. Although the National Reservation Malalcahuello and the National Park Conguillío are located in this river basin and protect portions of the Black Carpenter's habitat, it is necessary to expand its management outside of these protected areas to ensure its conservation. It is a species threatened with extinction and the antecedents of their basic biology and the impact of human activities on their habitat are ignored. For these reasons, it is necessary to determine the size of their habitat and their population in Imperial river basin.

The objective of this sub-component is to prepare a management plan of their river basin habitat that ensures conservation of their populations.

The Black Carpenter is an important indicator species of the health of the ecological systems of the Imperial river basin. The Black Carpenter feeds on various species living in riverside habitats making it dependent on the water resources of the river basin.

Very little is known of its basic biology and habitat. Such information is necessary to develop norms of resource exploitation in the river basin (including the water resources upon which it depends for survival). Furthermore, appropriate information has not been shared to local communities regarding the importance of the Black Carpenter and their role in conserving the species.

As with the Huemul, The Black Carpenter will be primarily used as a "flagship" species to promote habitat conservation in general and as a tool to increase awareness and public support for conservation.

The activities of this sub-component include:
- Prepare and implement an emergency protection plan for the species (immediate action is necessary given the limited remaining habitat and small population of less than 15 individuals).
- Determine the number and characteristic of remnant trees per hectare that must be conserved to effectively serve as habitat on private lands.
- Determine the specific riverside insects upon which the Black Carpenter depends.
- Prepare a conservation strategy with community participation considering the *Campephilus magellanicus* populations throughout the river basin.

3.H. Creation and Participatory Management of a Conservation Area in Lake Budi. Incremental Cost US$610,000; GEF US$600,000.

Lake Budi belongs to a natural system made up of various bodies of water, including the Puerto Saavedra and Nehuentué swamps, the final tract of the Imperial river, the Moncul river, the Trovolhué lagoon, the White Waters tidal area, the Lobería of Pilolcura, coastal dunes and the adjacent flooding plains. Together, this system includes aquatic, riverside, estuarine and sweet water ecosystems, creating highly favorable conditions for exceptional biological diversity.

The area is surrounded by Mapuche indigenous communities, which traditionally have used the natural resources of this ecological system. Therefore, conserving biodiversity requires the active involvement of Mapuche communities in the management of the area as well as ensuring their subsistence (traditional and otherwise).

Lake Budi, within the complex of water systems mentioned above, faces the most significant threats from human activities and therefore is a priority area for conservation and sustainable management activities. Creating a protected area (such as a national reserve) is considered the most appropriate mechanism to achieve these conservation and sustainable use goals. This category of protected area will allow both habitat conservation and the rational use of the natural resources by local communities that have traditionally depended on them.

The proposed area includes species threatened by non-sustainable human activities, including the extraction of birds and aquatic mammals from the Lake. This reduces animal populations and degrades habitats, creating losses for human communities that depend on this system.

Lake Budi also is an important habitat for birds that migrate each season from the Andean mountain range as well as habit for various endemic species. Lake Budi also has high potential tourism and recreational values, offering development opportunities for the Mapuche indigenous communities (some ecotourism activities have already begun).

Lake Budi is one of the few coastal lakes located in the center-south region of Chile. It sustains important agricultural activities as well as poorly understood flora and fauna. Traditional techniques also need to be rescued and incorporated into the conservation alternatives implemented within protected area framework..

The objectives of this sub-component include:

- To characterize the biological diversity, limnology and productive activities of Lake Budi. Based on the results, identify conservation actions necessary to conserve of this body of water and its environment.
- To identify and evaluate the best options for a protected area for Lake Budi and its environment based on the current legal framework and mechanisms.
- To create and to equip the Lake Budi protected area, ensuring the preservation its the aquatic and terrestrial biological resources and allowing the development of productive activities that will benefit the local community.

The activities of this sub-component include:

- Determine the physical, social and ecological characteristics of Lake Budi (including its limnology).
- Identify and quantify the species (and their location) which are important for local communities (such as shrimp in coastal areas).
- Identify, design and carry out shrimp habitat protection activities.
- Determine the most appropriate category of protected area (based on the legal regulations in Chile) as well as its area, demarcations and the necessary activities to integrate this area into the System of Private Protected Areas or the SNASPE, whichever is most appropriate.
- Support the development of a management plan for the protected area which will specify: the mechanisms and techniques for regulating natural resource use; activities to protected biological diversity; the mechanisms to ensure community participation in protected area management; an implementation plan for the protected area.
- Define and implement participatory management of the protected area, involving Mapuche indigenous communities based on the framework of the rights they have in protected areas located within an Area of Indigenous Development.
- Develop a training and extension plan for the rural population for the catch and use of shrimps and fish as a alternative activity to agricultural production.

- Provide the necessary equipment to carry out management actions defined in the protected area's management plan.

All activities will be executed with the full participation of the indigenous communities living around the area.

3.I Sustainable Management of the Northern Shrimp (*Cryphiops caementarius*) in the Lluta, Elqui, Limarí, Petorca and La Ligua River Basins. Incremental Cost US$350,000; GEF US$300,000.

The river northern shrimp (*Cryphiops caementarius*) is a economically important species in northern Chile which is in danger of extinction due to limited water resource and land use changes to its habitat. It reproduces in the outlets of rivers from the Lluta to the Aconcagua. Currently, it is possible to find juvenile in sufficient quantities to develop management programs to recover this almost exhausted resource. Also, there is already the information necessary for its sustainable management.

Given the importance of conserving river outlets in arid and semi-arid areas for agricultural management, conservation activities to maintain water quality in order to preserve aquatic resources complements agricultural activities. The existing information indicates that northern river shrimp cultivation is feasible in the low areas of the rivers Lluta, Elqui, Limarí, Petorca and La Ligua. Currently, northern river shimp are only extracted illegally from these areas.

The extraction of the northern river shrimp, a species in danger of extinction, is prohibited and its commercialization is only possible if this species is cultivated artificially. In the outlet areas there are sufficient juveniles (which are lost when migrating to the headwaters of the river) to allow significant commercial activities. These juveniles can be raised in handmade lagoons to increase the revenue of the inhabitants of these area (such activities are an important economic activity in Peru). The general objective of this sub-component is therefore to ensure the conservation of this threatened species through its sustainable management.

The objectives of this sub-component include:
- Improve the outlet areas of the rivers Lluta, Huasco, Elqui, Limarí, Petorca and La Ligua.
- Quantify the populations of juvenile in the outlets of these rivers.
- Develop shrimp cultivation as an activity associated with agriculture.
- Contribute to the improvement of the quality of life of the populations of this region by increase revenue from shrimp cultivation.

The activities of this sub-component include:
- Supplement existing activities to improve the outlet areas of the rivers in the context of the project's environmental restoration framework.
- Identify and quantify areas of concentrated juvenile in the river outlets from the Lluta to the Aconcagua.
- Establish measures of habitat protection targeting the most important areas of the habitat of the northern river shrimp.
- Train the rural population in catching and raising shrimp as a complementary activity to agricultural production.

3.J Conservation and Sustainable Management o f Freshwater Fishes (*Basilichthys microlepidotus* and *Cauque brevianalis*) in the Lluta, Elqui, Limarí, Petorca and La Ligua River Basins. Incremental Cost US$350,000; GEF US$300,000.

The wetlands between the rivers Huasco and La Ligua maintain natural populations of freshwater fish species whose populations have diminished dramatically over the last 50 years. Deterioration of water quality, long recurrent periods of drought, and the digging of irrigation canals have significantly contributed to the decline of

these two species. For this reason, the two target species have been identified as in danger of extinction and vulnerable.

These species are endemic and their habitat is restricted to the mentioned hydrological basins. Once the recovery of these two species in danger of extinction is ensured, it will be possible to sustainable manage these resource as protein sources for local populations in the arid and semi-arid areas of northern Chile. The necessary information currently exists to restock these wetland areas.

The activities of this sub-component include:

- Improve and maintain the quality of the water of the middle and low areas of the rivers Huasco, Elqui, Limarí, Petorca and La Ligua.
- Quantify the populations of pejerreyes (*B. Microlepidotus* and *C. Brevianalis*) in the middle and low areas of these rivers.
- Promote the development of artificial cultivation with local communities.
- Implement a restocking program.

3.K Conservation of Biological Diversity in the Radal Siete Tazas in the Mataquit o River Basin. Incremental Cost US$500,000; GEF US$400,000

This area, classified as a high-priority site by the ecological profiles, possesses terrestrial and aquatic flora and fauna that require protection and regulated use. The Mataquito river basin represents the northern distribution of flora and fauna species of the Chilean rain forest. The same is true for species of crustaceans and fish, especially the big bagres, which has disappeared from the central area. The area also has ecological, aesthetic and educational value. The lack of knowledge of the natural resources of this area has limited both conservation and sustainable management efforts, especially related to tourism and educational activities of the SNASPE sites. Intensive agriculture (especially irrigation projects) also has deteriorated water quality.

The objectives of this sub-component include:

- To characterize the area physically and biologically to establish sustainable, alternative resource uses.
- To establish a baseline of the flora and fauna of the protected area.
- To quantify and to recover the flora and fauna of the Radal Siete Tazas.

The activities of this sub-component include:

- Characterize the limnology of the aquatic systems of the area.
- Prepare a baseline of the aquatic natural resources.
- Repopulate the aquatic systems with the species that have disappeared.
- Develop and implement a management plan.

3.L Recovery of the Estuarine Vegetation of the Bosque de Fray Jorge in the Limarí River Basin. Incremental Cost US$800,000; GEF US$700,000.

The Bosque de Fray Jorge National Park was created in 1941 to protect the northernmost *laurifolius* forest of Chile which, due to its special ecological characteristics, has great scientific value and constitutes an unique ecosystem in the world.

Negative human activities have created islands of trees located in an arid environment. Although large strips of climax forest still exist, other, more exposed areas, are threatened by ecosystem transition when old trees fall and create clearings. If not replanted, these clearings imply a loss of the superior canopy and result in a change in the botanical composition of the forest. This forest this constituted by various species including: Olivillo (*Aextoxicon punctatum*), Petrillo (*Myrceugenia correifolia*), Cinnamon tree (*Drymis winteri*) and other species of

the southernmost forests. It is a refuge of the pleistocene and constitutes a live sample of the forests that existed millions of years ago in the region. The importance, from a biological diversity point of view, can be highlighted by the fact that in this protected area of 7.3 km2 there are 209 species of 161 genera and 80 families. Of these, 113 are endemic of Chile. Of the 29 species with conservation problems in the Region of Coquimbo, 17 exist exclusively in this habitat.

The vegetation of the Bosque de Fray Jorge National Park suffers a degradation process that needs to be addressed immediately. Although a lot has been in the past, it has not been enough. It is necessary to stop the regression of the vegetation (especially estuarine vegetation), by mitigating the causal factors implementing a program of ecological restoration in degraded areas.

The factors causing this regression have been analyzed, including: the cycle of nutrients, the sanitary state of the forest, the regeneration of tree species, and the effect of fog. However, the dynamics of vegetation (seeding, age, vertical and horizontal structures, measures of the forest, waters in the forest) have been ignored. It is necessary to identify the core areas to conserve and also develop experimental plantations. Other activities to consider include: analyzing the temporary change of forest cover; preparing floor charts (physical and chemical); establishing biological stations of fog under the canopy; and establishing a microstation network in the forest to study microclimatology. The Bosque de Fray Jorge National Park should constitute a monitoring station of global climatic change.

The objectives of this sub-component include:

- To stop the regression of the estuarine vegetation of the national park by means of the elimination or mitigation of causal factors.
- To start a program of ecological restoration in degraded areas.

The activities of this sub-component include:

- Establish exclusion areas and effective protection of pristine areas.
- Begin the process of recovery of degraded areas by means of artificial and natural regeneration of the dominant vegetation species.
- Study vegetation dynamics and natural succession of the surrounding forest.
- Establish the dynamics of fog in the maintenance of vegetation.

Component 4: Monitoring of Biological Diversity. Total Incremental Costs US$1.22 million; GEF US$1.00 million.

The biological monitoring system has been integrated into the project' s overall M&E system. This component has two sub-components to ensure the gathering of information on environmental variables in a systematic way (especially from areas under highest threats of biological diversity changes) and the objective analysis of this information.

4.A Establish and Implement a Ecological Information System for Biodiversity Conservation. Incremental Costs US$660,000; GEF US$600,000.

The objective of the activity is to develop an information system for the river basins included in the project. The information system will be used to gather, store, process, analyze, monitor, relate and diffuse information on key environmental variables indicating the state of biological diversity and other hydrological processes. Data will be collected from various locations in the country and throughout the life of the project.

This system will be structured in a computer Geographical Information Systems (GIS) and linked to databases so that it can be used as a source of information and baseline for successive projects.

The information to be stored will be related to the availability of the water resources (i.e. quantity) and their physical, chemical and bacteriological quality. It will also provide information of the physical environment, such as water speeds, substratum, and depth. Finally, it will also include information on the fauna and flora in aquatic environments.

Information on the current status of biological diversity and potential trends will be a fundamental element of this system. Specific locations inside each basin will be selected (with priority for biologically sensitive areas) and visited on a regular basis to collect quantitative and qualitative data on key environmental variables.

Furthermore, a geoecological focus will be applied to relate species and communities to environmental variables that most affect their establishment and dispersion (which, in turn, has a direct relationship with the activities of the project).

The system also will allow access (ideally through internet) by the general public to the stored information (a mechanism will be provided for updating and broadening the information).

The GIS will store, process, manage and facilitate the updating of thematic information and associated databases. It also will establish links to other existing databases in other public institutions that manage environmental information on river basins. These institutions include: the National Forestry Corporation (CONAF), the Center of Investigation in Natural Resources (CIREN), and the National Commission of the Environment (CONAMA).

The sub-component also will make it possible to implement what is established in the *Definitive Project of Rules for the Regulation of Pollutants Associated to the Discharges of Liquid Residuals to Superficial Waters*, which is in the final approval stages at the General Controller of the Republic (*Contraloría General de la República*). This assigns to the General Directorate of Waters, among other, the responsibility "to receive information about the content of diverse parameters in the reception of water."

The activities of this sub-component include:

- Develop an inventory of biological diversity. The initial ecological profiles revealed very limited quantity and quality information on biological diversity for communities and species in the selected river basins. This situation can be corrected by implementing well designed inventories, establishing habitat and species priorities and presenting conservation problems based on the information gathered in the initial ecological profile. This will generate information on their current state of conservation, as well as possible threat trends. These inventories will be georeferenced at two scales: (1) a landscape scale (1:250,000) that allows identification of the main remnants of biological diversity as well as the changes in land use; and (2) a detail scale (1:50,000 or 1:20,000) that allows identification of the current state of populations of threatened, endemic and charismatic species.
- Generate up-to-date and georeferenced information that indicates the general state of biological diversity in the selected basins. Based at a landscape scale, this will allow the identification of the main remnants of biological diversity as well as land use changes that affect it.
- Evaluate, at the detail scale, the current state of populations of threatened, endemic and charismatic species (e.g. carnivores) that indicates the current state of their conservation, as well as changes in threat factors.
- Generate information to support the establishment of areas of ecological sensitivity and create sub-systems of environmental information for each basin selected by the project.
- Identify other existent information systems in public institutions, as well as other national and international systems, and identify ways and means to share information.

4.B Identify and Establish Areas of Ecological Sensitivity. Incremental Cost US$560,000; GEF US$400,000.

The objective of this sub-component is to identify and characterize areas which are ecologically sensitive to water resource development projects in the selected basins.

The identification of areas of ecological sensitivity in the selected basins will be based on the basic premise that water resources need to be used both for ecological processes and to satisfy human needs (including productive activities). In this context, the Ministry of Public Works will administer river basins considering both the use of water resource and other elements such as the conservation of biotic resources whose life cycles depend upon these water resources.

Additionally, it is important to consider the location of water resource development projects to ensure that benefits are maximized and environmental impacts are minimized. To achieve this, it is necessary to identify those areas inside the basins where the implementation of water development projects can cause considerable impacts (this is the definition of sensitive areas from the ecological point of view).

Therefore, the establishment and the protection of areas of ecological sensitivity constitutes a fundamental element in the sustainability of the development of water resources and for the conservation of the biological diversity of the basins.

In this way, identifying areas of ecological sensitivity complements activities included in component 2 and allows predicting and avoiding situations of high risks for biological diversity. This will also facilitate the spatial planning of the river basins to increase the opportunities for complementary relationships between conservation and development initiatives.

The activities of this sub-component include:

- Define, in a participatory way, the characteristics of areas of ecological sensitivity.
- Design and validate a method for identifying establishing and monitoring areas of ecological sensitivity.
- Design and establish a Geographical Information System for the management of spatial and georeferenced information that allows a geographical interpretation of the location and characteristics of the identified areas of ecological sensitivity.
- Implement the method for identification, establishment and monitoring areas of ecological sensitivity, by means of an institutionalized system, in the basins of the project, based on the information generated by the ecological profiles.

Annex 3: Incremental Cost Analysis
Chile: Water Resources and Biodiversity Management Project

Overview of the Incremental Costs Analysis

The project' s main global objective is to conserve aquatic biodiversity of global significance through mainstreaming biodiversity considerations in the management of water resources in Chile. The project will allow the GOC to: (i) incorporate biodiversity considerations in water management within 8 river-basins of global significance; (ii) enhance capacity to manage biodiversity within water management regimes, (iii) strengthen tools, policies, and technical baseline information required to manage aquatic biodiversity in Chile, and (iv) demonstrate successful models for mainstreaming aquatic biodiversity within integrated water management regimes.

The GEF alternative proposes to achieve these objectives at an incremental cost of US$11.35 million, of which US$10.00 million are requested from the GEF (US$1.35 million of the incremental cost will be financed by government counterpart contributions).

Context and Broad Development Goals

As the Chilean economy continues to develop and the population expands, the competition for water resources will increase. Over the next 50 years, it is estimated that, in response to increased demand, the irrigated area with high irrigation security would more than double; hydroelectric capacity would increase five-fold; and industrial, mining and urban water consumption would double. Unless properly managed, this increase in demand will lead to development constraints, inter-sectoral conflicts and losses of biological diversity.

The current system of water resource management in Chile is overly centralized and lacks the instruments necessary for efficient water resource management. Furthermore, the current water resource management institutions and instruments do not significantly take into consideration biodiversity conservation considerations. Finally, The National System of Wildland Areas (SNASPE) does not adequately represent fresh water and coastal ecological regions considered of global importance in terms of biological diversity.

Baseline

The SNASPE protects approximately 14 million hectares which corresponds to 19% of the national territory. It includes 92 protected areas in the following categories: 32 national parks, 47 national reserves and 13 natural monuments. However, 20 ecological systems of a total of 85 still are not represented in the SNASPE. This under representation is particularly acute with regard to aquatic ecosystems and in particular those located on the coast and in the Mediterranean bioclimatic region.

Under the *baseline scenario*, Chile will improve its management of water resources but will be unable to adequately manage the biological diversity in the selected basins. Furthermore, biodiversity conservation will not be mainstreamed into the institutions and instruments used in water resource management. Thus, the baseline scenario would result in minimum progress toward achieving an adequate level of conservation and management of biological diversity in the selected river basins.

Implementation of the Baseline scenario would result in:

- Development of a new, decentralized institutional model for water resource management which considers biodiversity conservation only to a very limited extent.
- Water resource management instruments are developed but incorporation of biodiversity conservation and ecosystem issues is limited.
- Infrastructure investments (e.g., flood control and river training, rural water supply, irrigation and drainage systems) are made in the eight watersheds with limited consideration of biodiversity conservation. Very

limited investments specifically targeting biodiversity conservation resulting in minimal closing of the gaps in the coverage of the SNASPE.

- Monitoring and evaluation systems established that do not incorporate indicators of biodiversity conservation.

Total expenditures under the Baseline scenario are estimated at US$308.65 million.

Global Environment Objectives

In Chile, the General Bases of the Environment law (number 19.300 of 1994) defines biological diversity as "the variability of live organisms that are part of all terrestrial and aquatic ecosystems. It includes the diversity within one species, among species and among ecosystems." Based on this definition, Chile has remarkable biological diversity, largely due to its biogeographical isolation at the southern tip of South America. To the east, Chile is isolated by the *Cordillera de los Andes*, to the north by the Atacama Desert and to the west by the Pacific Ocean. In addition, Chile has significant altitudinal and latitudinal variation which results in diversified climatic representation. These characteristics contribute to Chile's biological diversity and to the high number of endemic species in the country (endemic species represent 77% of amphibians, 58% of reptiles, 51% of vascular plants and 37% of mammals).

Regarding aquatic resources, Chile contains an extensive system of rivers, nearly 230 basins and numerous Andean and coastal wetlands. The Directory of Neotropical Wetlands includes 34 Chilean aquatic ecosystems (including lakes, bays, lagoons, estuaries, and salt lakes) as places of high importance (based on the Convention of Wetlands of International Importance). Furthermore, Chilean fresh water ecosystems receive high scores for distinguishing characteristics (measured in terms of rates of endemism and wealth of species) and growing threats in a recent analysis of fresh water biological diversity conservation priorities in Latin America and the Caribbean. For the same reasons (high biological importance and high degree of threat), a technical publication titled "Freshwater Biodiversity of Latin America and the Caribbean" (WWF/USAID/Biodiversity Support Program, 1998) considers all of the fresh water ecosystems in Chile as either "priority" or "high priority" for conservation in Latin America and the Caribbean. The ecological regions with the highest priority include: Valdivian, Island of Chiloé, Arid Puna, and Mediterranean Southern Chile.

