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ENVIRONMENT AND NATURAL RESOURCES STRATEGY IN CHILE

Prepared for USAID/Chile

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ACRONYMS

ACHIDAM	Asociación Chilena de Derecho Ambiental
ADC	Advanced Developing Country
A.I.D.	Agency for International Development
CEPAL	Comision Economica para America Latina
CESCO	Comision de Estudios del Cobre
CIEPLAN	Corporacion de Investigaciones Economicas para America Latina
CIPMA	Centro de Investigaciones y Planificacion del Medio Ambiente
CMPC	Compania Manufacturera de Papeles y Cartones
CODEF	Comite Nacional de Defensa de Flora y Fauna
CONAF	Corporacion Nacional Forestal
CONICYT	CORFO
CORFO	Corporacion de Fomento
ENR	Environment and Natural Resources
FAA	Foreign Assistance Act
FSP	Forestry Support Program
GDP	Instituto Forestal
GTT	Grupos de Transferencia Tecnologica
IDB	Interamerican Development Bank
INIA	Instituto de Investigaciones Agropecuarias
MOS	Ministry of Health
NEC	National Environment Commission
NGO	Non-Governmental Organization
OC	Organochlorine
OP	Organophosphate
SAG	Servicio Agricola Ganadero
SNA	Sociedad Nacional de Agricultura
SNASP	Sistema Nacional de Areas Silvestres Protegidas
S&T/FENR	Bureau for Science and Technology, Office of Forestry Environment and Natural Resources
The Center	Center for International Development and Environment
UN	United Nations
USAID/Chile	U.S. Agency for International Development Chile
WB	World Bank
WRI	World Resources Institute

I. INTRODUCTION

USAID/Chile's new initiatives in environment and natural resources (ENR) respond to a growing concern in Chile and worldwide over the quality of the environment and the sustainable use of natural resources. With the publication of Our Common Future, the report of the U.N Commission on the Environment and Development, issues ranging from global climate change and transnational disposal of toxic wastes to soil erosion, deforestation and desertification and urban air pollution have become common topics for public debate in developing countries as well as in the industrialized world. Narrow commitments to economic growth alone as the engine of development are being replaced by a broader appreciation of the linkages between economic development, social equity and the sound management and conservation of natural resources.

In Chile, the quality of the environment and the long-term sustainability of its recent economic growth also have become matters of serious concern. As the country returns to democracy, public discussion of environmental issues has centered on the problems that a new popularly elected government will face: pervasive air pollution in Santiago; inadequate water and sewage systems in most urban areas; industrial pollution; water scarcities and mining contamination; desertification in the northern regions of the country; issues of soil erosion and pesticide use in agriculture; deforestation and watershed degradation; the overexploitation of marine resources; and the need for more effective management of national parks and protected areas. Left unattended, these problems threaten the long term vitality of the Chilean economy, but at present, no comprehensive national policy exists to shape public and private actions with regard to the quality of the environment and the use of natural resources.

In August 1988, A.I.D. established a small Advanced Developing Country (ADC) program in Chile. In keeping with A.I.D. policy, the ADC approach emphasizes relationships with the private sector, including NGOs, universities, business enterprises and existing organizations, rather than government to government projects and the establishment of new institutions. Under the ADC program, USAID/Chile acts as a catalyst, seeking to establish linkages between U.S. and Chilean organizations and leveraging funds and technical assistance from a variety of sources.

The major purpose of USAID/Chile's program is to support Chile's transition to democracy. At present, the program concentrates on promoting initiatives which foster democratic practices and improve the social responsiveness of the Chilean private sector. With this in mind, A.I.D. is supporting activities in civic education, the administration of justice, legislative analysis, housing, vocational education, the development of microenterprises, and human relations management for private business.

A.I.D. has taken a strong stand towards environmental protection in its own programs by complying with environmental assessment requirements, and by strengthening host country capabilities and institutions. There is a clear mandate outlined in the Foreign Assistance Act (FAA), which has been repeatedly strengthened to deal with environmental concerns. Its recent amendments include Sections 119 and 118 of the FAA which promote conservation of biological diversity and local participation, and conservation and sustainable use of tropical forests, respectively. The articulated policy of the Agency (A.I.D. Policy Paper on Environment and Natural Resources, April 1988) is that economic growth is only possible with a reliable and sustainable natural resource base.

In addition to A.I.D.'s policy, other donors have begun to take a more positive and active stand on environmental management. This includes the InterAmerican Development Bank (IDB), the World Bank (WB) with its newly stated environmental policies, and the European community, which recently funded a major study for the management of the Bio Bio Watershed in Chile.