According to Dinerstein, et. al (1995), the river basins selected for the project are located within three ecological regions, one of which is considered "endangered" and two of which are considered "vulnerable" (see Table 1). By comparison, Chile has 12 terrestrial ecological regions, of which three are considered endangered and eight vulnerable.

Table 1: Ecological regions according to Dinerstein, et. al (1995) represented in each basin.

River Basin	Ecological Region	Status
Lluta	Atacama Desert	Vulnerable
San José	Atacama Desert	Vulnerable
Huasco	Mediterranean bushland (matorral)	Endangered
Elqui	Mediterranean bushland (matorral)	Endangered
Limarí	Mediterranean bushland (matorral)	Endangered
Petorca	Mediterranean bushland (matorral)	Endangered
La Ligua	Mediterranean bushland (matorral)	Endangered
Mataquito	Mediterranean bushland (matorral)	Endangered
Itata	Valdivian Temperate Forest	Vulnerable
Imperial	Valdivian Temperate Forest	Vulnerable
Lago Budi	Valdivian Temperate Forest	Vulnerable

A consolidated program of conservation and management of watersheds certainly will help to conserve a great

proportion of this biological diversity and to maintain ecosystem processes.

GEF Alternative

Under the *GEF Alternative scenario*, Chile will be able to improve the management and conservation of water resources and biodiversity in the selected river basins through investments, strengthen institutions and the use of water resource management instruments. Specific outcomes would include:

- Development of biological diversity conservation and management instruments in the selected watersheds.
- Supervision and direct management of biodiversity conservation investments and activities related to water resources.
- Establishment of long-term institutional mechanisms that allow the conservation and management of water resources and which incorporate biological diversity considerations.
- Increased participation of communities and organizations involved in water resource management.
- Establishment of an efficient monitoring mechanism for biological diversity conservation in the selected basins.

Total expenditures under the GEF Alternative scenario are estimated at US$320.00 million.

Incremental costs

The difference between the cost of the Baseline scenario (US$ 308.65 million) and the cost of the GEF Alternative (US$320 million) is estimated at US$11.35 million. This represents the incremental cost for achieving global environmental benefits. Of this amount, US$10.00 million is requested from the GEF and US$1.35 million will be financed from government counterpart contributions.

Incremental costs matrix (US$ millions)

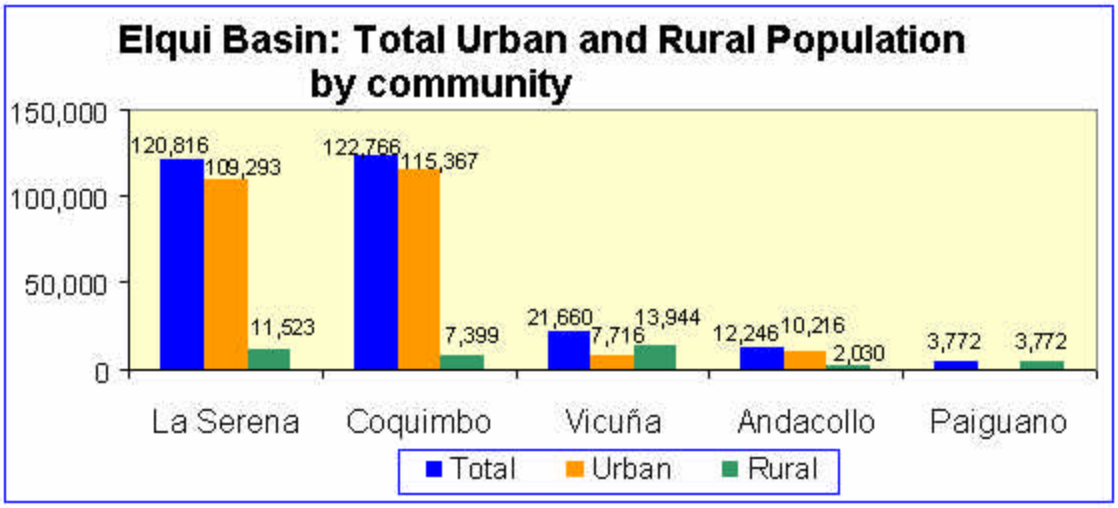
Component	Category	Cost	Domestic Benefit	Global Benefit
Institutional strengthening	Baseline scenario	$13.93	Limited coordination that likely will not achieve technical efficiency	Limited, short term measures for the protection of biodiversity of global importance
	GEF alternative	$14.60	Complete understanding and strengthening of technical coordination.	Full mainstreaming and enhanced capacity to conserve biodiversity in a cross-sectoral and decentralized manner
	Increment	$0.67		
Development of management instruments	Baseline scenario	$35.63	Few and very basic tools in place for effective management of selected basins based on ecological principles	Some short term measures for the protection of biological diversity of global importance
	GEF alternative	$40.10	Establishment of integrated management of selected basins based on ecological, biodiversity, social, economic and political considerations	Sustained conservation of areas of biological diversity of global importance
	Increment	$4.47		
Watershed development and conservation investments	Baseline scenario	$257.31	Sporadic government actions to conserve biological diversity	Some short-term measures for the protection of biological diversity of global importance
	GEF alternative	$262.30	Effective actions to sustainably conserve biological diversity	Effective conservation of areas of biodiversity of global importance
	Increment	$4.99		
Monitoring and evaluation	Baseline scenario	$1.78	Limited monitoring of biological diversity	Some knowledge of the ecosystem dynamics
	GEF alternative	$3.00	Establishment of comprehensive mechanisms for sustainable biodiversity monitoring	Effective understanding of the biological dynamics associated with water resource management
	Increment	$1.22		
TOTAL	Baseline scenario	$308.65	Some actions toward biodiversity conservation in the selected watersheds	Sporadic measures to protect biological diversity of global importance.
	GEF alternative	$320.00	Establishment of effective planning for the sustainable management and conservation of water resources, considering biological diversity as an integral element and based on institutional and social realities	Effective conservation of biological diversity through watershed management of selected basins in ecological regions of global importance.
	Increment	$11.35		
Requested from GEF:		$10.00		

Annex 4
Chile: Water Resources and Biodiversity Management Project
Social Indicators
(Elqui, Mataquito, and Itata Watersheds)

1. Elqui River Watershed

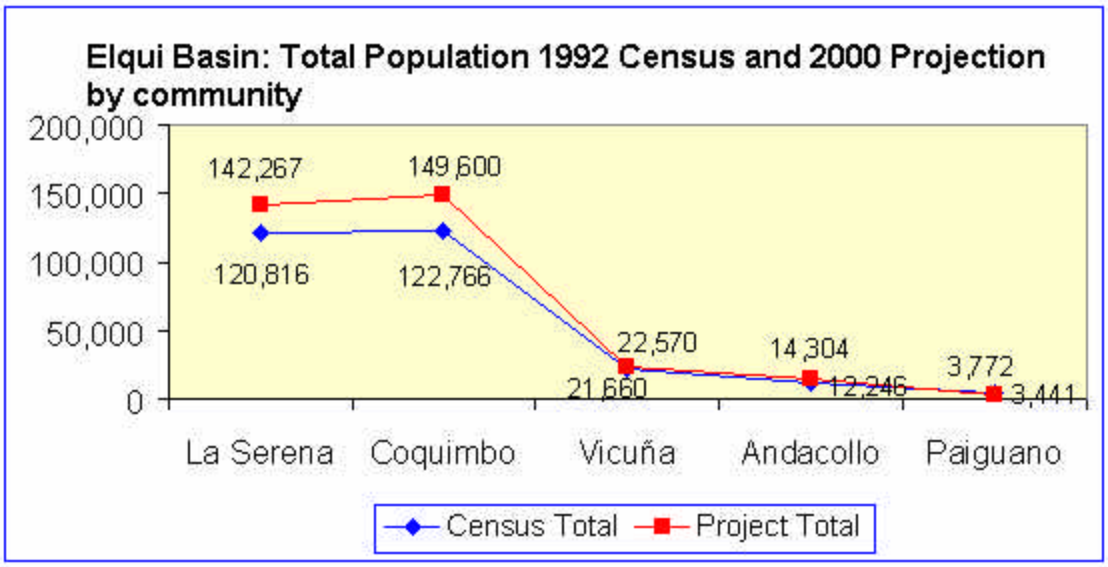
For the socioeconomic characterization of the Elqui river watershed, data are obtained from the CASEN Survey of all the communities that comprise it. Thus, although there may be a variation due to the fact that the data are from 1998, the basin's average is obtained with all communities integrated.

POPULATION



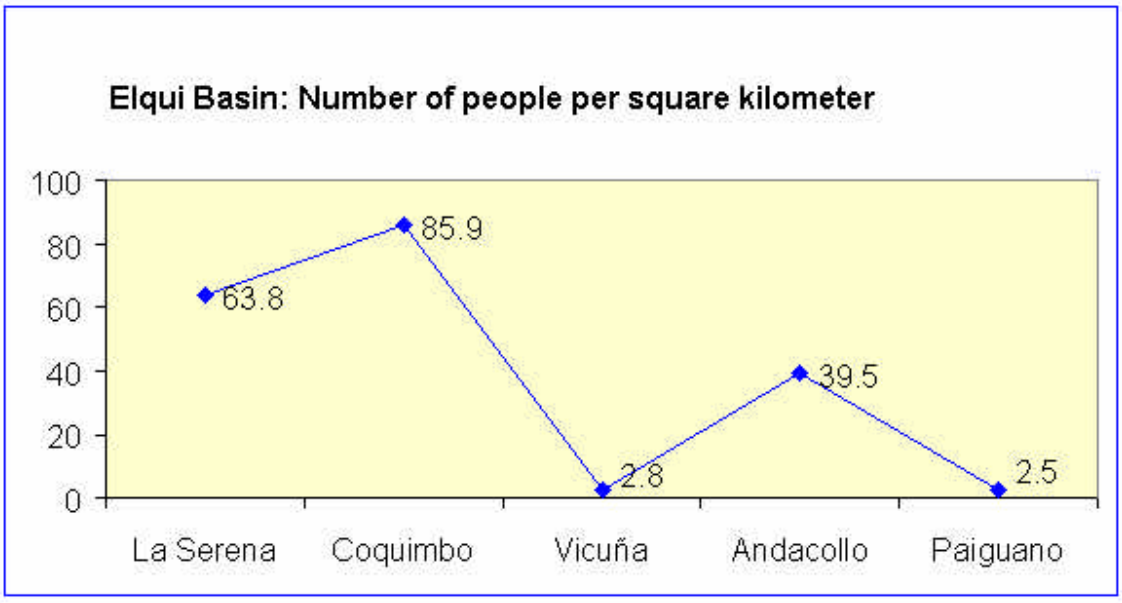
Source: 1992 Census

The total population of the communities that comprise the Elqui River Basin is 281,260, distributed mainly in the cities of La Serena and Coquimbo. Of these, 242,592 correspond to urban population (86.3%), and 38,668 to rural population (13.7%). The communities of Vicuña (64.4%) and Paiguano (100%) have the highest percentage of rural population. Most of the Elqui Basin's population lives in urban zones. With the implementation of the PMRH, the migratory trend from rural to urban areas should at least remain constant, since rural living conditions would have to improve.



Source: INE 1998

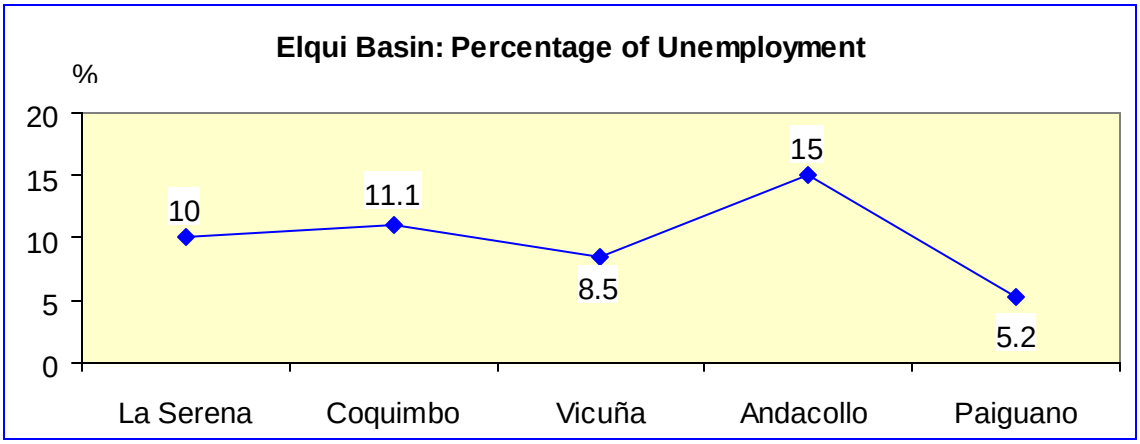
The population projection for 2000, for the communities that comprise the Elqui Basin, estimates an increase of 50,922 people (1992: 281,260 – 2000 Projection: 332,182). It is worth noting that the population increase will occur mostly in urban communities (La Serena and Coquimbo), while the increase is significantly smaller in rural communities (Vicuña and Andacollo). However, the population of the community of Paiguano (the only one that is exclusively rural) is expected to decrease (1992: 3.772-2000: 3.441). Thus, it may be noted that the projection estimates an increase in the urban population and a slight decrease in the rural population.



Source: INE-1992 Census

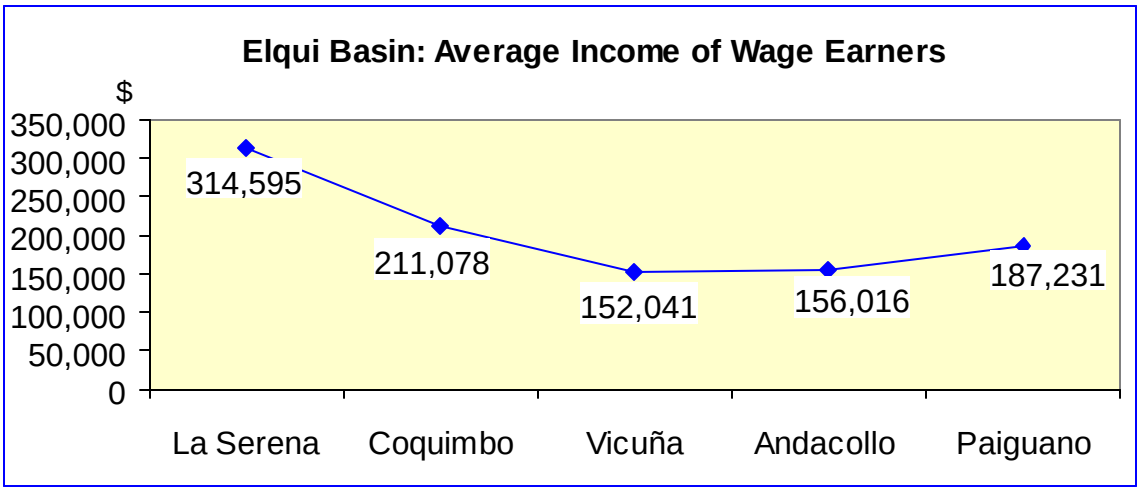
The population density of the communities that comprise the Elqui Basin is 22.08 people per sq. km, placed among the three basins under study with a smaller population density. The community with the largest population density is Coquimbo (85.9), while the one with the smallest density is Paiguano (2.5). The density of the community of Andacollo (39.5), the former mining center of the IV region, is noteworthy.

LABOR



Source: CASEN Survey 98[1]

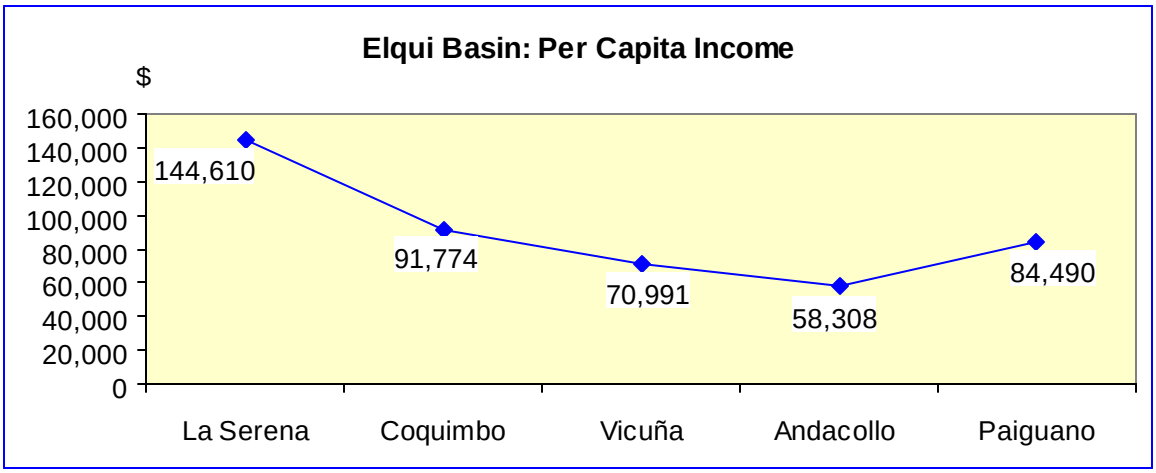
The percentage of regional unemployment is 10%, nearly coinciding with the average unemployment of the communities that comprise the Elqui Basin (9.9%). The largest percentage of unemployment is in the community of Andacollo (15%), a former mining center, while the lowest level is in the community of Paiguano where the main productive activities are agriculture and tourism.



Source: CASEN Survey 98

The average income of employed persons at regional level is $213,532, lower than the national average of $274,820, while the average income of employed persons in the Elqui Basin is around $204,192, which is lower than the previous two averages. The lowest income is in the community of Vicuña ($152,041), while the highest is in the community of La Serena ($314,595). A difference was observed between salaries in urban and rural zones. However, the cost of living in rural areas is lower than that in urban areas.

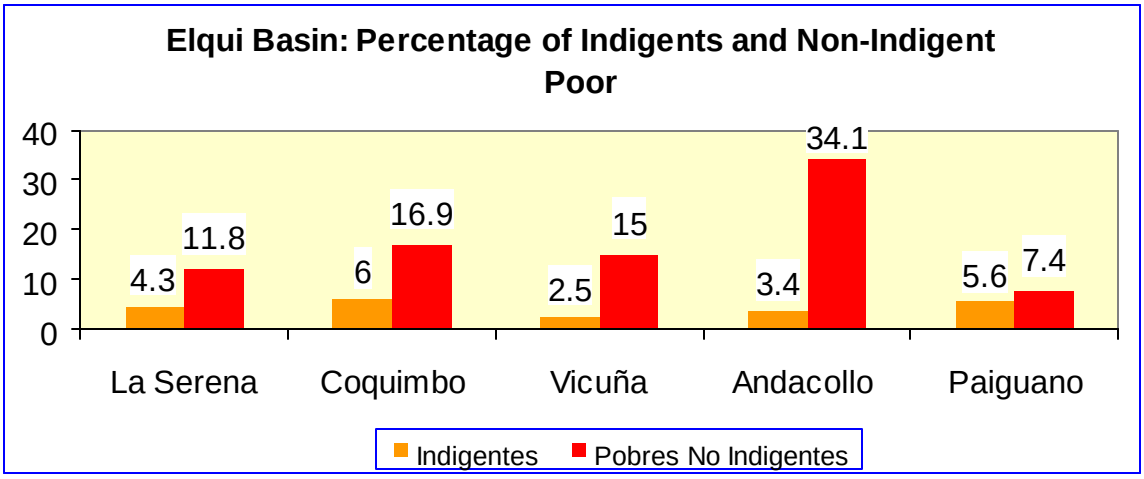
[1] Even though the data presented may have varied since the ' 98 survey, it is assumed that the proportions have remained relatively constant and thus the analysis remains valid.



Source: CASEN 98

The per capita income of the IV Region is $91,299, similar to the average per capita income of the communities that comprise the Basin, which is $90,034. However, both averages are below the national per capita income ($120,770). The community of Andacollo has a lower income ($58,308); coincidentally, this community has the highest percentage of unemployment. Once again, one may observe that the inhabitants of the community of La Serena have a better quality of living.

POVERTY



Source: CASEN Survey 98

The percentage of indigence at regional level is 6.2%, higher than the national average (5.6%). However, the average indigence in the communities that comprise the Elqui Basin is 4.4%, which is lower than the regional and national totals.

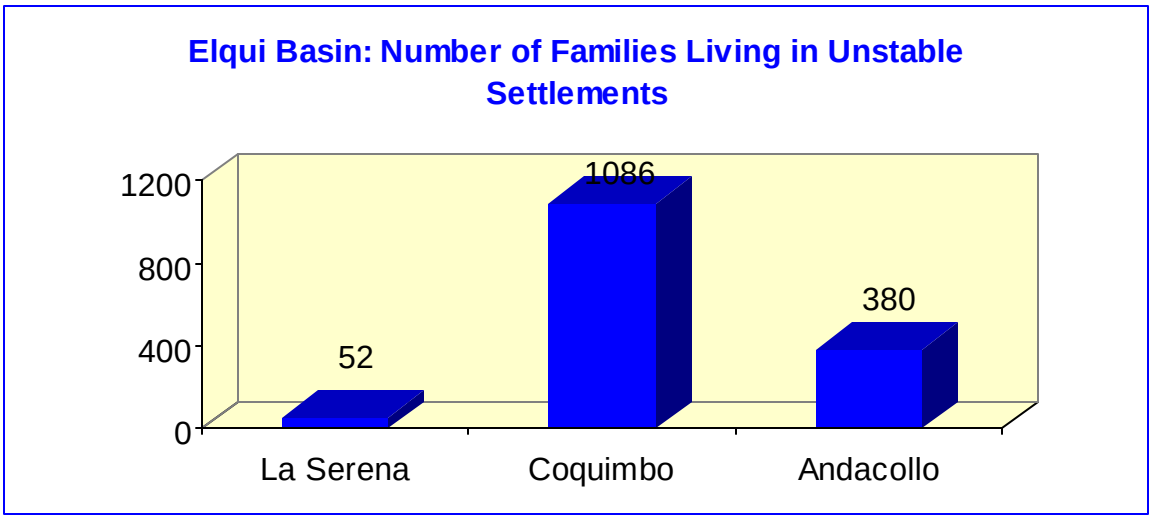
With regard to non-indigent poor, the regional percentage is 18.8%, higher than the national total (16.1%), while the average of non-indigent poor people in communities that comprise the Basin is 17%, lower than the regional average but higher than the national. The community with a significantly higher percentage of non-indigent poor is Andacollo (34.1%). The community of Paiguano has the highest percentage in the Basin (7.4%).

Number of Unstable Settlements by community

Communities	Number of Camps or Unstable Settlements
La Serena	1
Coquimbo	10
Andacollo	6
Paiguano	0
Vicuña	0
TOTAL	17

Source: cadaster of Chile Barrio 2000 Program

The total number of unstable settlements in all communities that comprise the Elqui Basin is 17 [1]. Most of them are located in the community of Coquimbo (10). However, it should be noted that there is a high number in the community of Andacollo (6). This number coincides with the features described above which make this community the poorest in the Basin. The presence of unstable settlements is a significant problem in the implementation of the PMRH, since they are generally established on the banks of rivers and canals and draw water from them in order to live. This generates water theft and contamination.



Source: Cadaster of Chile Barrio 2000 Program

The total number of families in the Elqui Basin who live in unstable settlements is 1,518. Most are in the community of Coquimbo (1,086), while 380 families live in such precarious conditions in the community of Andacollo. The precarious situation in both communities has different characteristics since Coquimbo is a mainly urban community and Andacollo is rural.

Camps in communities that comprise the Elqui Basin and their location within it

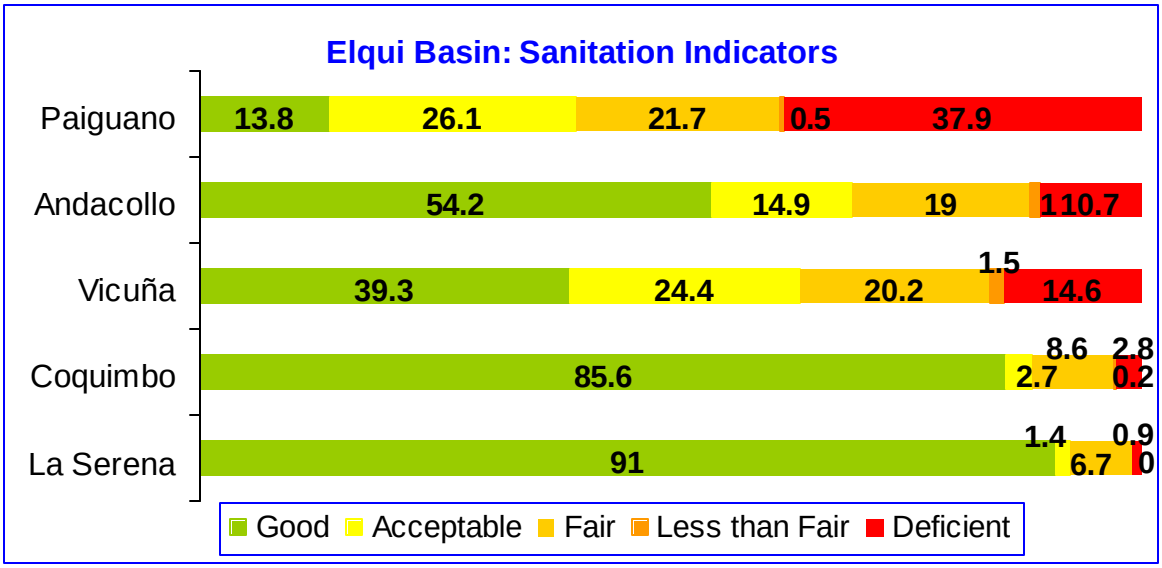
COMMUNITY	LOCALITY	SETTLEMENT NAME	NUMBER OF FAMILIES	LOCATION ON BANK OF

[1] Some of these unstable settlements are being handled through the Chile Barrio Program. However, they still exist. The goal of the government' s inter-ministerial program is to eradicate unstable settlments in Chile by the year 2005.

				RIVER, CANAL OR RAVINE
La Serena	La Serena	Ampliación Juan XXIII	52	Quebrada San Francisco
Andacollo	Andacollo	Ampliación 25 de Octubre	130	No
Andacollo	Andacollo	El Sauce	33	Quebrada el Sauce
Andacollo	Andacollo	El Toro	40	Quebrada El Toro
Andacollo	Andacollo	Villa Andacollo	50	No
Andacollo	Andacollo	Villa Santiago	59	No
Andacollo	Chepiquilla	Chepiquilla	68	No
Coquimbo	Coquimbo	Gruta Shangri-la	43	No
Coquimbo	Coquimbo	Los Castyears	45	No
Coquimbo	Coquimbo	Playa Changa	29	No
Coquimbo	Coquimbo	Qda. Las Rosas	25	Quebrada Las Rosas, flows into sea
Coquimbo	Coquimbo	Villa El Canelo	229	No
Coquimbo	Coquimbo	Villa El Faro	256	No
Coquimbo	Coquimbo	Villa Violeta Parra	223	No
Coquimbo	Coquimbo	Vista al Mar	145	No
Coquimbo	Huachalume	Comité sin Casas	46	Quebrada Huachalalume
Coquimbo	Tierras Blancas	Calle Tarapacá	45	No
TOTAL			**1518**	

Source: cadaster - Chile Barrio 2000 and Information from CHB Regional Technical Secretary.

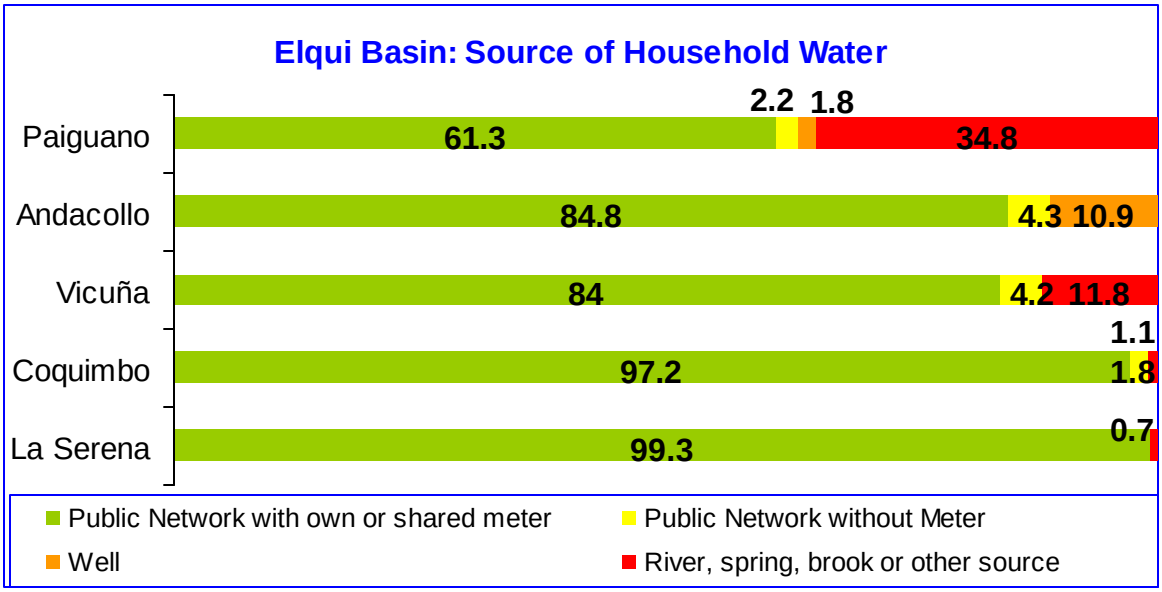
Of the 17 camps considered in the cadaster of the Chile Barrio Program, 6 are located on ravines. However, through in-depth interviews carried out for this consultancy, the existence of new unstable settlements was noted on the banks of canals, which may not be registered and may not be benefiting from this social program.



Source: CASEN 1998

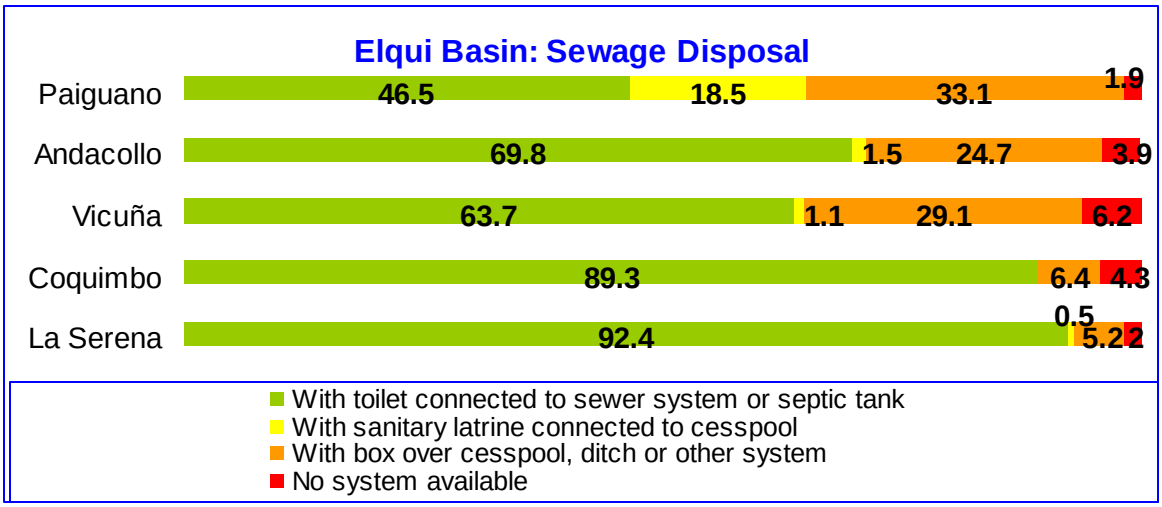
The sanitation indicator in the communities that comprise the Elqui Basin is rather diverse. While some communities have high percentages in the "good" category, such as La Serena (91%) and Coquimbo (85,6%), in communities with a large rural component the percentage of homes with deficient sanitation include Vicuña (14.6), Andacollo (10.7%) and Paiguano (37.9%). It should be noted that although the community of Paiguano has no unstable settlements (according to the Chile Barrio cadaster), there is a high percentage of homes without sanitation (availability of water, sewage disposal system and availability of electricity). This indicator is extremely important for the PMRH because its components include sanitation, and its non-development means the contamination of waters practically from their source, as occurs in the community of Paiguano.

Due to the importance of this social indicator for the PMRH, the results of indicators that integrate the indicator of sanitation in general are expressed in detail.



Source: CASEN 1998

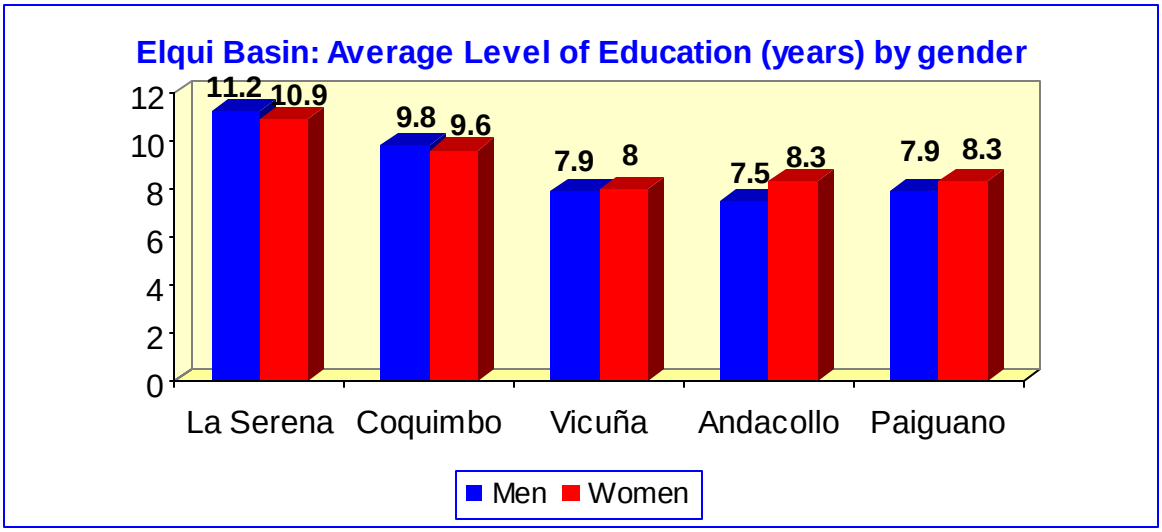
The sources of water available to homes in the communities that comprise the Elqui Basin are varied. In urban communities such as La Serena (99.3%) and Coquimbo (97.2%), most are connected to the public network with their own meter or a shared one. In communities with a larger rural population such Vicuña and Andacollo, although most homes are connected to the public network, there is an increase in the percentage of homes that obtain water from a river, spring, or other source as in Vicuña (11.8%) and from wells as in Andacollo (10,9%). However, the community of Paiguano, which is strictly rural, has the greatest percentage of homes that receive water from non-potable sources, mainly from rivers, springs, brooks or other sources (34.8%). This situation should be considered under the PMRH in order to be incorporated into the benefits of the rural drinking water component.



Source: CASEN 1998

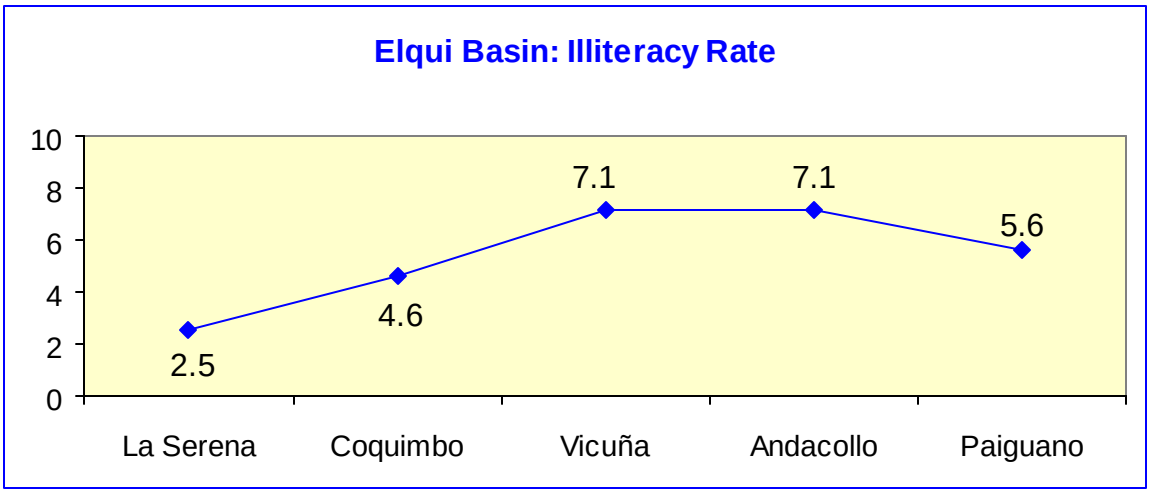
There is varied distribution in the communities that comprise the Elqui Basin in terms of sewage disposal. The urban communities of La Serena (92.4%) and Coquimbo (89.3%) mostly use toilets connected to septic tanks. In communities with a rural presence such as Vicuña (29.1%) and Andacollo (24.7%) there is an increase in the use of a box over a cesspool, ditch or other system. In the community of Paiguano (strictly rural) the percentage of homes with toilets connected to a sewage system or septic tank is smaller than the other alternatives (46.5%). This situation increases the levels of water contamination in the rivers and brooks that comprise the Elqui Basin.

EDUCATION



Source: CASEN 1998

The average level of education of the communities that comprise the Elqui Basin is 8.9 years for men and 9 years for women. In the graph below, one can see that the average years of education are higher in cities than in rural areas. Moreover, in urban communities men have more years of education than women, as in La Serena and Coquimbo, in contrast to rural communities where women have more years of education.



Source: CASEN 1998

The average illiteracy in communities that comprise the Elqui Basin is 5.4%, nearly coinciding with the average of the IV Region Coquimbo (5.9%) and lower than the national average (4.6%). The lower percentages coincide with those of urban communities (La Serena 2.5%-Coquimbo 4.6%) and greater percentages with communities having a rural population (Vicuña and Andacollo 7.1%). However, the low percentage existing in the rural community of Paiguano (5.6%) is worth noting.

In summary, the community of Andacollo has the most alarming social indicators among the communities that comprise the Elqui Basin. This situation may be due to the closing of mining activities in the zone that had attracted most of the population. This situation shows how the non-implementation of adequate reconversion plans or programs in zones where the productive focus changes, negatively affects the social development of their inhabitants. This situation serves as a warning in light of the possibility of leveling taxes on whisky and pisco. This makes it necessary to have an adequate reconversion plan with a countrywide strategy.

The social indicators that show the most significant results for the implementation of the PMRH are those dealing with sanitation. This situation coincides with the problem of water pollution in the Basin, a problem with a strong presence as evidenced by in-depth interviews.

Finally, the economic and social differences among rural and urban communities are only significant in relation to the indicator of sanitation (with the exception of Andacollo which presents deficient social indicators on poverty, per capita income and unemployment). It may be stated that agricultural activity (the principal activity of this zone) is moderately meeting the social needs of the inhabitants of the Elqui Basin. In light of this, the PMRH should represent an incentive to improve a situation that is in good shape.

BASELINE OF SOCIAL INDICATORS IN ELQUI BASIN

SOCIAL INDICATORS	BASELINE
Total population Elqui Basin (inhabitants)	**281,260**
Urban population Elqui Basin (%)	**86.3**
Rural population Elqui Basin (%)	**13.7**
Population Density Elqui Basin (people per km2)	**22.08**
Unemployment Elqui Basin (%)	**9.9**
Average Income of wage earners Elqui Basin ($)	**204,592**

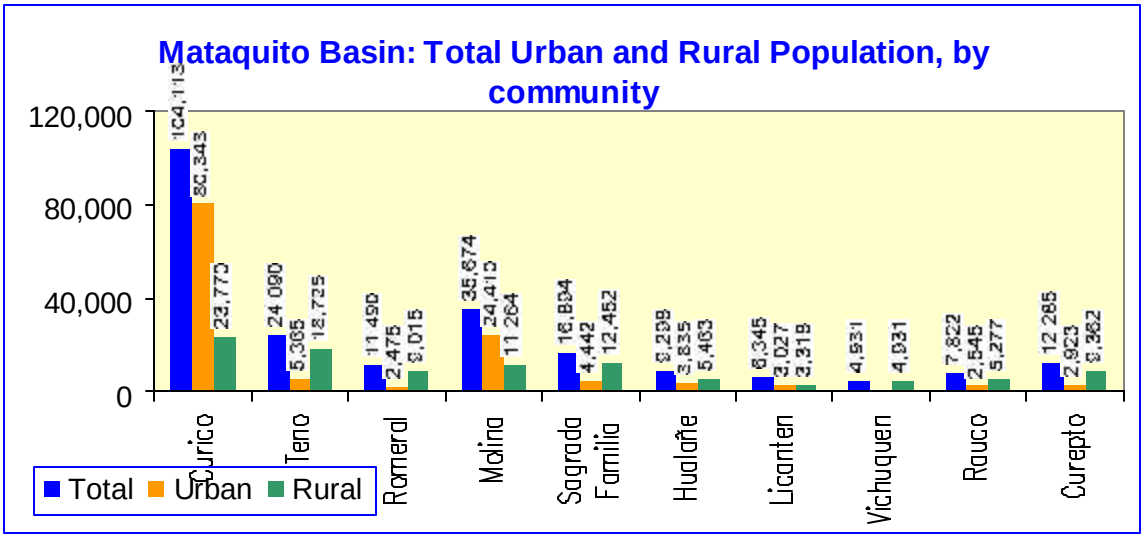
Per capita income Elqui Basin ($)	**90,034**
Indigence Elqui Basin (%)	**4.4**
Non-indigent poor Elqui Basin (%)	**17**
Number of Unstable Settlements Elqui Basin	**17**
Number of Families living in Unstable Settlements Elqui Basin	**1,518**
Indicator of Deficient Sanitation Elqui Basin (%)	**13.4**
Water extraction for household use, from river, spring or brook in Elqui Basin (%)	**9.7**
Elimination of sewage by cesspool, ditch, or no system Elqui Basin (%)	**23.4**
Average level of education Elqui Basin (years)	**8.9**
Education Rate in Elqui Basin (%)	**5.4**

2. Mataquito River Watershed

For this Basin, it should be noted that social indicators for all the communities comprising it are not available, and therefore the results are partial. This is because the CASEN Survey lacks representation for all communities.