It is within this policy and legislative framework that an environmental program is being developed by USAID/Chile. In addition to facilitating actions of Chilean organizations, USAID/Chile, with this initiative, can foster and stimulate continued active support for improved environmental management by and with other donors.

In the spring of 1989, USAID/Chile started its environmental program with a grant to the Center for International Development and Environment (the Center) of the World Resources Institute (WRI). The grant to the Center had two main purposes. The first was to support the "Tercer Encuentro Cientifico Sobre El Medio Ambiente," a week long conference sponsored by the Centro de Investigación y Planificación del Medio Ambiente (CIPMA). The conference brought together Chilean scientists, environmentalists and private sector interests to discuss the relationship between environment and development in Chile. The second was to help USAID/Chile formulate a strategy for its future programs in environment and natural resources management.

The strategy set forth here is the result of that second effort. Prepared by a team of professionals drawn from WRI's Center, A.I.D.'s Bureau of Science and Technology, Office of Forestry, Environment and Natural Resources, USAID/Ecuador, the Chilean Association for Environmental Law (ACHIDAM), and USAID/Chile, the strategy is based on a thorough review of Chilean environmental issues conducted during the summer of 1989. The team drew upon the proceedings and results of CIPMA's Tercer Encuentro, consulted experts from the WB, the IDB, Comision Economica Para America Latina (CEPAL), the Chilean government, scientific community, nongovernmental organizations (NGOs),

universities and the private sector. The team also reviewed literature and project proposals dealing with environmental and natural resources management problems in the country. Based on these consultations and reviews, the team then worked closely with USAID/Chile to define a strategy for action that addressed the central issues affecting ENR management in Chile while remaining within the bounds of USAID/Chile's mandate and expected levels of funding.

USAID/Chile's Environment and Natural Resources Strategy is organized in three main parts. In the first, a brief overview of the Chilean political, social, economic and geographic context is provided, setting the stage for the second section which contains a summary assessment of the major cross sectoral and sectoral issues in ENR management in Chile. These two sections provide the fundamental definition of the issues and constraints which have shaped the ENR strategy. The strategy itself is defined in the third section of the paper.

The ENR strategy should be seen as a flexible and evolving approach to action. It provides a framework for assessing critical issues and selecting specific courses of action for USAID/Chile's Development Assistance Program. As explained below, its strategic objectives address three fundamental requirements for improving environmental and natural resource management in Chile: 1) the need for environmental policy and effective institutions; 2) the need for more research analysis and basic information on environmental issues; and 3) the need for environmental education programs, training and increased public awareness.

Under each of these objectives, the ENR team has identified potential projects or opportunities for action which came to its attention during the course of its work. While these projects should be regarded as potential activities rather than fully refined recommendations, the ENR strategy has a general plan that suggests which actions would be appropriate for immediate, medium or longterm implementation. Aside from their technical feasibility, the projects selected for immediate action fulfill two other criteria of special importance at this time in Chile's transition to democracy. They offer the opportunity to provide future public officials with critically needed information and policy analyses, and they offer forums for discussion of environmental issues and policies from all sectors. Through such broadbased discussion, a consensus can be built on the direction that public policy should take in the future.

II. CHILEAN CONTEXT

A. Overview

Chile is in the midst of a historical process of political transition to democracy. For the first time, after 16 years of a military regime, the people will elect a president and congress in December 1989. All the presidential candidates and the political parties that support them have agreed, from their different ideological perspectives, that the next election opens the way to a full restoration of a democratic governmental process. The candidates represent the prevailing public desire to overcome the political divisions of the past with a peaceful transition to a more open and pluralistic expression of the will of the people.

The military government's development policy has systematically pursued a free enterprise, market oriented and export driven economic model that has successfully achieved significant growth and export objectives. Following the severe recession of 1982-83, the economy has grown 5 percent in real terms for each of the last three years, reaching a GNP per capita of U.S.\$1,525 in 1988. Much of this growth has been led by increases in exports in the agricultural, forestry, fisheries and mining sectors.

At the same time, a new territorial and institutional structure has been established. Thirteen administrative regions have been created and the role of the municipalities has been enlarged. Public services and institutions now have regional structures and basic economic resources are invested or spent directly by regional and/or local levels of government. However, a regionally generated and administered tax base is not existent.

While the adoption of a free market philosophy has contributed to considerable economic growth, it has been accompanied by profound social impacts. There is a growing feeling, particularly among the poorest sectors of society that they have not benefited by this growth, and that their social needs (education, housing, health, employment, etc.) have not been adequately satisfied. Their legitimate demands for greater public investment in social programs will create a challenge to any new government trying to maintain economic growth and efficiency.

Chile's recent and historical economic policies have also severely affected the quality of the environment and natural resource base. First, economic growth has been fueled largely by greater short term exploitation of basic natural resources and intensified production systems. Second, the private sector's role has greatly expanded while that of the public sector has been redefined and reduced, and short term profit gains predominate over longer term sustainable use of natural resources. The combination of these two factors has led to serious environmental

problems, which have been further aggravated by limited public expenditures forcing government institutions to devote few staff and financial resources to management and effective regulation of environmental quality.

In response, public interest in environmental concerns have called for heightened attention to the trends in environmental degradation that may threaten economic growth and sustainable development. This new consciousness has been driven mostly by private conservation groups and community, professional, scientific and local organizations, and is now being considered seriously by the political parties and presidential candidates.

Balancing the demands for greater equity and improved environmental management with economic growth objectives will be a major challenge for the government leading Chile's return to democracy.

B. Institutional and Legal Framework for Environment and Natural Resources Management

While there are numerous references to environmental protection and resource conservation within existing Chilean laws and regulations, the primary legal mandate for environmental protection lies in the Chilean Constitution of 1980. This provides that all citizens have the right to live in an environment free of contamination, and creates a special judicial mechanism ("recurso de protección") to protect this right. This judicial mechanism lacks, however, a general regulatory law for implementation. Beyond the Constitution, existing environmentally related laws are scattered and lack an updated, accessible and comprehensive regulatory framework.

From an institutional perspective, with the exception of the National Ecology Commission (NEC), there is also no single national agency or institutional structure responsible for environment and natural resources management. Numerous public agencies and offices within different Ministries have some environmental functions and responsibilities, but their work is generally poorly coordinated and supported by few staff and financial resources. For this reason, in 1984, the NEC was established to: 1) advise the President, 2) coordinate public sector work; and 3) formulate environmental policy. Again, due to lack of technical and financial resources and uncertain political backing, NEC has acted more as a limited watchdog and monitor of public sectoral agencies than as a forceful supraministerial coordinating and advisory body.

The main public institutions with some ENR management responsibilities include CONICYT, the Science and Technology Research Commission with a subgroup on environment within the Ministry of Education; CONAF, the Forestry Corporation within the

Ministry of Agriculture, with responsibilities for managing wildlife, protected areas, watershed management and forest resources; SAG, the Agricultural and Livestock Service of the Ministry of Agriculture, which oversees flora and fauna sanitary regulations, and establishes and enforces pesticide regulations; the Environmental Health Service of the Ministry of Health, which monitors food, water and air quality; the Fisheries Subsecretariat of the Ministry of Economy, which sets norms for marine resources management; and the Ministry of Transport, responsible for emission control standards for vehicles. There is also a National Energy Commission, that formulates strategies and approves investments in the energy sector. The Santiago Metropolitan government (Intendencia) has established a special commission to address the pollution problems of the region. CORFO, the state development corporation, also has specialized institutions dealing with research and information gathering on the forestry (INFOR) and fisheries (INFOP) sectors. While each of the above agencies are set with a mandate to protect the environment, staff and fiscal resources have limited their ability to enforce existing laws and promote sound natural resources management.

The main private sector environmental organizations have evolved from their original limited interests in environmental protection to work now on a broader range of sustainable development issues. These include CODEFF, the main advocacy environmental NGO, CIPMA, the Environmental Research and Planning Center, and a number of other important groups involved in education, public campaigns, technical assistance or appropriate technology. Despite limited funding and staff resources, they have been highly effective, and to an important extent are responsible for increased level of awareness in Chile and favorable public opinion towards improved environmental management.

Universities represent, for the most part, the intellectual resources and technical expertise in the environmental disciplines. Although CONICYT has placed greater emphasis on research in the biological and ecological disciplines in recent years, no comprehensive environmental management program or research agenda has been formulated in Chile. The two most important universities (University of Chile and the Catholic University) have the strongest science faculties and some regional universities have developed some sectoral expertise in areas like forestry (Universities of Concepción and Austral) and fisheries (University of the North).

C. Regional Characteristics

The geography and population distribution in Chile creates a diverse and complex set of issues from both an ecological and economic perspective. The country can be delineated into three

main regions, North, Central and South, and a highly urbanized center.