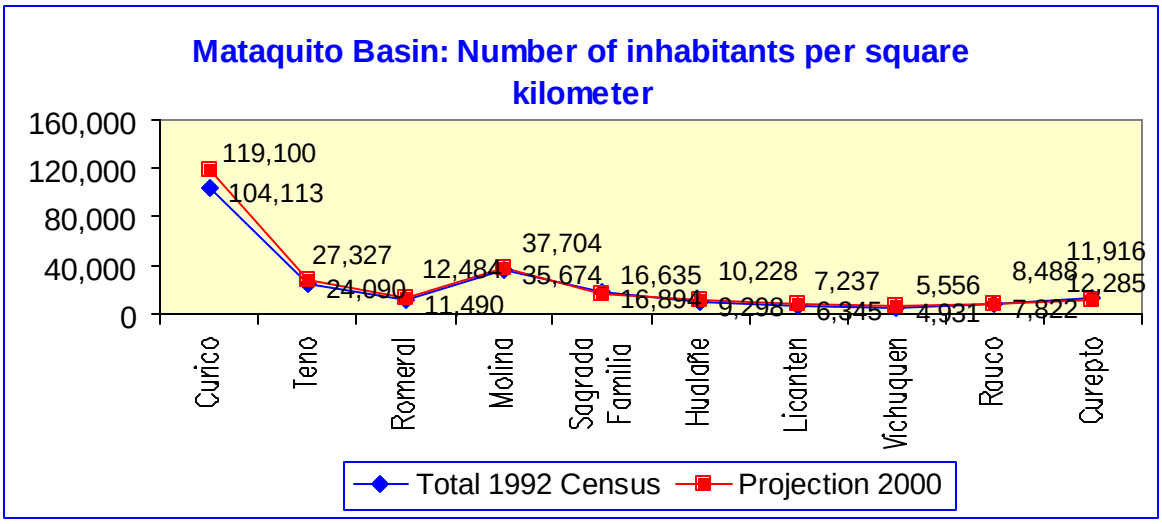
It should also be noted that these indicators may vary substantially if Chile decides to terminate price bands for products such as sugar and wheat, as international trade agreements indicate. Both sugar and wheat are produced in the Mataquito Basin, by small and large producers, and their prices are currently just about subsidized by price bands.

POPULATION



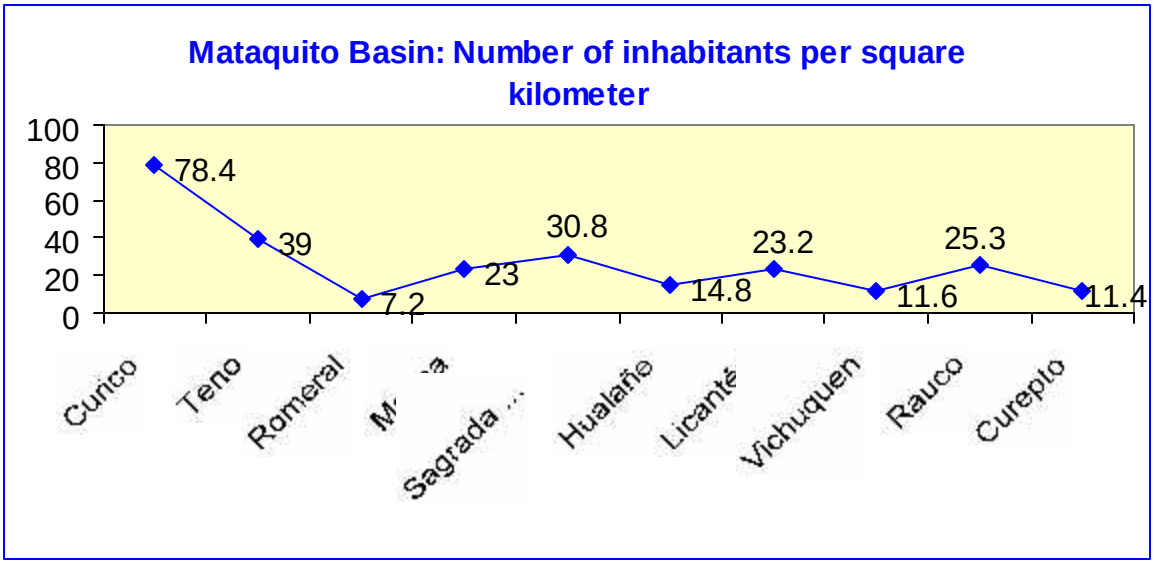
Source: 1992 Census

The total population of the communities that comprise the Mataquito River Basin is 232,942, of whom 129,365 correspond to urban population (55.5%) and 103,577 to rural (44.5%). The principal urban centers are Curico and Molina. The rest of the communities have a larger rural, rather than urban, population. Only the community of Vichuquén is exclusively rural.



Source: INE 1998

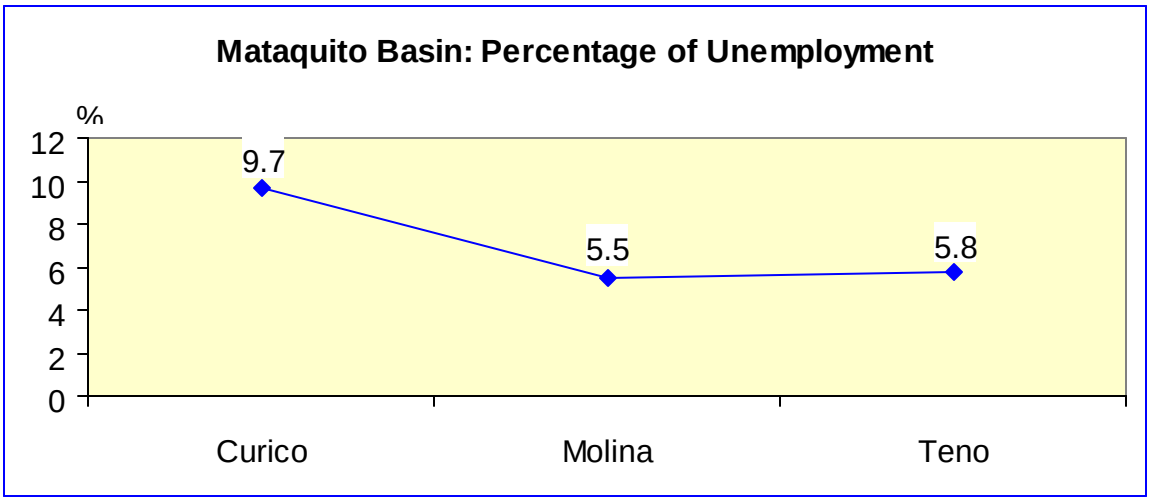
The population projection for the year 2000, made by the INE according to 1992 Census data, estimates that the population in the communities of the Mataquito Basin will increase by 23,733 (1992 Census: 232,942 – Projection for 2000: 265,675). A population increase is projected in all communities, with the exception of the communities of Sagrada Familia (1992: 16,894 - 2000: 16,635) and Curepto (1992: 12,285 - 2000: 11,916).



Source: INE 1998 and 1992 Census

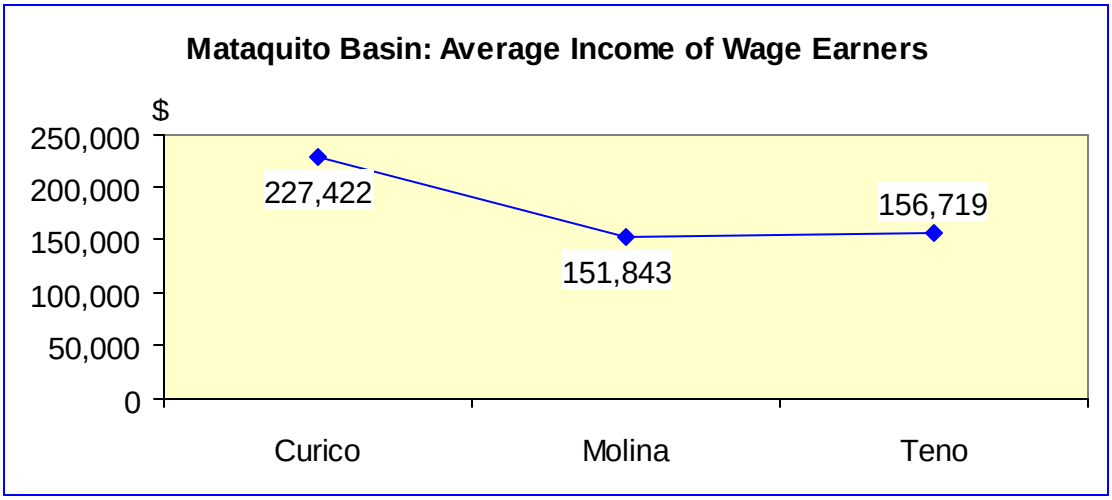
The population density of the communities that comprise the Mataquito Basin is 27.9 people per square km. The urban community of Curico has the highest density (78,4), while Romeral, which is the largest in area, has the lowest density (7.1). The density of this Basin is higher than that of the Elqui River Basin.

LABOR



Source: CASEN 1998[1]

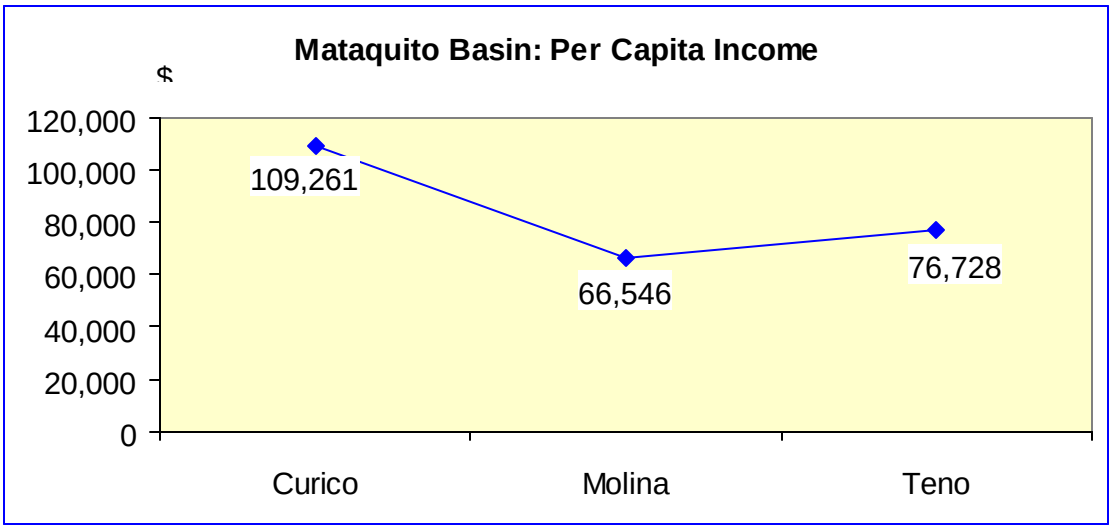
The percentage of unemployment in the Maule Region, according to the CASEN 98 survey, is 10.3%, higher than the average value for the communities that comprise the Basin and which were measured by CASEN (7%). However, this data is partial, both in terms of the lack of data from other communities and the time of measurement. According to INE's latest indicators (July-September 2000), the VII Region has an unemployment rate of 12.7%, making it one of the country's regions with the highest unemployment rates. This may be explained by last winter's storms that produced significant agricultural losses.



Source: CASEN 1998

The average income of wage earners in the Maule Region is $179,711, similar to the average income of wage earners in the communities that comprise the Basin ($178,661). There is a significant difference in salaries earned by people in the provincial capital ($227,422) compared to those of people in more rural communities ($151,843 – 156,719). However, it should be remembered that the cost of living in rural areas is lower than that of cities.

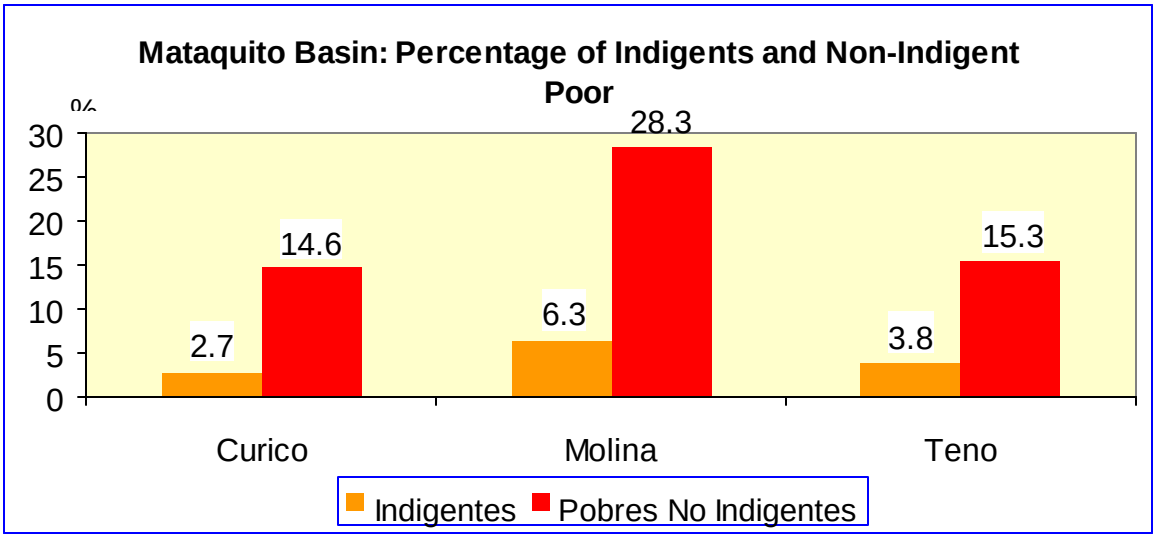
9 It should be noted that the sample design of the 1998 CASEN survey does not allow estimates to be made for all of the country's communities. For this version only 196 communities are represented. For this reason, of all the communities that comprise the Mataquito River Basin, data exists only for Curico, Teno and Molina. The communities of Romeral, Sagrada Familia, Hualañe, Licantén, Rauco, Vichuquen and Curepto are not included.



Source: CASEN 1998

Regional per capita income is $77,531, lower than the per capita income observed in the Basin ($84,178). Once again, we may point out that the salaries of the inhabitants of Curico ($109,261) are higher than those of people living in more rural communities ($66,546 – 76,728).

POVERTY



Source: CASEN 1998

The percentage of indigents in the VII region is 7%, higher than the national percentage (5.6%). However, the average indigence in the Basin' s three communities for which information is available, is lower than the national and regional totals (4.3%).

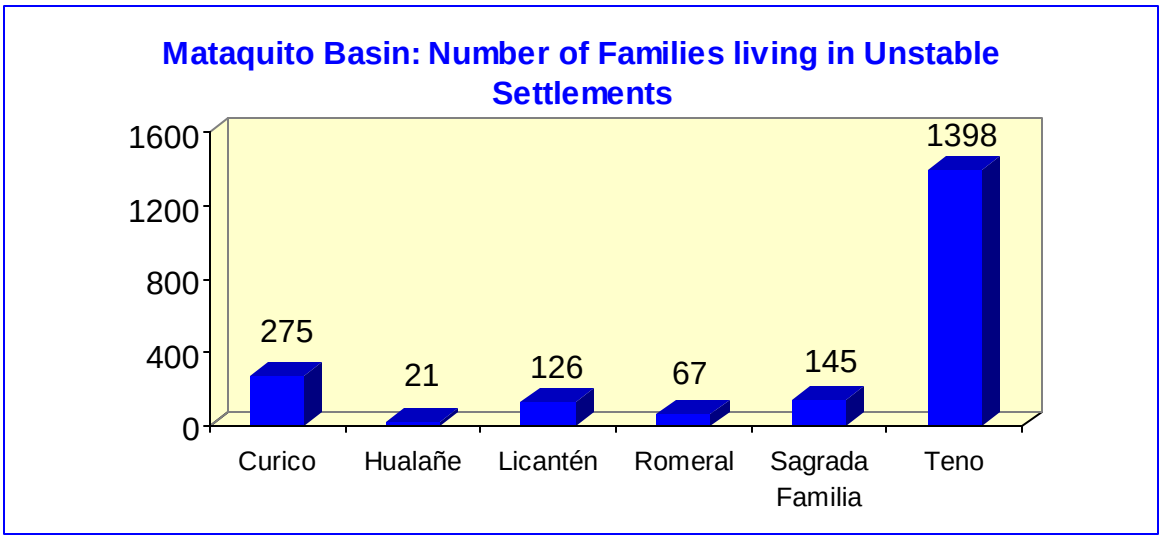
The percentage of non-indigent poor in the region (22.3%) is higher than the average of the three communities that comprise the Basin (19,4%). However, the community of Molina has a significantly higher percentage than that of the other two communities (28.3%).

Number de Unstable Settlements by Community

Communities	Number of Unstable settlements or Camps
Curico	3
Hualañe	1
Vichuquen	0
Licantén	1
Molina	0
Romeral	3
Sagrada Familia	1
Rauco	0
Teno	19
TOTAL	28

Source: cadaster Chile Barrio 2000 Program

The total number of unstable settlements in the communities that comprise the Mataquito Basin is 28. The community with a higher number of camps is Teno (19). It should be noted that the community of Molina, with high indicators of poverty and indigence, has no camps.



Source: Cadaster - Chile Barrio 2000 Program

The total number of families in the communities that comprise the Mataquito Basin who live in unstable settlements is 2,032. It is worth noting that more than half of them are located in the community of Teno (1,398).