Northern Chile comprises Regions number I to IV. It includes the Norte Grande desertic area, with 5.6% of the national population, rich in minerals (e.g. Chuquicamata and La Escondida mines), with an active fishing industry (e.g. Arica and Iquique) and a commercial agricultural sector in irrigated river valleys with intensive production of fruits and vegetables for internal consumption. In the Norte Chico arid area, with 5.3% of the population, the two major resource sectors include irrigated agriculture, producing grapes and other export crops (e.g. Copiapo Valley), mining (e.g. El Salvador) and fisheries (Caldera, Coquimbo and shellfish farming near La Serena).

Central Chile comprises Regions number V to VIII and Metropolitan Santiago. Heavily populated (74% of the population) with a mild mediterranean climate, Central Chile is the most industrialized area of the country, but is also characterized by a significant agricultural sector, representing the greatest production of fresh fruit for the international market. Important mining interests (e.g. El Teniente and La Disputada mines) are also active.

Southern Chile encompasses Regions IX through XII. In the temperate South, where 13.2% of the Chileans live, industrial forestry, fishing and fish farming, tourism, livestock and agriculture are all important resource sectors. The austral South is sparsely populated (1.8% of population) with a rugged geography and difficult communications. In a very rainy climate, the principal economic activities are related to forestry, fishing and fish farming. In the extreme South of the Region, where the climate is drier and colder, together with sheep ranching, there is exploitation and industrialization of petroleum and gas reserves.

More than 84% of the 12.7 million Chileans live in urban areas and produce 75% of the country's GDP. Metropolitan Santiago with 4.4 million inhabitants is the largest urban concentration. Together with Concepcion (0.8 million persons) and Valparaiso (0.7 million persons), these are the largest urban agglomerations of the country and account for more than 50% of the total urban population.

The urban areas of Chile have also experienced the highest rate of population growth, increasing from 7 million in 1960 (67%) to 10.7 million in 1982 (84%). While the absolute size of the rural population has remained stable at about 2 million inhabitants during the same period, it has declined in terms of the proportion of the population, going from 33% to 16% of the country's population. The most significant growth has occurred at the periphery of metropolitan areas, with a stagnation or slight

decline in central urban area populations. In general, urban areas in Chile have moderate population densities, with greater Santiago at approximately 7,900 persons/km², for example.

III. ENVIRONMENT AND NATURAL RESOURCES: REVIEW AND MAJOR ISSUES

A. Cross Sectoral Issues

1. Environment and National Development

A free market, export-oriented economic development model has been systematically implemented throughout the country during the current regime. This approach accounts for the strengthened private sector, broadened capital base for investment and the highest accumulated economic growth figures in Latin America during the 1980s. The next civilian government is likely to follow this same strategy, maintaining similar macroeconomic, non-interventionist policies and economic growth trends. While this model has had positive short-term economic impacts, it may not be sustainable in the long-run unless greater attention is paid to the negative consequences of its intensive exploitation of natural resources and the lack of environmental regulations for public health and safety.

Natural resources in Chile, as in many developing countries, represent an important means of generating national employment and are the basis upon which most economic growth depends. In Chile, the most dynamic export sectors are natural resource based. Renewable natural resources contributed more than U.S. \$2.5 million, or over 35 percent of the total exports of the country. Three products, fishmeal, fresh fruit and cellulose comprise more than 25% of the 1988 exports with a total volume of U.S. \$1.8 million. Two factors are key: 1) growth in these sectors has resulted from continued exploitation, some of which may not be sustainable in the long term sense; and 2) expanded and intensified use of natural resources in forestry and agriculture particularly, has been accompanied by costly rates of environmental degradation (e.g. soil loss and loss of native forests) and environmental contamination (e.g. the use of chemicals in agriculture and chemical wastes in mining). These two trends not only threaten public health and environmental quality, but may decrease Chile's ability to maintain and sustain current economic trends.

Forestry. In the forestry sector, current rates and patterns of exploitation of native forests and reforestation policies and practices may reduce the potential forestry in the future. In 1988 forest products accounted for 10.4 percent of the export earnings. There is an increasing emphasis on chipping, with 40 percent coming from native forests. At this rate of harvesting and the lack of reforestation with native species, native forests

are seriously threatened. Again, careful economic studies have not been conducted but chipping undervalues the native species that could be sold for lumber or processed wood products. Finally, given the fact that reforestation has largely emphasized exotics, the replacement of natives is largely non-existent. As the diversity of forest products is reduced with the reduction in native forests, the potential of the forest export sector will also be reduced, ultimately relying on cultivation of introduced, fast growing species.

Health Costs of Environmental Contamination. Human health impacts from the exposure to air and water pollutants are all too evident in Santiago. Data from comparative studies in Santiago and Los Andes demonstrate strong negative relationships between air pollution levels (particulates and gases) and the incidence of upper respiratory and pulmonary disorders. Lung capacity of children may be significantly reduced and this condition will persist throughout their adult lives. The health care costs are currently borne by the individual or the state for treatment and/or insurance. While there are clear linkages, the economic costs are less well-defined.

The source of air pollutants is focused on the transportation system (diesel exhaust releasing 70% of the particulates in Santiago) and manufacturing facilities (atmospheric gases and contaminants). With prudent investment, an incentive system and regulatory framework, buses emissions could be reduced significantly by merely improving maintenance operations. Maintenance would also contribute to gas savings, ultimately reduced health problems and costs for health care.

Human health impacts as a result of environmental contamination may result in additional costs for individuals, insurance companies and the state. Data available indicate a strong negative relationship between human health and environmental pollution (e.g. Santiago, Talcahuano and Calama), but no economic analysis has been conducted. Understanding these costs in economic terms may greatly contribute to an improved understanding among policymakers for the full costs of environmental degradation.

In general, the linkages between environmental degradation and economic sustainability has not been elucidated in Chile. Macroeconomic indicators do not include valuation of natural resources nor are natural resources incorporated into national income accounts. Thus the importance of the capital stock that has pulled Chile's economic growth during the past 16 years fails to be appreciated by decisionmakers and public and private institutions.

2. Environmental Policy and Institutional Setting

Environmental policy in Chile has been a direct outgrowth of the free-market economic philosophy of the current government. Natural resource management and environmental protection have not been a priority and little support has been given to those institutions that do exist to execute environmental laws and regulations. For change to occur in these areas, a new government will have to address a number of fundamental policy and institutional issues.

One overarching issue has to do with the scope of the government's role in environmental protection and resource management. While the Chilean constitution guarantees citizens the right to an environment free from contamination, no coherent body of environmental policy, law and regulations have been formulated to implement that constitutional provision. Defining the scope of new policy and law, however, is no easy matter particularly in light of the relative economic success of current free-market, non-interventionist policies. New policy must seek to establish institutions and regulations which can minimize and ameliorate negative environmental impacts of development activities while strengthening and supporting the dynamism of the country's economy. This is a difficult task, at best, as it goes to the heart of the political debate about the role of the state in a free enterprise economy.

Some specific institutional issues accompany these broad philosophical questions of governance. At present, the public institutional framework for environmental planning and management is diffuse and poorly defined. As noted earlier, little government leadership or support has been given to the National Ecology Commission and the environmental units that exist within line Ministries.

Strengthening the institutional framework raises a number of key and basic questions regarding governmental approaches. At issue is first whether a new Ministry for the environment should be created, or whether the government can rely instead on new and strengthened forms of inter-ministerial coordination. Second, the role that governmental institutions should play at the local, regional and national levels must be resolved. Decisions must be made about the most effective and efficient allocation of resources and institutional functions.

Linking ENR planning and management to economic policymaking is also a critical issue in Chile. The public institutions responsible for the economic planning, such as the Ministry of Finance, the sectoral ministries, and the National Planning Commission, traditionally have not regarded ENR issues as within their purview. Although issues such as environmental pollution, soil erosion and degradation, and overfishing may be recognized as

negative externalities associated with the development process, the effects that these trends might have on the long-term productivity of the economy have not generated a search for new policies. Planning and policymaking among private businesses is similarly concentrated on short-term horizons for resources exploitation.

Another critical step associated with establishing a sound framework for ENR planning and management in Chile is the development of accessible sources of information for public and private decisionmaking on ENR issues. This issue emerges in several ways. Although there is no absence of excellent data on specific environmental issues in Chile, no clearinghouse or integrated ENR database that could be routinely accessible to planners and decisionmakers exists. Similarly, while some monitoring of resource trends occurs in such areas as fishing and forestry, the information produced is often fragmented and not linked to broader development planning processes. A need exists for policy and programs to develop environmental data and indicators that can be linked to development planning as a whole to determine the sustainability of different types of economic activity.

Both the need for environmental trend data and increased economic analysis of the externalities associated with resource exploitation relate generally to the need for improved public policies on environmental assessment (EIA). While some large mining and hydroelectric projects supported by international donors have required EIAs, such assessments have not become a commonplace instrument of project planning and design in the public nor private sector. Aside from their use as tools for identifying potential adverse environmental impacts, they also serve to generate critical information on conditions and trends in the country.