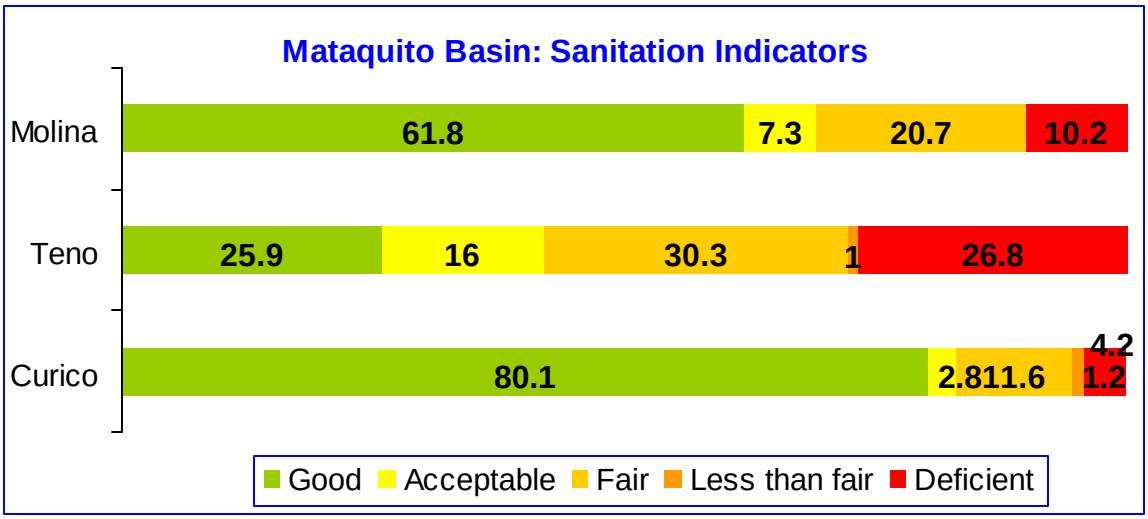
Camps in the communities that comprise the Mataquito Basin and their location within it

COMMUNITY	LOCALITY	SETTLEMENT NAME	NUMBER OF FAMILIES	LOCATION ON BANK OF RIVER, CANAL OR RAVINE
Curico	Los Niches	Los Niches	150	Río Guaiquillo

Curico	Los Niches	Sta. Claudia	55	Río Guaiquillo
Curico	Los Niches	Sta. Mónica	70	Río Guaiquillo
Hualañe	El Porvenir	El Porvenir Oriente	21	No
Licantén	La Pesca	La Pesca	126	Río Mataquito
Romeral	Bellavista	Bellavista	20	Río Guaiquillo
Romeral	El Boldal	El Boldal	27	Estero
Romeral	Tres Puentes	Tres Puentes	20	Canal de Regadío
Sagrada Familia	Sagrada Familia	Lo Valdivia	145	No
Teno	Casas Vizcaya	Casas Vizcaya	43	No
Teno	Dgo. Mancilla	Dgo. Mancilla	105	No
Teno	El Cóndor	El Cóndor	25	No
Teno	El Escudo	El Escudo	28	No
Teno	El Heraldo	El Heraldo	45	No
Teno	El Quelmen	El Quelmen	150	No
Teno	La Estrella	La Estrella	75	No
Teno	La Estrella	Villorrio La Estrella	32	No
Teno	Las Liras	Las Liras	62	No
Teno	Los Guindos	Los Guindos	50	No
Teno	Morza	Caupolicán	41	Canal de Regadío
Teno	Morza	Morza	250	No
Teno	Sn. Francisco	Sn. Francisco	35	No
Teno	Sn. León	Villa Sn. León	52	Estero Chimbarongo
Teno	Sta. Rebeca	Sta. Rebeca	100	No
Teno	Ventanal Alto	Ventanal Alto	30	No
Teno	Ventanal Bajo	Ventanal Bajo	150	No
Teno	Viluco Bajo	Brisas del Río Viluco	25	Río Teno
Teno	Viluco Bajo	Pob. Viluco Bajo	100	No
TOTAL			**2032**	**10**

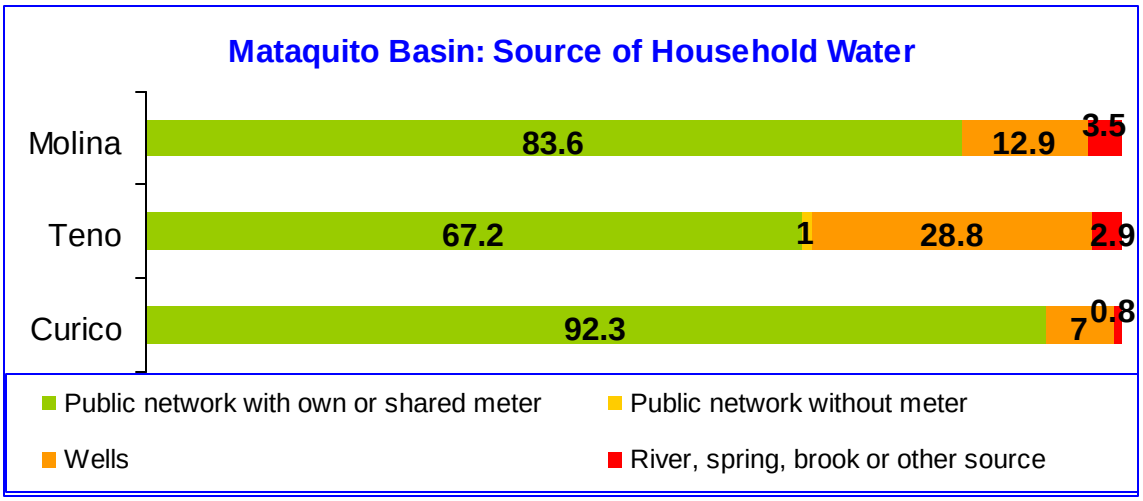
Source: Cadaster – Chile Barrio 2000 Program and information for CHB Regional Technical Secretary.

Of the total number of unstable settlements in the Mataquito Basin (28), 10 are located on the banks of rivers, brooks or canals. However, data obtained during in-depth interviews indicate the existence of more populations that lack sanitation, generally in settlements built with rural subsidies during the military government, which contaminate the waters of the zone's rivers and brooks. This situation may be worsened by the inadequate treatment of wastewater in cities that have "sanitation" services.



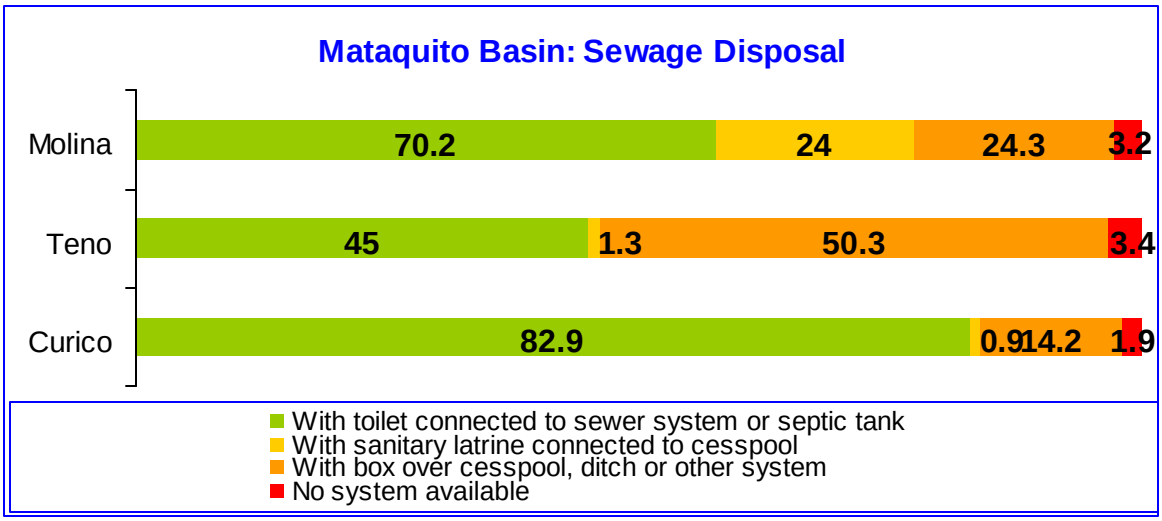
Source: CASEN 1998

The sanitation indicator in the communities that comprise the Mataquito Basin is distributed in diverse ways. The community of Curico (80,1%) has a significant percentage in the "good" category, followed by the community of Molina (61.8%). However, the community of Teno has a significant percentage in the "deficient" category (26.8%) and in the "fair" category (30.3%). This background coincides with the indicators expressed above, which give the community of Teno high poverty indicators and show the existence of better living conditions in the provincial capital.



Source: CASEN 1998

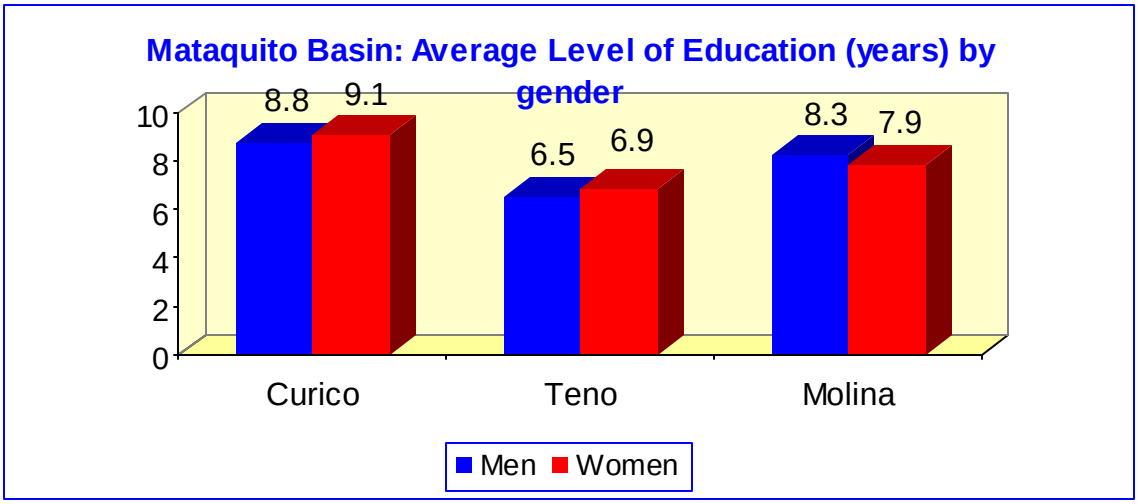
Although most homes in the communities that comprise the Mataquito River Basin have their own or shared meters connected to the public water supply network, fewer homes have them in more rural parts of the zones. Thus, the community of Teno has a significant percentage of homes that obtain water from wells or waterwheels (28.8%). However, the largest percentage of homes that obtain water from rivers, springs, brooks or other sources is in the community of Molina (3.5%), but even so, this value does not exceed the national average of homes in such conditions (3.9%).



Source: CASEN 1998

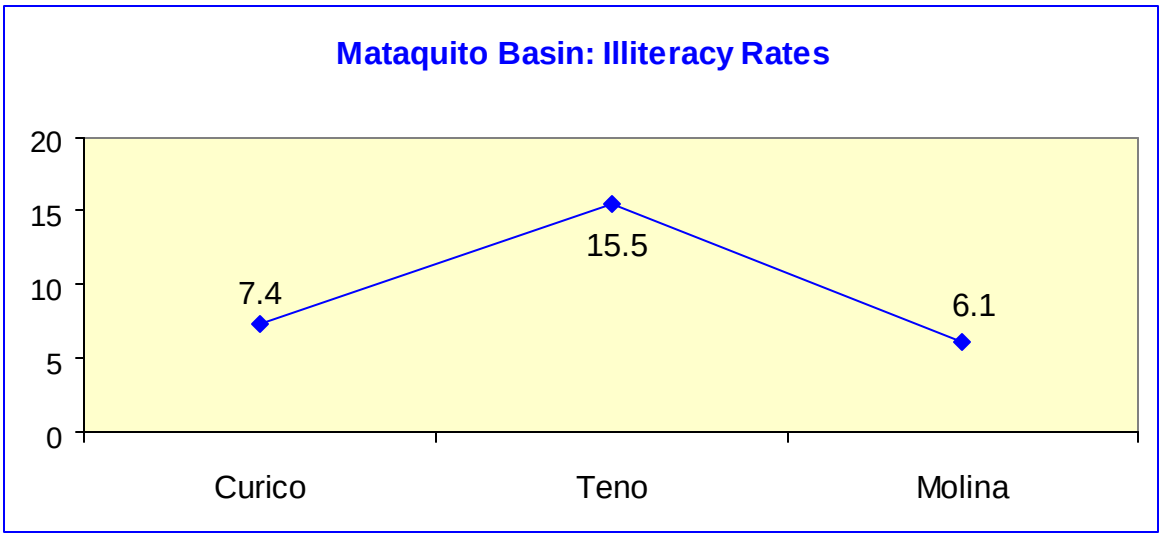
In the communities that comprise the Mataquito Basin, there are varied ways of eliminating sewage. Although the community of Curico has the highest percentage in the category of toilets connected to sewers or septic tanks (82.9%), there is an appreciable percentage in the urban community, in the category of a box over a cesspool, ditch or other (14.2%), while in this category the community of Teno shows a significant 50.3%. This exceeds the national (11.8%) and regional parameters (29.2%) for this category.

EDUCATION



Source: CASEN 1998

The average level of for men is 7.9 years, and for women 8 years education in the communities that comprise the Mataquito Basin. There is a low level of education among inhabitants of the community of Teno (men: 6.5 and women: 6.9 years), significantly lower than the average for the Maule Region (8 years) and the national average (9.7 years).



Source: CASEN 1998

The average of illiteracy in the communities that comprise the Mataquito Basin is 9,7%, slightly lower than the average for the VII Region (10.8%) and higher than the national average (4,6%). The average is high for the community of Teno (15.5%), which coincides with the results of the average level of education.

In summary, the Mataquito Basin has a significant percentage of rural population (44.5%) who work in agriculture. This Basin has had a significant growth in production in recent years, principally from wine exports and emerging vineyards, and also from agroindustry. However, the major social problem mentioned in interviews, i.e., water pollution, could place at risk the expansion of exports in the zone and therefore economic and social development.

This situation is reflected in sewage disposal indicators, in which on average the Basin disposes 32.4% of its sewage in cesspools or ditches, or simply lacks any system at all. It is worth noting that, with the implementation of the PMRH, this precarious sanitation situation should be reversed. This would not only improve the social conditions of inhabitants but also would not endanger the productive economic development of the Mataquito Basin.

The highest social indicators are in the provincial capital, while the lowest are in Teno and Molina. Molina has the lowest salaries and the highest unemployment and percentage of indigence and non-indigent poor, while Tena has the worst sanitation indicators and the highest number of unstable settlements.

BASELINE OF SOCIAL INDICATORS - MATAQUITO BASIN

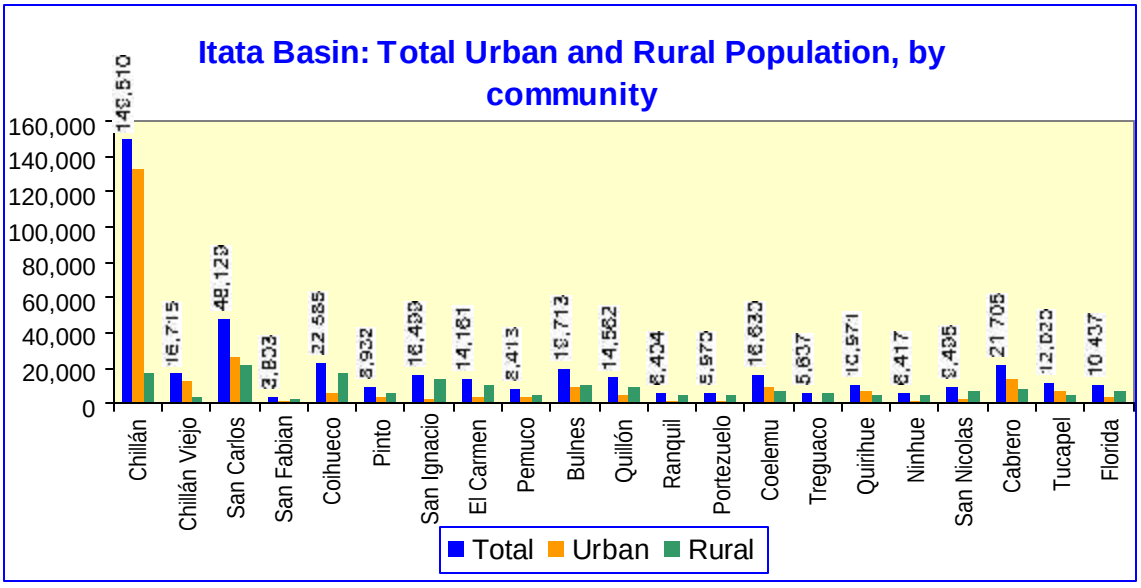
SOCIAL INDICATORS	BASELINE
Total Population Mataquito Basin (inhabitants)	**232.942**
Urban Population Mataquito Basin (%)	**55.5**
Rural Population Mataquito Basin (%)	**44.5**

Population Density Mataquito Basin (people per km2)	**27.9**
Unemployment Mataquito Basin (%)	**7**
Average Income of Wage Earners Mataquito Basin ($)	**178,661**
Per Capita Income Mataquito Basin ($)	**84,178**
Indigence Mataquito Basin (%)	**4.3**
Non-indigent Poor Mataquito Basin (%)	**19.4**
Number of Unstable settlements Mataquito Basin	**28**
Number of Families living in Unstable Settlements Mataquito Basin	**2,032**
Indicator of Deficient Sanitation Mataquito Basin (%)	**13.7**
Water Extraction for household use, from river, spring or brook in Mataquito Basin (%)	**2.4**
Sewage elimination by cesspool, ditch, o lack of any system in Mataquito Basin (%)	**32.4**
Average Level of Education Mataquito Basin (years)	**7.9**
Rate of Education in Mataquito Basin (%)	**9.7**

3. Itata River Watershed

This watershed has the same characteristics of the Mataquito watershed, i.e., most small- and medium-scale farmers subsist on beet and wheat crops which are subsidized by the price band system. This system should be abolished to respond to international trade agreements. This would modify the expressed social indicators and merits a serious, comprehensive reconversion plan by the Government.

POPULATION

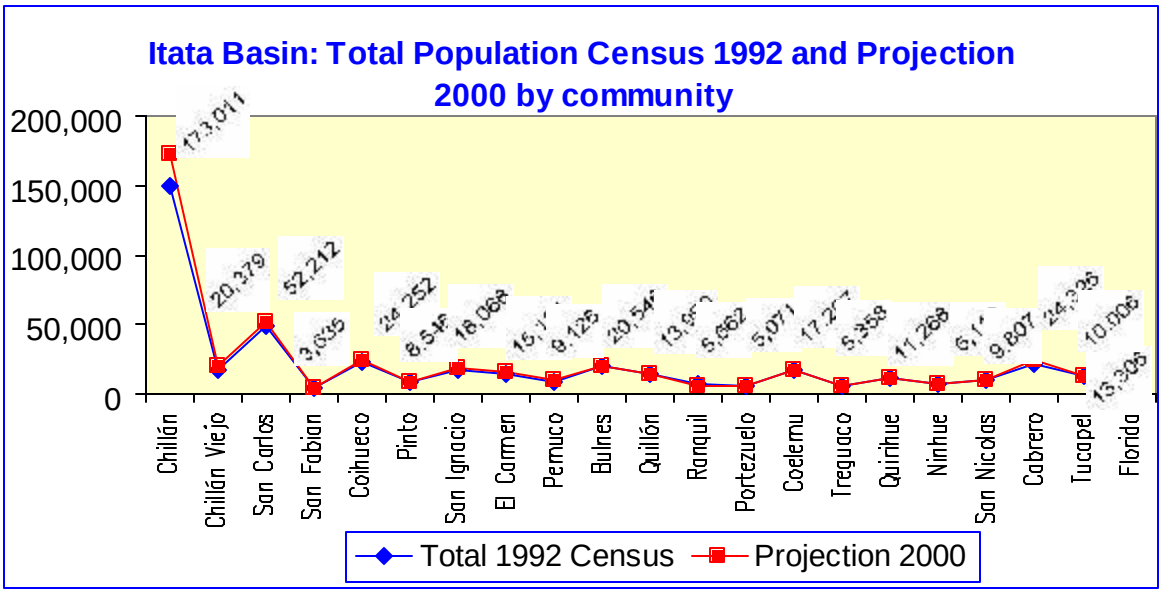


Source: 1992 Census

The total population of the Itata Basin is 428,709, of whom 252,136 belong to the urban area (58.8%) and 176,573 to the rural area (41.2%). The community of Chillán has the largest population (149,510) and is principally urban. The rest of the urban population is located in the communities of San Carlos (26,048), Cabrero (13,998), Chillán Viejo (13,019) and Coelemu (9,453), while the largest strictly rural population is

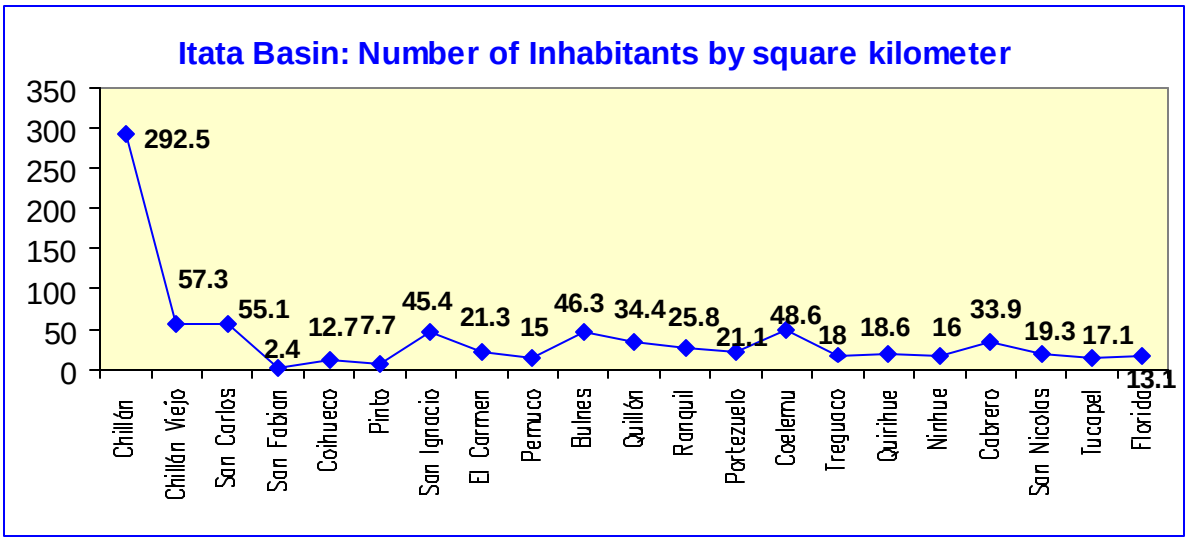
located in Coihueco (17,148), San Ignacio (14,065), El Carmen (10,670) and Bulnes (10,350). The only community with an exclusively rural population is Treguaco (5,637).

The high percentage of the zone's rural population, which mainly depends on agriculture is worth noting. Although the zone has forestry companies, the amount of labor they need is smaller than that required for agriculture.



Source: INE 1998

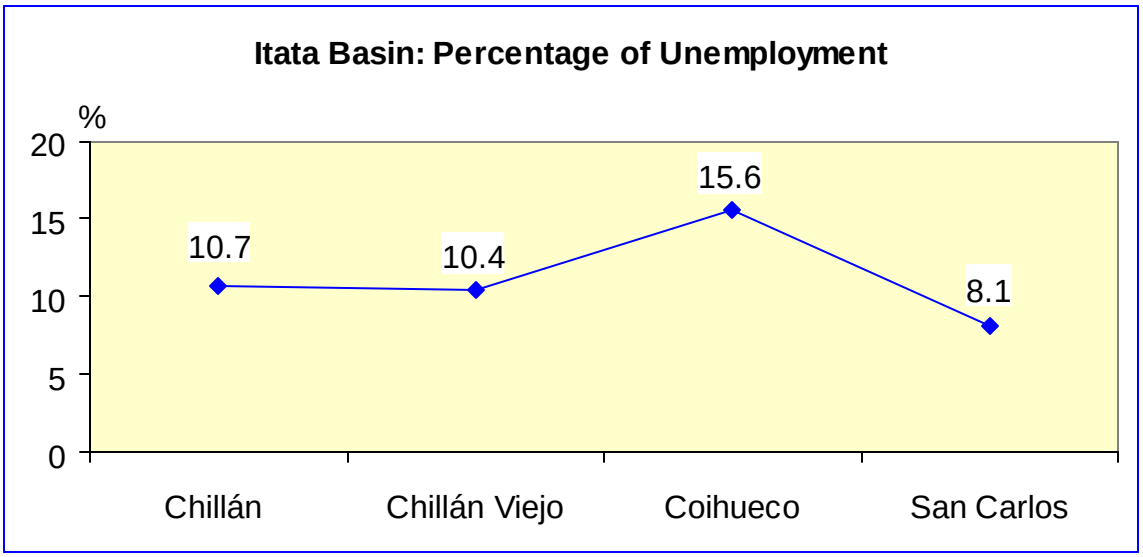
The population projection for the year 2000 in the communities that comprise the Itata Basin anticipates an increase of 38,316 people (1992 Census: 428,709 – 2000 Projection: 467,025). The largest increase is in the community of Chillán (1992: 149,510 - 2000: 173,011). However, there are 8 communities in which no population growth is estimated, but rather a decrease: Ranquil (1992: 6,404 - 2000: 5,662), San Fabián (1992: 3,803 – 2000: 3,635), Pinto (1992: 8,932 - 2000: 8,546), Quillón (1992: 14,562 - 2000: 13,990), Florida (1992: 10,437 - 2000: 10,006), Portezuelos (1992: 5,970 - 2000: 5,071), Treguaco (1992: 5,637 - 2000: 5,358) and Ninhue (1992: 6,417 - 2000: 6,118). Most of the population living in these communities is located in rural areas.



Source: INE 1998-1992 Census

The population density of the communities that comprise the Itata Basin is 31.9, the highest density of the study' s three Basins. Urban communities have a significantly important population density in relation to that of rural communities.

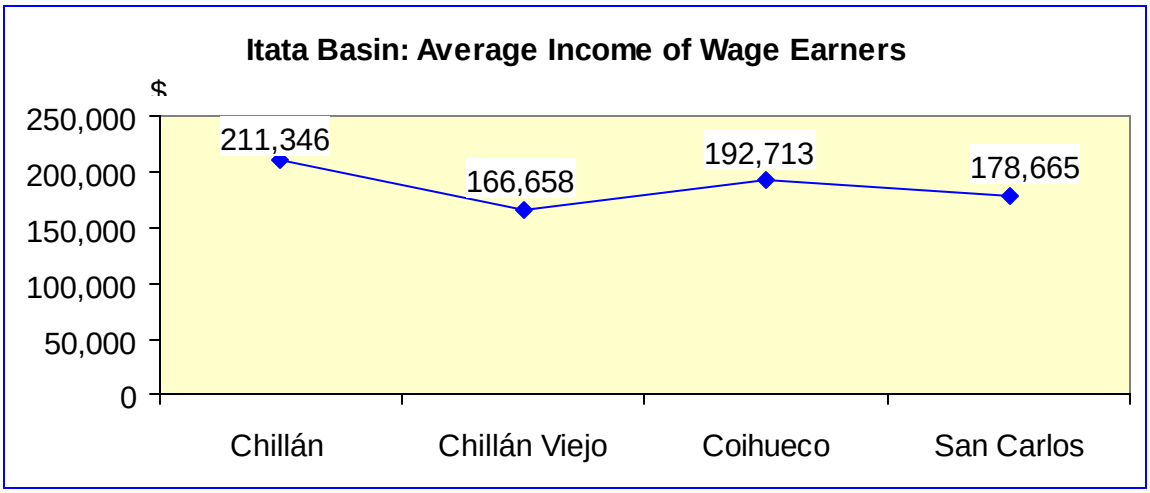
LABOR



Source: CASEN[1] 1998

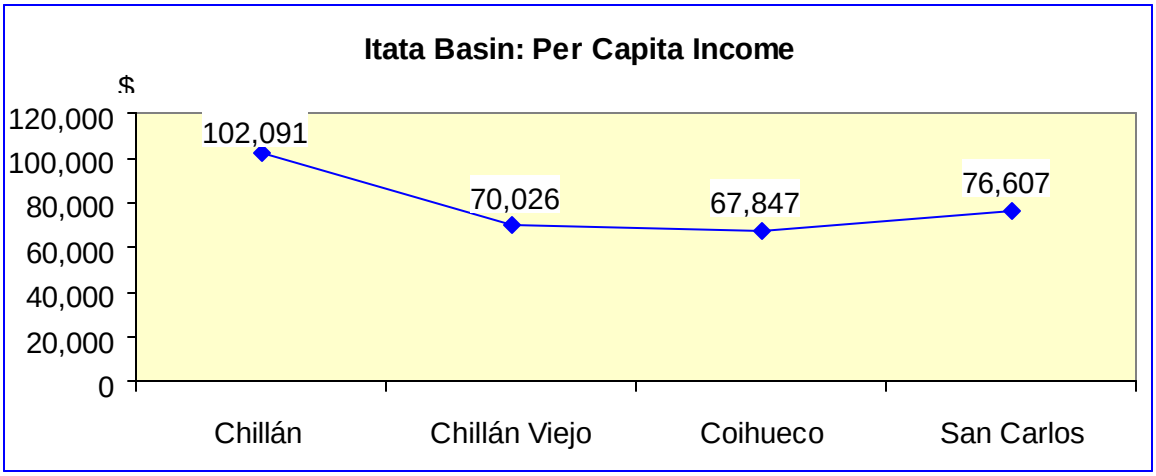
10 It should be noted that the sample design of the 1998 CASEN survey does not allow estimates to be made for all of the country's communities. For this version, only 196 communities are represented. Thus, of all communities that comprise the Itata River Basin, data is only available for Chillán, Chillán Viejo, San Carlos and Coihueco. The communities of Quirihue, Ninhue, Treguaco, Portezuelo, Coelemu, Ranquil, Quillón, San Nicolas, Bulnes, San Ignacio, Pemuco, San Fabian de Alico, Pinto, El Carmen, Tucapel, Cabrero and Florida are not included.

The percentage of unemployment in the VIII region is 13.5%, higher than the average unemployment in the communities (11.2%) that comprise the Basin, as represented in the 1998 CASEN survey and the national rate (9.9%). The community of Coihueco has the highest percentage of unemployment (15.6%), while the community of San Carlos has the lowest (8.1%).



Source: CASEN 1998

The average income of wage earners in the Bio-Bio Region is $234,785, significantly higher than the average income of wage earners in the communities present in the Basin ($187,345). This situation may be explained by

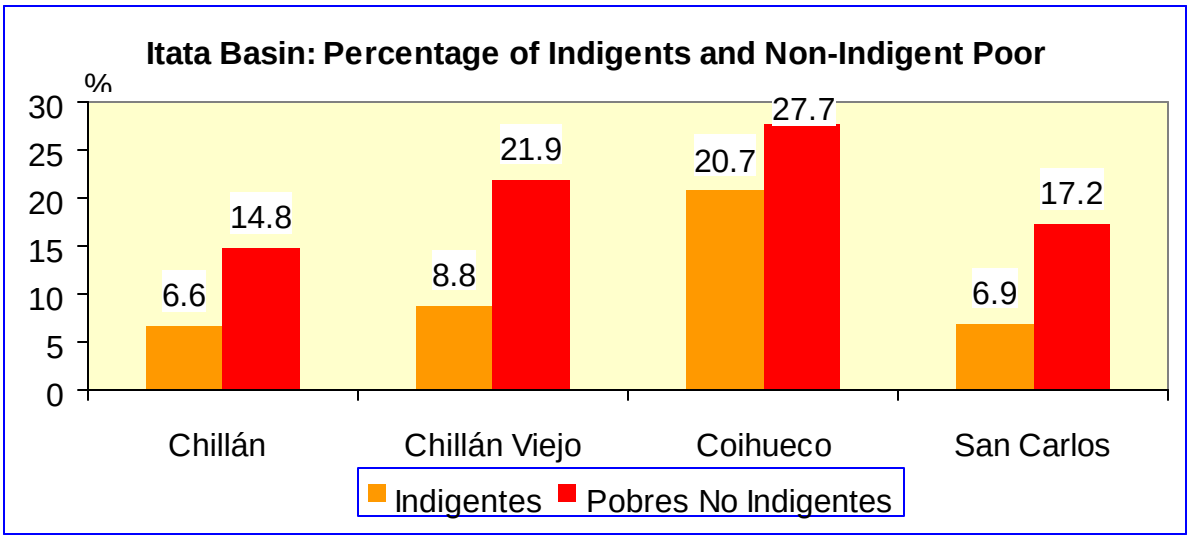


the fact that higher salaries are found in the community of Concepción which is not present in the Basin.

Source: CASEN 1998

Regional per capita income is $93.875, higher than the average per capita income of the communities that comprise the Basin ($79,142). However, the community of Chillán has a higher value that those of the two indicators described, while the community of Coihueco again has the lowest figures ($67,847).

POVERTY



Source: CASEN 1998

The percentage of indigents in the VIII Region corresponds to 10%, coinciding with the percentage seen in communities of the Itata Basin, although the national percentage is lower (5.6%). However, the community of Coihueco shows a high 20.7%.

With regard to percentage of non-indigent poor, the region is placed at around 22.3%, while the percentage of communities that comprise the Basin is 20.4%. It should be noted that the national percentage of non-indigent poor is lower, around 16.1%. Once again, the community of Coihueco has a higher percentage than regional ones (27.7%).

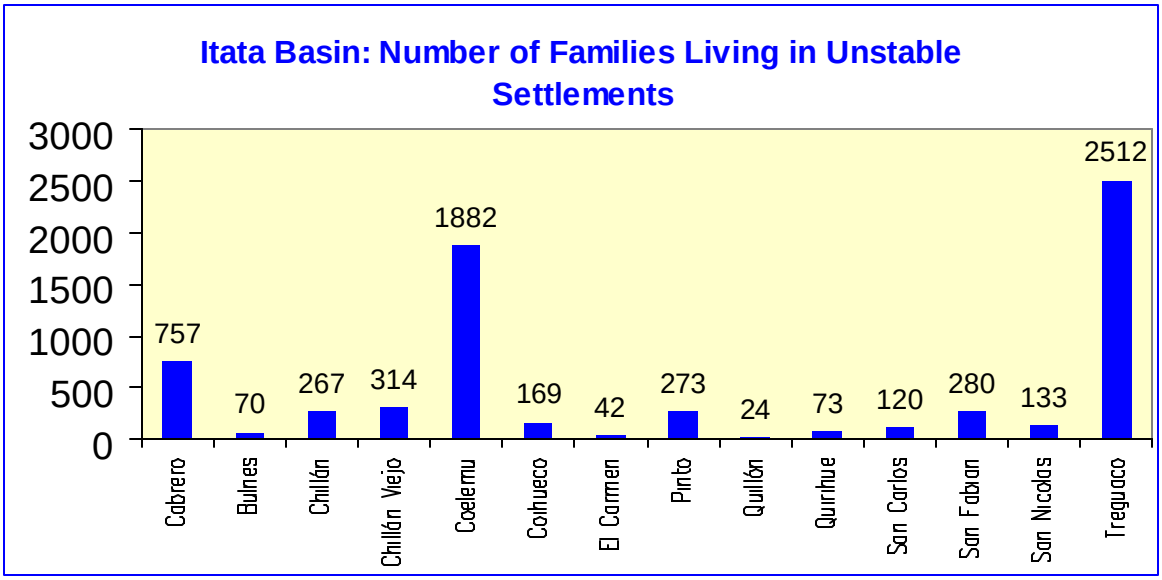
Number of Unstable Settlements by Community

Communities [1]	Number of Unstable Settlements or Camps
Qurihue	2
Treguaco	16
Coelemu	11
Quillón	1
San Carlos	2
San Nicolas	2
Chillán	6
Chillán Viejo	5
Bulnes	1
San Fabian de Alico	4
Coihueco	2
Pinto	4
Cabrero	7
TOTAL	63

Source: Cadaster - Chile Barrio 2000 Program.

[1] This table only includes communities with camps or unstable settlements within the Itata Basin.

The total number of unstable settlements in the communities that comprise the Itata Basin is 63. It is worth noting that the VIII region is one of those with more camps at national level. Most of them are found in the communities of Treguaco (16) and Coelemu (11).



Source: Cadaster - Chile Barrio 2000 Program.

The total number of families living in unstable settlements in the communities that comprise the Itata Basin is 6,916. More than half of them are in the communities de Treguaco (2.512) and Coelemu (1.882). With regard to the communities that presented data in the CASEN 98 survey, a larger number of families living in camps was observed in the communities de Chillán Viejo (314) and Coihueco (169), both with higher indices of poverty and indigence.

Camps in the Communities that Comprise the Itata Basin

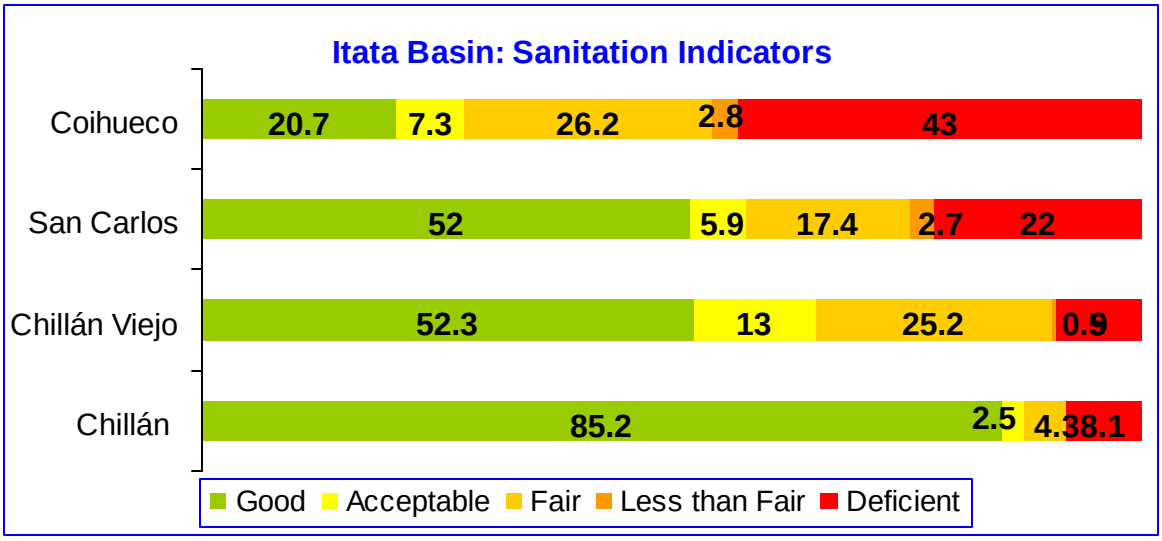
COMMUNITY	LOCALITY	SETTLMENT NAME	NUMBER OF FAMILIES	LOCATION ON BANK OF RIVER, CANALA OR RAVINE
Cabrero	Cabrero	Heroes de Chile	89	No
Cabrero	Cabrero	Osvaldo Muñoz	66	No
Cabrero	Charrua	Charrua Sur	45	No
Cabrero	Charrua	Charrua Norte	82	No
Cabrero	Monteaguila	11 de septiembre	113	No
Cabrero	Monteaguila	Chile Nuevo	315	No
Cabrero	Monteaguila	Pob. V. La Merced	47	No
Bulnes	Bulnes Sur	Bulnes Sur	70	No
Chillán	Cam. A las Mariposas	Sector Los Montes	23	No
Chillán	Cam. A Pinto	Verde Esperanza	36	No
Chillán	Chillán	Caserío Boyen	30	No
Chillán	Pob. Río Viejo	El Saque	80	No
Chillán	Puente Barrio Chino	Callejón Maipón	33	No

Chillán	Puente Lazareto	Las Habas	65	Canal Las Toscas
Chillán Viejo	Chillán Viejo	Ex. Barraca Canahuate	36	No
Chillán Viejo	Chillán Viejo	Sta. Inés	80	No
Chillán Viejo	Chillán Viejo	Villa Crisol	30	Río Viejo
Chillán Viejo	Chillán Viejo	Villa Primavera	98	Río Viejo
Chillán Viejo	Chillán Viejo	Villa Sta Rita	70	No
Coelemu	Coelemu	Alto Perales	90	Estero Perales
Coelemu	Coelemu	Meipo	70	Río Itata
Coelemu	Coelemu	Pob. Alejandro P.	83	No
Coelemu	Guarilihue Bajo	Guarilihue Bajo	200	Estero Guarilihue
Coelemu	Guarilihue Bajo	Guarilihue Centro	500	No
Coelemu	Magdalena Bajo	Magdalena	35	Río Itata
Coelemu	Perales	Perales	500	Estero Perales
Coelemu	Ranguelmo	Cerro Estanque	52	No
Coelemu	Ranguelmo	La Higuera	32	No
Coelemu	Ranguelmo	Villa Sta. Laura	120	No
Coelemu	Vegas de Itata	Vegas de Itata	200	Río Itata
Coihueco	Bustamante	La Viñita	149	**No**
Coihueco	Minas del Prado	Pob. Perales	20	**No**
El Carmen	El Carmen	Sta. Elvira	42	**No**
Pinto	Las Vertientes	Las Vertientes	70	**No**
Pinto	Pinto	Las Vegas	24	**No**
Pinto	Pinto	Primero de Mayo	39	**No**
Pinto	Pinto	Villa Primavera	140	**No**
Quillón	Quillón	José Campos 2	24	**No**
Quirihue	Quirihue	Las Barracas	20	**No**
Quirihue	Quirihue	Pob. Coiquen	53	**No**
San Carlos	Cocharcas	Cam. Viejo Sn Carlos	60	**No**
San Carlos	Cocharcas	Pob. Nva. Esperanza	60	**No**
San Fabian	El Macal	El Macal	70	**No**
San Fabian	Los Guardias	Los Guardias	30	Río Ñuble
San Fabian	Los Puquios	Los Puquios	40	**No**
San Fabian	Paso Ancho	Paso Ancho	140	**No**
San Nicolas	Cam. A Monteleón	Los Alamos	45	**No**
San Nicolas	Puente Ñuble	Puente Ñuble	88	Río Ñuble
Treguaco	Antiquereo	Antiquereo	70	No
Treguaco	Boca Itata	Boca Itata	28	Río Itata
Treguaco	Boca Itata	Puahún	80	Río Itata
Treguaco	Caña Dulce	Caña Dulce	100	No
Treguaco	Denecan	Denecan	120	Río Itata
Treguaco	El Conquistador	Pob. El Conquistador	24	No

Treguaco	Hernán Brañas	Pob. Hernán Brañas	120	Río Itata
Treguaco	El Manzano	El Manzano	45	**No**
Treguaco	La Ballica	La Ballica	210	**No**
Treguaco	Las Nieves	Las Nieves	20	Orilla Canal
Treguaco	Minas de Leuque	Minas de Leuque	500	**No**
Treguaco	Pachagua	Pachagua	20	**No**
Treguaco	Tauco	Tauco	20	**No**
Treguaco	Torreón Bajo	Torreón Bajo	150	**No**
Treguaco	Treguaco	El Aromo	45	**No**
Treguaco	Treguaco	J.V. El Progreso	960	No
TOTAL			**6916**	**16**

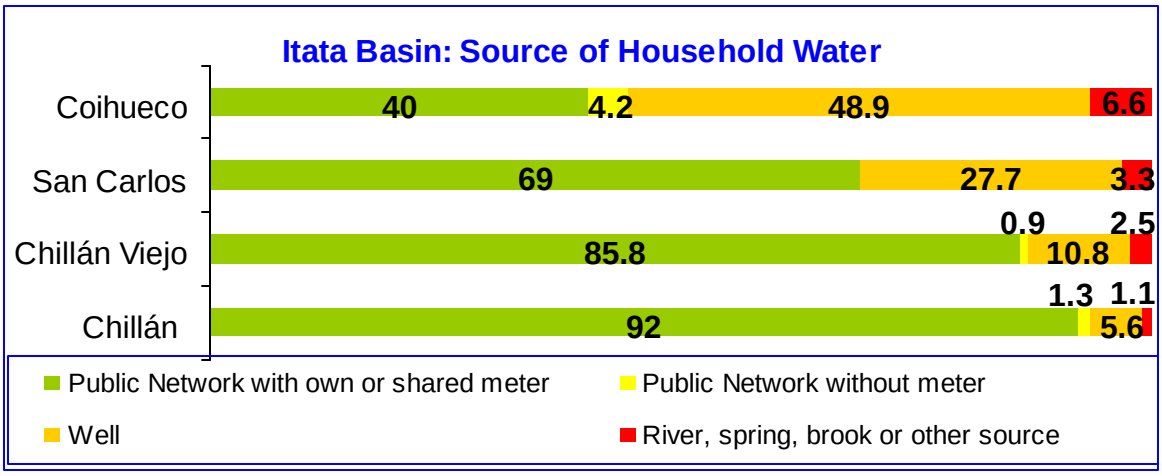
Source: Cadaster - Chile Barrio 2000 Program and information provided by the CHB Regional Technical Director.