Finally, public participation is an important factor in ENR planning and management. Chile's long tradition of democratic participation has been revived by last year's plebiscite and the electoral campaigns followed. There are also an increasing number of community groups emerging in both urban and rural areas. For NGO groups concerned with conservation, pollution issues, and natural resources management, there are new opportunities for expanding support for training and technical.

3. Science and Technology: Research and Application

Historically Chile has had a productive scientific community. University scientists are well trained, many holding Ph.D.s, and they have established and maintained active research programs despite limited resources. Notwithstanding these strengths the contribution of universities to addressing the R&D needs of Chile has declined in recent years, and is not well established in

applied areas of ENR management. The growing private sector in Chile has little confidence in the interest and willingness of university researchers to solve specific problems beyond those that will yield academic publications. Moreover, the strength and resources of the private sector has also enabled it to undertake greater research activity on its own. In fact, more than half of current R&D efforts in Chile today are performed in the industrial sector.

In the environmental sciences, however the private sector does not lead in experience and knowledge. Universities have strong biology, zoology, ecology and agronomy faculties that can bring to bear knowledge of environmental management. More positive and active interactions with universities should be promoted to access the capabilities and experience of professional biologists, ecologists, and environmental engineers. This could come in the form of seminars between universities and industries, participation of business and academia in regional planning organizations, which is already happening in some regional NGOs, and/or by private sector, business support for faculty and student applied research to be conducted in the university. Collaboration among regional universities and business, mining and agricultural interests could help to bring to bear the capabilities of the academic community to find solutions for regional ENR management problems. Student participation with the private sector could also help to sensitize the private sector to the importance of ENR management and begin to create employment opportunities for ENR specialists.

Within the academic community, although strong disciplinary departments are present, integrated programs in environmental studies, and particularly environmental management disciplines, are less common. Theoretical ecology is well developed while applied ecology is a minor component of most departments. Training in environmental studies and integrated applied research is needed which provides students with practical research opportunities in environmental management. Ecology must compete for scarce research resources in the same arena with all other scientific disciplines.

Finally, while the resource base in Chile is relatively simple compared to more complex tropical countries on the South American continent, and also has been relatively well studied, information critical to making sound management decisions is not readily nor broadly available. As stated earlier, data have not been systematically collected, indicators on the actual state of the resource base are not available or information has not been compiled in an appropriate format. A well organized and complete database is essential for diagnostic purposes and for the establishment of priorities. This is an issue affecting all resource sectors, and one that could begin to be addressed by

supporting an environmental profile and information management projects.

4. Education, Training and Public Awareness

The importance of public awareness and knowledge of the environment must form the basis of any social and political changes aimed at improved environmental protection and management. Starting with primary school age children to policy and decision makers, there is a critical need to raise consciousness and assure that decisions are founded on a solid base of knowledge.

In addition, there is a need to more fully integrate environmental considerations into national development planning. This will require greater attention to valuation of natural resources, such as natural resource accounting methods being undertaken by CEPAL, inclusion of long term costs and benefits of environmental management into financial and fiscal analyses, i.e. development of resource and environmental economics in Chile, and greater interdisciplinary planning and implementation of public and private sector programs.

While the concern for the environment in Chile grows in parallel with the awareness on a global scale, there is still a generally poor understanding among Chileans on environmental issues, the importance of their environment, the science of applied ecology and the role of individual action to maintain a cleaner, safer environment. With a more than 90% literacy rate in Chile, awareness could be raised rapidly and swiftly with a modest infusion of well placed resources, and by drawing on the skills and knowledge of the well-trained professional ecologists present in Chile.

Several constraints are evident in existing programs. While primary and secondary school teachers are well trained, environmental education has been somewhat limited in the schools and in teacher training in the universities. The Ministry of Education, through the Centro de Perfeccionamiento Experimentacion e Investigaciones Pedagogicas, has prepared teachers manuals in environmental studies as part of an overall effort to improve instruction in the natural sciences through a 10 year project, ending in 1990. The criticism with these efforts is that they focus primarily on natural sciences, rather than integrating environmental education into each discipline. From a quick review of some of their materials, there is less emphasis on the study of interactions in the natural environment than on observation and reporting the occurrence of animals and plants in the natural world. In other words, the emphasis appeared to be more on what is present than on how it works together. Nevertheless, it is a good start.