Of the 63 camps recorded by the Chile Barrio Program, 16 are located on the banks of a river, ravine or canal in the Itata Basin.



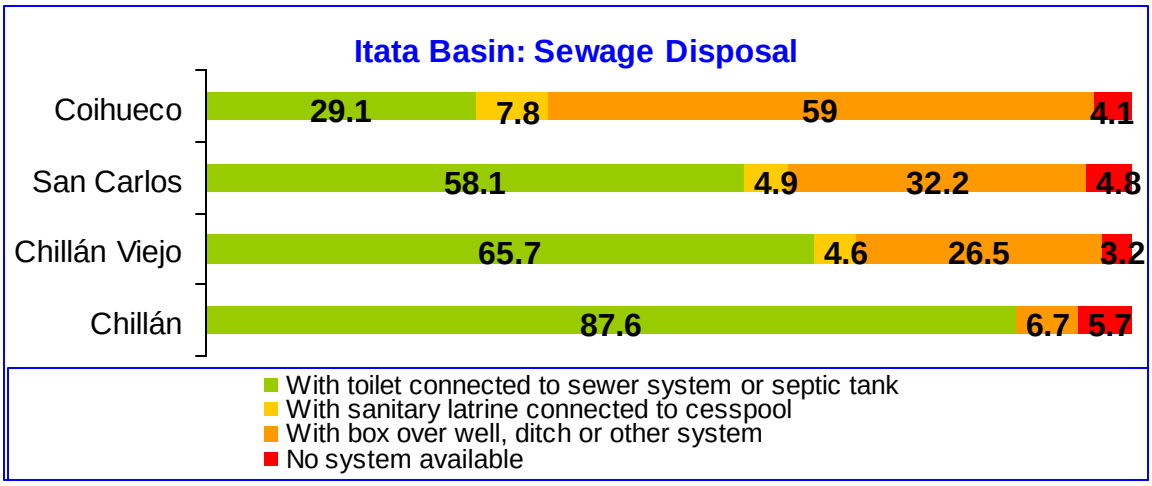
Source: CASEN 1998

The sanitation indicator is distributed in varied ways in the different communities comprising the Itata Basin that are represented in CASEN 98. Thus, one may observe that Chillán has the highest percentages in the "good" category (85.2%). However, in this same community 8.1% are in the "deficient" category, which is significant for a mainly urban community. For its part, the community of Coihueco again presents the lowest indicators, the largest number of homes in the "deficient" category (43%) and only 20.7% in the "good" category.



Source: CASEN 1998

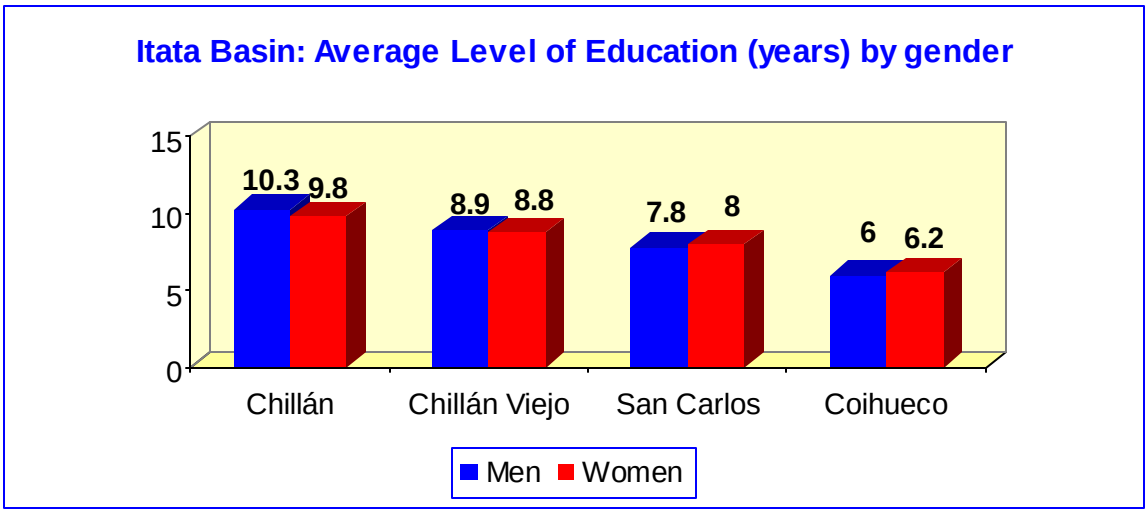
The source of water for homes in the communities that comprise the Itata Basin is diverse. The community of Chillán has a larger percentage of the category of "public network with meter" (92%), while Coihueco scores highest in the category of "well" (48.9%). The category of "river, spring, brook or other source" is not very significant in any of the communities, and its highest percentage is in the community of Coihueco (6.6%).



Source: CASEN 1998

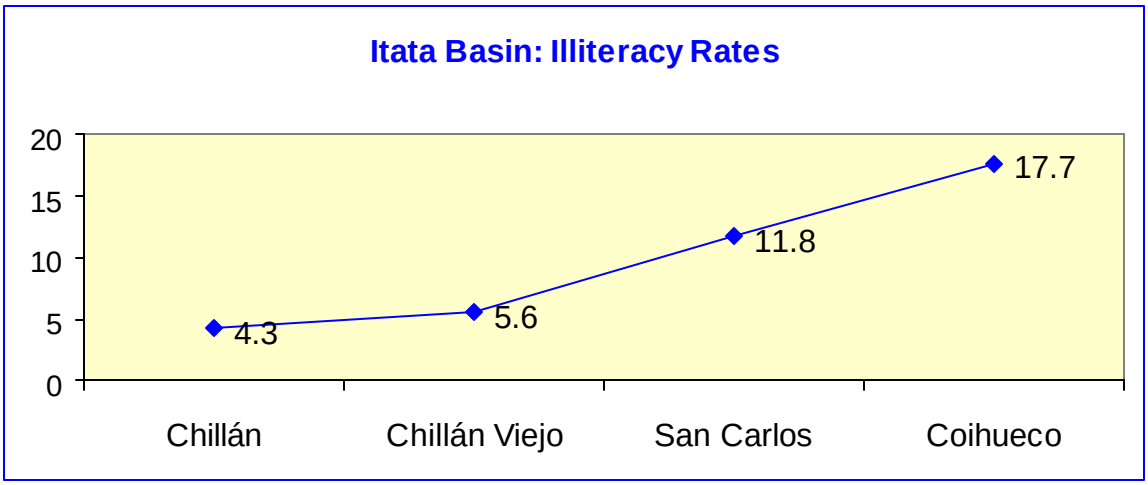
The elimination of sewage in the various communities that comprise the Itata Basin is varied. While in Chillán most of the population has toilets connected to a sewer system or septic tank (87.6%), in the community of Coihueco most sewage disposal is by means of a box over a cesspool, ditch or other system (59%). It is noteworthy that in the mainly urban community Chillán, 5.7% lack any sewage disposal system.

EDUCATION



Source: CASEN 1998

The average years of education among men and women in the communities of the Itata Basin is 8.2, lower than the average of the VIII region (9.2 years) and the national average (9.7 years). In communities with a larger urban population, years of education increase, but they decrease in communities with a larger rural population. The low percentage of schooling in the community of Coihueco is worth noting.



Source: CASEN 1998

The average illiteracy rate in the communities that comprise the Itata Basin is 9.8%, significantly higher than the regional illiteracy rate (6.7%) and the national rate (4.6%). This value is strongly influenced by the high percentage in community of Coihueco (17.7%), which coincides with figures previously expressed.

In summary, one may observe that the urban community of Chillán has the highest social indicators, while the lowest are in the rural community of Coihueco where indicators of sanitation, education and illiteracy are also noteworthy.

The Itata Basin also has a high number of precarious camps, accompanied by a significant poverty indicator.

BASELINE OF SOCIAL INDICATORS - ITATA BASIN

SOCIAL INDICATORS	BASELINE
Total Population Itata Basin (inhabitants)	**428,709**
Urban Population Itata Basin (%)	**58.8**
Rural Population Itata Basin (%)	**41.2**
Population Density Itata Basin (people per km2)	**31.9**
Unemployment Itata Basin (%)	**11.2**
Average Income of Wage Earners Itata Basin ($)	**187,345**
Per Capita Income Itata Basin ($)	**79,142**
Indigence Itata Basin (%)	**10**
Non-indigent Poor Itata Basin (%)	**20.4**
Number of Unstable Settlements Itata Basin	**63**
Number of Families living in Unstable Settlements Itata Basin	**6,916**
Indicator of Deficient Sanitation Itata Basin (%)	**20.5**
Water Extraction for household use, from river, spring or brook in Itata Basin (%)	**3.4**
Sewage elimination by cesspool, ditch, or lack of any system in Itata Basin (%)	**35.5**
Average level of education Itata Basin (years)	**8.2**
Rate of Education in Itata Basin (%)	**9.8**

Annex 5
Chile: Water Resources and Biodiversity Management Project
Summary Findings of Ecosystem Profiles

In-depth ecological profiles were prepared with funds from the Block B and are available in the project' s files. These voluminous documents (in spanish) have not been included in this appraisal document given their size and format complexity (most are GIS-based), but are briefly summarized here. A full summary, however, has not been possible, given their interactive nature for decision making based on a GIS methodology.

Ecological profiles included information on the state of the Chilean flora and fauna, defined ecological processes for each of the project' s watersheds, identify and ranked threats according to importance, and identified priority actions which served as the basis for prioritizing the biodiversity investments listed in Annex 2 (component 3).

Methodology

The following methodology was used to prepare the ecosystem profiles:

(i) Literature review. The foremost Chilean experts in various aspects related to biodiversity in these watersheds (soils, water, ecosystems, flora, and fauna) were contracted directly or through their respective academic institutions. Experts that participated in this exercise were led by Dr. Hernan Torres, Principal Ecologist. Team leaders included:

A. Aquatic Systems:

- Carlos Ramirez (flora)
- Luis Zuniga (flora)
- Jose Arenas (insects)
- Carlos Jara (crustaceans)
- Irma Vila (fish)
- Alberto Veloso (amphibians)
- Manuel Contreras (Physical and Chemistry Characteristics of Watersheds)
- Gonzalo Olivares (Geographic Analysis)
- Rodrigo Pardo (Geographic Analysis)

B. Terrestrial Systems:

- Elizabeth Barrera (flora)
- Melica Munoz (flora)
- Gloria Rojas (flora)
- Herman Nunez (reptiles)
- Juan Carlos Torres (birds)
- Jose Yanez (mammals)
- Andres Moreira (Geographic Analysis)

(ii) GIS. All information was summarized, digitized, and entered into a GIS system which presently resides within the Directorate of Water at the Ministry of Public works. The following information layers are included:

- Base maps (topography, towns, political divisions, rivers, 1:100,000)

- Soils (1:200,000)
- Potential vegetation (1:200,000)
- Land use (based on landsat and aereal photography, various scales)
- Water quality
- Meteorological information, including temperature and precipitation
- Presence/absence of species of conservation concern
- Ecological formations and forest types (actual)
- Priority areas for conservation based on Chile's protected area system priorities
- Existing protected areas
- Environmental stressors (mines and other contamination sources).

(iii) Expert consultation. A summary of theinformation gathered was prepared for each watershed, including all data layers, and additional information in the literature that was not possible to incorporate in the GIS. These summaries were discussed at technical workshops with additional experts both in Santiago as well as with local experts via a detailed questionnaire.

Watershed	Expert	Institution
Lluta – San José	Presidente Comunidad de Aguas Canal Azapa	Comunidad Aguas Canal Azapa
	Directiva Junta Vigilancia Río Lluta	Junta Vigilancia Río Lluta
	Oficina Asuntos Indígenas	CONADI I Región (Arica)
	Jefe Provincial de Vialidad Arica	Dirección de Vialidad de Arica
	Luis Rojas	Dirección General de Aguas I Región
	Rector Universidad de Tarapacá	Universidad de Tarapacá
Huasco	Sergio Catalán García	Dirección de Obras Hidraúlicas III Región
	Daniel Alvarez Pardo	CONAMA III Región
Elqui – Limarí	Waldo Canto Vera	CONAF IV Región
	Carlos Galleguillos Castillo	Dirección General de Aguas IV Región
	Mirtha Meléndez Rojas	Dirección Obras Hidráulicas IV Región
Petorca – La Ligua	Mario Gálvez Fernández	CONAF V Región
Mataquito	Pedro Bravo Carrasco	Dirección General de Aguas VII Región
	Alberto Barrera Muñoz	SAG VII Región
Itata	Ramón Daza Hurtado	Dirección General de Aguas VIII Región
	Juan Riffo Ormeño	CONAF VIII Región
Imperial – Lago Budi	Alejandro Blamey Alegría	CONAF IX Región
	Janette Matte Casanova	CONAMA IX Región

(iv) Synthesis. Based on the expert feedback received, a 240 page summary of the main findings was prepared (available in the project's files). This document includes the following sections:

- Methodology
- Ecological characteristics of each watersheds
- Threats
- Priority actions
- Proposed projects and project profiles
- Four CDs with the entire GIS data set

(v) Priorization. The final step in the process was the ellaboration of specific proposals for action, which form the basis of component 3 of the project. For each watershed, these investments are grouped along 3 main axes of action:

- Habitat restoration (primarily in the riverbed)
- Protected areas

- Flagship species as drivers for habitat conservation.

Quality of Data and Threats

Several workshops, organized by CONAF, have concluded that of a total of 684 analyzed vertebrate species, 35% showed conservation problems, that is, they are classified in some of the following categories: Extinct (only two species), Endangered, Vulnerable, Rare, Indeterminate or Insufficiently known. The information on the conservation status and the number of species with conservation problems is not referred for the watersheds, but instead has only been registered for each administrative region. It was possible to distinguish, however, some important sites: the watersheds of the rivers Lluta and San José are considered in Priority III; the sites Punta Teatinos (Priority I) and Southern Coquimbo Area (Priority III), in the River Elqui watershed; and the site Los Molles (Priority II), in the Petorca watershed.

Lake Budi, in particular, is considered as place in Priority 2 due to diverse important factors: it contains species that support high saline concentrations; it contains such endemisms as the fish (*Micropogonias furnieri*); it is a refuge of acquatic birds of the region, and it contains several endangered, vulnerable and rare species.

The ecological profiles also indicate that the impacts derived from the factors that threaten biological diversity are not evaluated for each watershed. However, the effects at the country level reflect the significant consequences they have had or could have on biological diversity. For example, the habitat alteration is the main, secondary or probable cause of the problems of conservation of 18 mammal species taken of a group of 28 in the country, that is to say of 64% (University of Chile, 1999).

The deforestation causes the loss of habitat of numerous lichen species. It is important to note that 25 of the 30 lichen species considered vulnerable in the country are affected by loss or alteration of their habitat.

The extraction of water from rivers and lakes, as well as the pollution of the same bodies of water, has significant effects in the populations of fresh water species, with important modifications in the availability and quality of the habitats.

The exploitation of native fauna and flora species could constitute a factor of high impact on their populations, although there are no precise data at the present time. Between 1985 and 1993, 86 million individuals of spineless and native terrestrial vertebrates were exported, of which the reptiles are the most exploited group. The export of flora species is also an important factor. In 1997, for example, 116.000 units of "water sticks" were exported to the United States, manufactured with shafts of the cacti of the genera *Echinopsis* and *Eulychnia*.

The introduction of species constitutes a factor of which there is convincing evidence on its negative effects on the native fauna or flora in some cases. It is necessary to point out that 4% of the Chilean vertebrates and 11% of the vascular flora of continental Chile correspond to species introduced to the country.

Regarding threats to biodiversity, it is deduced from the achieved results that there is a high degree of recognition and, therefore, validation of the threats in the watersheds. Indeed, of the total 54 threats previously identified in the literature 54% were validated as present or latent in the Lluta-San José basin; 67% in Huasco; 50% in Elqui; 50% in Limarí; 70% in Petorca-La Ligua; 81% in Mataquito; 89% in Itata; 83% in Imperial; and 70% in the Lake Budi.

In general, identifications of other threats different to the previous list were not presented, except for some specific ones for the watersheds Petorca-La Ligua and Lake Budi, but they were implicit in other threats of the previous list.

The ecological profiles conclude that the watersheds with most variety of threats are Mataquito, Itata and Imperial. Among them, the watershed with more number of threats is Itata. The rest of the basins are in an inferior range, although always with a considerable number of threats present.

The above-mentioned is related with the previously established descriptions, in which the same watersheds that were identified with most variety of threats appear with high values risen in some factors, among which pollution is one of the most outstanding.

Generally, the common threats are the following:

- Soil erosion
- Destruction of riverbeds for extraction of materials for construction
- Pollution of rivers by sewage waters of human conglomerates
- Pollution of waters by emissions (pesticides, mining, other residuals)
- Seasonal droughts

The ecological profiles revealed that the information of the biota of the basins is still incomplete, broken into fragments and not up-to-date. Therefore, it is completely insufficient for the diagnosis of areas of ecological sensitivity that would allow to appropriately plan the recovery and conservation of the biota in all water basins of Chile. This is due partly to the fact that it is only recently legally requested that the environmental impact of certain works is evaluated, so the databases are recent and, on the other hand, such an aspect was not considered previously, so populations or complete communities of plants and animals were eradicated. The urban growth is a good example of eradication of communities of plants and animals for installation of humans. In addition to this, there was an insufficiently environmentally planned expansion of forestry and agricultural activities that also have negative effects. Nonetheless, the results were subjected to expert analysis in order to identify the short and mid-term priorities to be financed under the project.

One of the initial problems in the preparation of the ecological profiles was that the databases with the flora and fauna contents are remitted to bibliographical references that rather ratify the investigator's experience instead of giving an objective view of information that can be of crucial importance for an analysis from environmental planning perspective. In many cases, the modifications of the use of the soil have caused existing data and literature to be obsolete, which results in an overestimation of the current distribution of plant and animal species.

The ecological profiles point out that there are only partial studies in the rivers and that the areas on which there is information are located in the outlet areas until the 500 masl. Also, the analysis of the literature related with the *ichthyic fauna* of Chile clearly points out the mentioned preferential areas of research. For the previously exposed reasons it is evident that it is required to update both the distribution and the abundance of the populations that compose these species to achieve the sustainable management of the fluvial natural resources of the basins.

Continuing with the aquatic species, they are affected by their low natural number in the fluvial systems of the country and the lack of knowledge about the characterization and the time-space variations of the habitat that they use (climate, hydrology and quality of the water, among other variables), factors that have not been integrated so far. However, the Chilean aquatic flora and fauna present characteristics of high endemism and are in their majority with conservation problems (90% of fish, 95% of crustaceans and 70% of amphibians). The quality of the information about the biota is so fragmented and qualitative that it is of high-priority to study it at a populational-community level to maintain the necessary functions for the conservation of these ecosystems.

A similar situation is presented for the terrestrial flora and fauna. Many aspects of the biology of the involved organisms remain unknown and for several species, such as the endemic cactus “candelabro”

(*Brauningia candelaris*), in clear population decline, the basic biology is ignored. At least two hypothesis have been advanced to explain this decline: human action, (e.g., extraction for ornament, pollution, etc.) or effects of global changes (atmospheric heating with light but significant decrease of the relative humidity of the soil).

In accordance with the information gathered in the ecological profiles, it is possible to state that the aquatic biota would have been specially affected in the basins pointed out by the availability and permanency of water. During the long periods of drought a high number of first order affluents totally drain their flows.

Other elements that affect the aquatic biota, as concluded from the threats analysis, are the changes in the water quality due to industrial, mining, agricultural and urban discharges. Only in the last years the country has implemented the appropriate legislation to preserve the quality of the water together with the industrialization process and the population's increment.

However, due to the nonexistence of predictive models which incorporate the characteristics of native species, the above-mentioned represents work hypothesis that require both new information and the generation of numeric models. For this, it will be necessary to uniform the quality of the information.