NGOs are also involved in environmental education with schools and informally through newsletters and talks. CODEFF has just completed a one year program working with secondary school teachers. The CODEFF program worked with the teachers to develop local activities following a one week workshop. Where resources were available or where teachers were not forced to teach additional courses due to financial constraints, the program was successful. In the coming year, they are undertaking a similar project with primary school teachers. The CODEFF effort could be strengthened to help develop materials that can be provided to the participants. Stimulating individual action by teachers is a valuable approach, and support to NGO environmental education may be a cost effective means of heightening public awareness. Interaction of NGO programs with professional ecologists in the universities should be encouraged. Further, student projects in ecology could collaborate on environmental education efforts and improved interpretative displays in national parks.

The Chilean university and academic community is composed of a highly trained and motivated cadre of professionals. While individual disciplines are well represented and developed in most areas, there is a need to improve integration of environmental concerns into economic development. Resource or environmental economics as a means of more closely integrating environment and development is not a well established field. Traditional economics is strong in several universities (U.Catolica and U.Chile) and in some NGOs (CIEPLAN), and the capability exists to expand into resource economics and build this discipline within Chilean institutions. The second issue of concern is the general lack of effective interaction between disciplines, including the social, economics and natural sciences in university curricula and training programs. Several institutions are considering this issue but are constrained by academic disciplinary lines and the lack of opportunities for students leaving with an interdisciplinary degree.

Finally, although the lack of an ineffective policy and legislative framework limits sound resource management, greater sensitivity is also needed within the private sector. NGOs such as CIPMA and universities (e.g. U.Catolica) have taken some steps to sensitize the business and mining community on environmental issues. Continued efforts should be supported and might include additional seminars with business community organizations (e.g. the Fundacion Chile in agriculture or SOFOFA on environmental management.)

B. Sectoral Issues

1. Agriculture

a. General Conditions

The free market policies guiding most productive sectors in Chile also characterize the agricultural sector, and are most evident in the growth in production and the expansion of the export sector. Fresh fruit exports comprised 8.3% of total export earnings in 1988. Total agricultural production nearly doubled since 1980, per hectare production in basic grains (wheat, corn and rice) doubled from 1980-88, and the country is now virtually self sufficient in wheat and rice. At the same time, the actual area planted in basic grains has declined, and thus much of the increase in basic grain production has been enabled through intensified production practices. Yield gains on a per hectare basis are not as dramatic in other crops and production gains have been realized through a combination of intensification and expanded cultivation areas (e.g. fruit production areas more than doubled in area since 1972).

Intensified production has included the expansion of mechanization and irrigation, wider use of improved varieties and cultivars, and increased use of agricultural chemicals. During the past 11 years, pesticide imports have increased 8 to 9 times. Forty percent of this current use is herbicides. In economic terms, between 1984 and 1988, pesticide imports increased 184% from U.S.\$28.3 million to U.S.\$52.1 million. Fertilizer use and imports show similar rates of increases. From 1985 to 1988, imports of nitrogen, phosphate and potash increased 179%, 142% and 400%, respectively. The costs of pesticide imports has represented from 5-10% of total export earnings during that period. Fertilizer import costs from 1983-86 accounted for 25% of the total agricultural exports earnings during the same period. Thus the direct economic costs of the use of agricultural chemicals may be considerable. The indirect environmental and public health costs are uncertain and poorly documented.

b. Institutional Setting

The transition of Chilean agriculture is also reflected in a changing institutional structure. The private sector has become the driving force behind the expanded agricultural sector. Within the export sector, sophisticated and intensified production systems have been enabled and encouraged through technical assistance and the backing of groups such as the Fundacion Chile, other private technical assistance agencies and the Sociedad Nacional de Agricultura (SNA). The commercial sector also receives assistance from the semi-public Instituto de Investigaciones Agropecuarias (INIA) through its Grupos de Transferencia Tecnologica (GTT) program. Private commercial

sector organizations generally lack an articulated policy to promote environmentally sound agricultural practices. Soil erosion, runoff of agricultural chemicals, and contamination of surface and ground water are not considered from a policy or action perspective, although allowable residue tolerances of the export market have generally resulted in safer pesticide use on export crops to assure consumer safety. The focus is on increased production and yield gains in the near term. Long term economic costs of environmental degradation are neither considered nor realized by individual farmers.