The development actions of big or small engineering works that imply changes of soil use or modifications of rivers, particularly the latter when they imply retention of big masses of water (like reservoirs, canalizations, etc.), produce changes that result in the evident immediate colonization of aquatic birds or important increments of riverside vegetation. Other not so evident effects, and of a longer term, are a significant increase of the environmental relative humidity whose final action requires of more careful follow up. An increase of relative humidity generates subtle changes resented by the entire plant and animal community.

The irrigation works or others that mean deviations of water, imply the flood of areas. Once the water filters into the soil, it reinstates to the surface big quantities of salts with the rising change of pH of the surface and, consequently, changes of the microflora, setbacks of specialist communities and recolonizations of opportunist communities that invade plantations. With the substrata affected thus, the fauna will go back, taking refuge in neighboring areas or disappearing locally. These effects in their deeper manifestations should be monitored in order to appropriately plan the environmental reparation, if it proceeds, or to propitiate the development of the altered communities with mitigation ends.

The profiles recommend, for these ends, to establish a monitoring mechanism of the eventual evolution of changes that would happen in the event of substantial modifications of the landscape.

The critical processes in the rivers are characterized today by the inability of these ecosystems to recover their normal functions (resilience) due to the discharge it demands for the water in their different uses and to the processes of pollution and eutrofication of the bodies of water. The decrease of the flows implies the concentration of nutrients and pollutants, which at the same time consume the necessary oxygen for the aquatic life. Their study implies the generation of the baseline information on the status variables that control the processes of energy transfers and their later numeric modeling. The sustainable development today necessarily bears the consideration of these variables.

As an example, it is important to point out that the georeferenced information on the aquatic flora and fauna of the watersheds detailed in the ecological profiles is the first one in being elaborated systematically in the country. Although this is even incomplete and disparate, it constitutes an important advance for the knowledge and the understanding of the structure and operation of the aquatic communities that have colonized these ecosystems. Also, it will be of relevance to interrelate this knowledge with the climatic, hydrological and terrestrial aspects in an up-to-date concept of sustainable management. This implies not only having information spatially indexed but also generating numeric models that allow to analyze potential answers from the biota to diverse environmental conditions.

All these actions that will seemingly derive only in academic knowledge, will allow to sustain appropriate actions (i.e. regional planning administration, protection of the environment with all its components) of community development (irrigation works); increase and improvement of local or even regional economies (major works such as railings for the supply of big cultivation extensions or the supply of drinkable water, or hydroelectric centers, whatever their dimension may be).

In spite of this, without a mediating instance that accumulates such data in an orderly and classified way, with quick and efficient access, the information will remain dispersed, making its aggregation extremely difficult. In this circumstance, there is a risk of duplication of efforts and resources, both human and economic, resulting in, eventually, the impairment of a more beneficial use of them.

Threat and Impact Analysis

The following tables summarizes the threat and impact analysis conducted under the ecological profiles. For each watershed, each threat was translated into a geographically-referenced impact. The codes presented allowed the priorization of conservation investments (component 3) through an integration using the GIS.

		WATERSHED										
Threat Factor		Lluta	San José	Huasco	Elqui	Limarí	Petorca	La Ligua	Mataquito	Itata	Imperial	Lago Budi
Habitat Destruction	Soil Erosion	o	o	o	o	o	o	o	o	o	o	o
	Habitat loss	o	o	o	o	o	o	o	o	o	o	o
	River shore impact	o	o	o	o	o	o	o	o	o	o	o
	River training and flow disruption	o	o	o	o	o	o	o	o	o	o	
	Flooding			o	o	o			o	o	o	
	Desertification	o	o	o	o	o	o	o	o	o	o	
	Unsustainable soil use						o	o	o	o	o	o
	Vegetation loss						o	o	o	o	o	o
	Deforestation				o	o	o	o	o	o	o	o
	Over-exploitation of forest resources	o	o	o	o	o	o	o	o	o	o	
	Lateral erosion	o	o	o			o	o	o	o	o	o
	Urban growth				o	o	o	o	o	o	o	
	Forest fires						o	o	o	o	o	o
	Increase in solid extraction (river bed)			o					o	o	o	o
	Sedimentation			o					o	o	o	o
Contamination	Bacteriologic contamination	o	o	o	o	o	o	o	o	o	o	o
	Borium contamination	o	o									
	Salinization	o	o									
	Sewer contamination	o	o	o	o	o	o	o	o	o	o	o
	Mining	o	o		o	o	o	o		o	o	
	Salinization	o	o	o						o		
	Poor water quality due to improper pesticide usage	o	o	o			o	o	o	o	o	o
	Herbicides	o	o	o	o	o	o	o	o	o	o	o
	Other chemical products			o	o	o	o	o	o	o	o	o
	Salinization due to irrigaation	o	o	o						o		
	Eutrophication	o	o	o	o	o			o	o		o
	Biological contamination			o	o	o	o	o	o	o	o	o
Introduced	Disease	o	o									
Species	Exotic flora			o					o	o	o	o
	Exotic forest plantation						o	o	o	o	o	o
	Exotic fauna									o	o	o
	Salmonids	o	o	o							o	o

Global	Water deficit	o	o		o	o	o	o	o	o	o	o
Climate	Seasonal drought	o	o	o	o	o	o	o	o	o	o	o
Change	Unusually high regional precipitation	o	o	o	o	o	o	o	o	o	o	o
Poor	Erosion due to overharvsting of forests			o	o	o	o	o	o	o	o	o
Watershed	Overexplotation of native flora			o	o	o	o	o	o	o	o	o
management	Overexploitation due to timber extraction				o	o	o	o	o	o	o	o
	Goat over grazing			o	o	o			o	o		
	Water stress	o	o	o			o	o		o	o	o
	Lack of infrsatructure for water management	o	o	o			o	o	o	o	o	o
	Lack of water treatment plants	o	o	o	o	o	o	o	o	o	o	o
	Improper usage of rain	o	o		o	o	o	o	o	o	o	
	Lack of reforestation programs	o	o	o			o	o		o	o	o
	Improper land-use planning						o	o	o	o	o	o
	Lack of drought prone areas			o			o	o	o	o		
	Human-induced fires			o			o	o	o	o	o	o
	Lack of proper usage of subterranean water	o	o	o	o	o	o	o	o	o	o	
	Irracional usage of native forests						o	o	o	o	o	o
	Reforestation with monocultures (*Pinus radiata*)								o	o	o	o
	Illegal hunting and fishing	o	o	o			o	o	o	o	o	o
	Illegal wildlife export								o		o	o
	Illegal flora export			o					o			
	Lack of proper land-use planning at watershed scales			o	o	o	o	o	o	o	o	o

Sources: " *Medio Ambiente, Problemas y Desafíos*" , Universidad de Playa Ancha, Valparaíso, 1992; "*Perfil Ambiental de Chile*" , CONAMA, 1994; " *Percepción de los Problemas Ambientales en las Regiones de Chil*e" , Universidad Católica y Conama, 1994; " *Estudio de Factibilidad Programa Manejo de Cuencas Hidrográficas"* , Ministerio de Agricultura y Ministerio de Obras Públicas, 1995; *"Informe País, Estado del Medio Ambiente en Chile*" , Universidad de Chile – CONAMA, 1999.. Encuestados.

Threat	**Impact**	**Code for prirotization of conservation action (refer to Attachement)**
Habitat Destruction and Degradation	Habitat loss for critical species	A-1
	Alteration of vegetational communities	A-2
	Alteration of fauna micro-habitat	A-3
	Increased vulenrability of flora and fauna	A-4
	Loss of habitats for colonial waterbirds	A-5
	Danger of extinction for faunal species	A-6
	Danger of extinction of floral species	A-7
	Abnormal increase in disease-carrying insect populations	A-8
	Population decrease of flora and fauna	A-9
	Loss of vegetal biomass	A-10
	Increase vulnerability of ecosystems (loss of resilience)	A-11
Contamination	Vegetational community alteration	B-1
	Alteration of vegetational micro-habitats	B-2
	Increase vulnerability of flora and fauna	B-3
	Increased danger of extinction of local flora	B-4
	Increased danger of extinction of local fauna	B-5
	Decrease in population size	B-6
	Increase vulnerability of local ecosystems (loss of resilience)	B-7
Introduction of Exotic Species	Decrease in local fauna populations	C-1
	Loss of faunal genetic diversity	C-2
	Loss of floral genetic diversity	C-3
	Loss of native forest species	C-4
	Loss of water due to increase evapotranspiration	D-1
	Seasonal drought enhanced	D-2
	Loss of species due to amplified water cycles	D-3
Weak Watershed Management	Impacts on species of conservation concern (e.g., guanaco)	E-1
	Loss of natiev vegetational communities	E-2
	Habitat modification	E-3
	Loss of native fauna populations	E-4
	Loss of faunal genetic diversity	E-5

	Loss of floral genetic diversity	E-6
	Loss of native forests	E-7

Biological Significance of Selected Watersheds

No.	Freshwater Ecoregions	Region	Name of River Basin (Level of Threat: 1 to 3)	Biological Significance
1	Arid Puna, Atacama Desert and Deserts of Pacific Coast	I	Basin of Lluta River (1)	High endemism of freshwater insects and birds. In the upper part relict populations of plants such as *Azzorella compacta* and *Polylepis tarapacana*. The middle course of the river is the typical habitat of the freshwater shrimp *Cryphiops caementarius*. The wetland at the rivermouth is an important stopover site for migratory birds.
2	Arid Puna, Atacama Desert and Deserts of Pacific Coast	I	Basin of San Jose River ♦ (1)	A threatened population of endemic fish *Basilichthys semotilus* found at the head of the basin. Critical habitat for ungulates such as *Hippocamelus antisensis* and *Lama guanicoe*. At the middle course of the basin the only colony of the endemic hummingbird *Eulidia yarellii* is found
3	Chile' s Northern Mediterranean Region	III	Basin of Huasco River (3)	The upper portion of the basin is important habitat for plants like *Laretia acaulis* and freshwater fishes such as *Cauque brevianalis, Cheirodon pisciculus* and, *Trychomycterus areolatus*. The middle section of the basin is key habitat for the endangered fern *Adiamtum gertrudis*. The rivermouth is an important wetland ecosystem.
4	Chile' s Northern Mediterranean Region	IV	Basin of Elqui River (2)	High endemism in both plants and animals. Most of them menaced such as the fishes *Austromenidia laticlavia, Eleginops maclovianus* and *Mugil cephalus*. Also is an important habitat for the endemic amphibians *Bufo atacamensis* and *Caudiverbera caudiverbera* and the endangered fern *Isoetes hieronimy*.
5	Chile' s Northern Mediterranean Region	IV	Basin of Limari River (2)	Important habitat for the freshwater fish *Basilichthys microlepidotus*. Endangered ferns like *Equisetum giganteum* and *Marsilea mollis* are found. The middle course of the basin is the typical habitat for the chilean iguana *Callopistes palluma*. The rivermouth is an important wetland protected by the Fray Jorge National Park.
6	Chile' s Northern Mediterranean Region	V	Basin of Petorca River (3)	Important nesting sites for aquatic endangered birds like *Plegadis chihi* and *Nicticryphes semicollaris* are found. The middle portion of the basin is the habitat of the threatened bush species *Menodora linoidess, Porleria chilensis,* and *Calceolaria alicahuensis.* Aquatic invertebrates like *Aegla papudo* and *Chryphiops caementarius* are also found.
7	Chile' s Northern Mediterranean Region	V		The fish threatened species *Trycomiterus areolatus, Galaxias maculatus* and *Cauque brevianalis* The middle portion of the basin is the habitat of the threatened bush species *Carica chilensis, Citronella mucronata,* and *Pouteria splendens.* At the lower portion of the basin

No.	Freshwater Ecoregions	Region	Name of River Basin (Level of Threat: 1 to 3)	Biological Significance
				the threatened reptiles species *Lioalaemus kuhlmani* and *L. Zapallarensis* are also found.
8	Chile' s Southern Mediterranean Region	VII	Basin of Mataquito River (1)	This basin is the northern range of plants representative of temperate rainforest with several dominant species like the southern threatened oaks *Nothofagus glauca* and *Nothofagus alessandrii*. The largest colony of the endangered Burrowing Parrot *Cyanoliseus patagonus* is found in the upper part of the basin. An endemic lizard *Liolaemus hernani* is also found here.
9	Chile' s Southern Mediterranean Region	VIII	Basin of Itata River (2)	43 endemic plant species and 27 of animals are found in the upper part of the basin. In this area the remaining habitat of the Andean Deer *Hippocamelus bisulcus* is also found. The basin present a high rate of endemic fishes of Genera *Tricomycterus* and *Diplomistes*.
10	Valdivia	IX	Basin of Imperial River (2) ♦	This basin is the northern distribution of the Southern Birch *Nothofagus pumilio*. The largest colony of the endangered Black Woodpecker *Campephilus magellanicus* is found in this forests located at the upper part of the basin. Also, is the habitat of several endemic ferns: *Blechnum aspera, Hymenoglossum cruentum* and *Lycopodium gayanum*
11	Valdivia	IX	Budi Lake (2)	There are several endemic aquatic species in Budi Lake (cited in priority wetlands at international level). Among these species, that withstand high concentrations of salinity, the fish endemic to the zone *micropogonias furnieri* is noteworthy. This wetland is also refuge habitat of wild birds of continental waters and important reproductive residence of the Black-Necked Swan *Cygnus melancoryphus*

Notes: (1) The classification of Freshwater Ecoregions is in accordance with the publication: **Freshwater Biodiversity of Latin America and the Caribbean** (WWF / USAID / Biodiversity Support Program / Wetlands International, 1998). (2) Threat levels: Level 1 represents the river basin with greatest importance in biological terms (diversity and endemic species) and levels 2 and 3 in decreasing order under the same criteria. (3) Location of priority sites according to the publication, "*Libro rojo de los sitios prioritarios para la conservación de la diversidad biológica en Chile"* (Red book on priority sites for conservation of biological diversity in Chile), CONAF ed. 1996. (4) The " ♦" represents river basins on which feasibility studies already have been carried out by the Interamerican Development Bank (IDB).

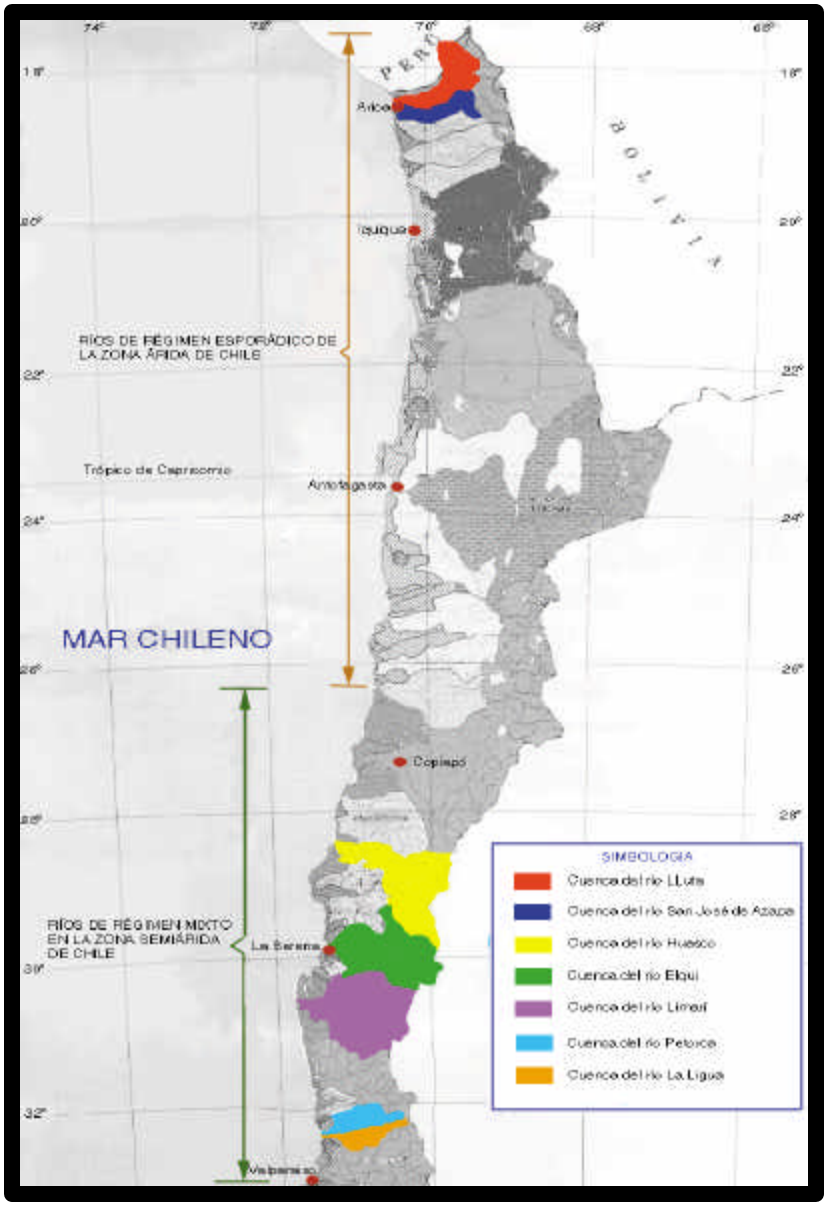


Fig 1.- Watershed Location (Arid Zone)

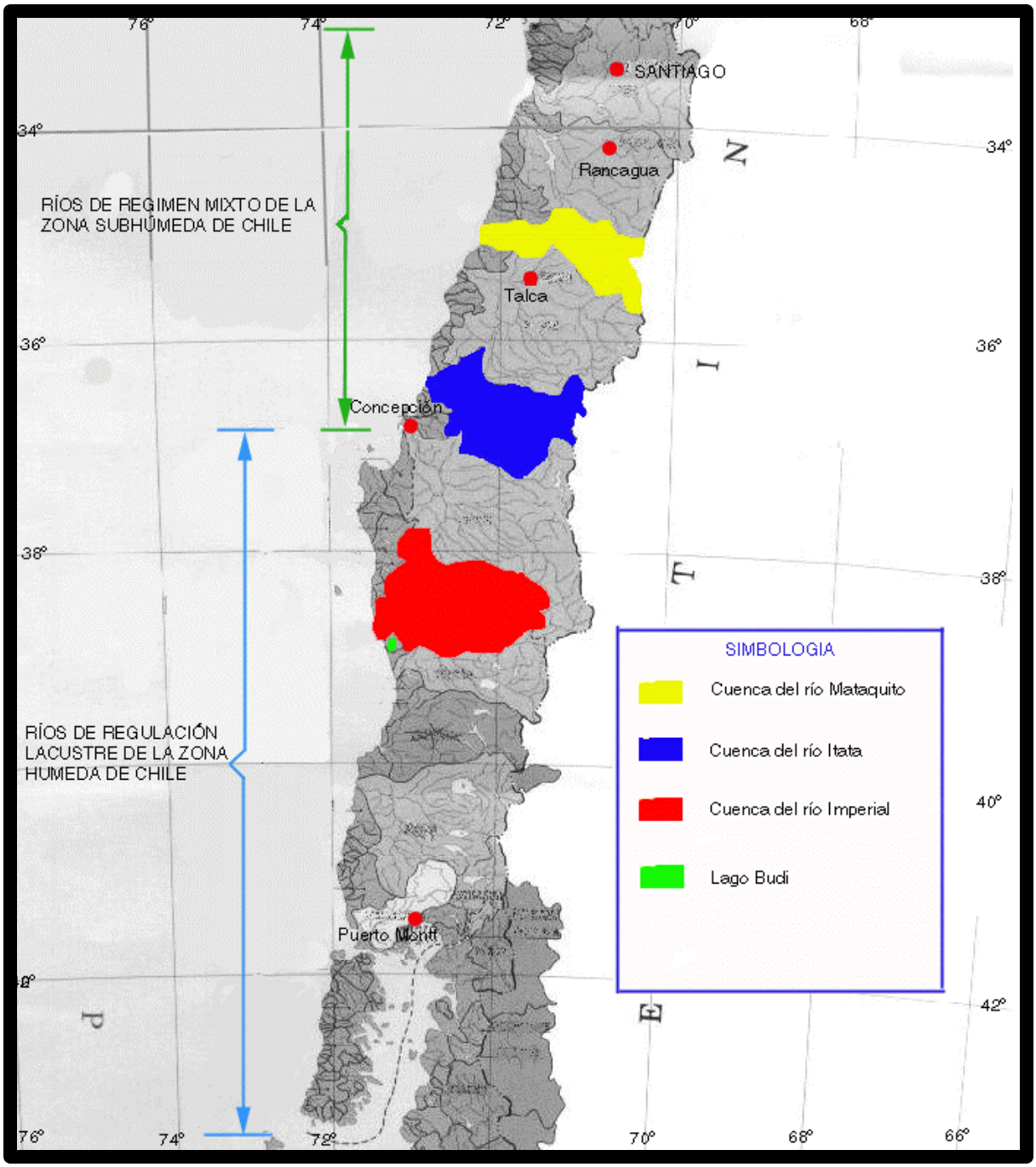


Fig 2.- Watershed Location (Humid and Dub-humid zone)