Small farmers have not been without representation in the private sector. There has been a significant growth of NGOs within rural communities, aimed at developing sound practices for small farmers which will ultimately improve the quality of life of small noncommercial farmers. These groups may, in many cases, represent the only source of technical assistance, information, and education and training on improved farming techniques, appropriate for specific ecological conditions for small farmers. Their emphasis has been on less input intensive practices to reduce economic and environmental risks, and on integrated cropping systems. While these groups have not had the advantage of a strong research network to support their outreach programs, they can be an effective and flexible means of training small farmers and promoting environmentally sound agricultural practices. In some cases, they work directly with small farmers and provide needed services.

As has generally been the case in Chile, the public sector has been reduced in both size and scope. INIA represents the only extension system supported at least in part by the state, and the primary agricultural research organization (50% of INIA's budget is provided by the state). While INIA is interested and is supporting research on environmentally sound agricultural technologies, the degree to which these approaches are applied in the field is uncertain. The GTTs have been a valuable means by which technologies have been transferred to medium and large growers to improve production and in some cases this has included conservation practices (e.g. water conservation to reduce water loss and conserve soil quality). There is not however, an explicit institutional policy emphasizing sustainability and environmental protection, although some of the researchers are strongly oriented towards agroecology and sustainable agriculture.

c. Environmental Issues

Classifying environmental impacts and the state of the natural resource base in agriculture is complicated by the ecological diversity in Chile, the diversity of cropping systems, and lack of a complete data base. In the north, agriculture is limited to the irrigated valleys of the lowlands and subsistence agriculture and grazing of camelids in the highlands (about 1

million Ha. of dryland grazing and cultivable areas). In this region, the greatest problems are posed by the scarcity and conflicts over the use of water resources. Salinization in the irrigated valleys is growing in severity both from the use of increasingly saline waters for irrigation and intensified land use. Water needs in agriculture conflict with those of urban areas, mining and conservation of fragile habitats in the altiplano. Little comprehensive planning has been undertaken, and water use policies do little to resolve sectoral conflicts, consider the short and long term demands for water, and promote water conservation and recycling.

Soil Management. The absence of effective soil management and conservation practices is resulting in high rates of erosion, declining soil fertility, desertification and flooding. One study estimates that 50% of Chile's land is already affected by desertification processes. In the Norte Chico, the rate of desertification is estimated to be 300,000 ha/year. Erosion may be proceeding at an average rate of 40,000 ha/year according to some estimates. The implications of these trends have not been systematically verified nor quantified in terms of loss of arable land, loss in production and yields, increasing costs for rehabilitation. It is generally agreed however, that land use practices including plantation forestry are leading to serious rates of soil loss that could threaten future agricultural productivity.

Pesticides Management. During the past 10 years, the use of pesticides and fertilizers has broadly expanded given the demands for aesthetically appealing products in the export market. The impact of this use specific to Chile is unclear. There is currently no monitoring of acute or chronic poisonings by the Ministry of Health (MOS). Monitoring of chemicals on foodstuffs has largely been limited to those destined for export or restricted to organochlorines (OC) in meat and butter, and in soil and water (INIA). Monitoring of organophosphates on fruits and vegetables destined for internal consumption is scheduled to begin in November. Very little specific information on the environmental impacts of pesticides is available. There is evidence however, that changes in pest complexes and secondary pest outbreaks have resulted from inappropriate reliance on pesticides. Further, persistence of OCs may be longer in Chilean volcanic soils than is typical of temperate climates. These represent two additional economic (i.e. management) costs of environmentally unsound agricultural practices.

Pasture Management. Poor pasture management practices in the southern regions of the country (e.g. Punta Arenas and Magallanes) may result in additional natural resources management problems. Weed invasion is reducing the productivity of natural pasture. This may require expansion of pasture or the use of herbicides to

bring the weed growth under control. Pastures are also generally poorly managed and suffer from high rates of erosion.

Land Use Conflicts. Agricultural regions are threatened by conflicts over land and water use in the mining, urban and forestry sectors. The most notable arise from the water use demands and the quantity and quality of water available for agricultural uses. In the north, water quantity and increasingly, water quality are important problems which require regional planning and decision making. In the central region of the country, contamination of irrigation water with urban waste has led to outbreaks of typhoid and hepatitis. Mining wastes are contaminating irrigation waters and degrading the quality of agricultural lands with heavy metals (e.g. El Teniente Mine and agricultural areas north of Rancagua).

d. Conclusions and Opportunities

Several constraints limit the development and application of environmentally sound agricultural practices. There are first no clear policies within the Ministry of Agriculture to establish research and development priorities oriented towards environmental protection and natural resource conservation. Thus, environmentally sound and economically viable technologies are not widely available, nor applied. Second, environmental concerns are not generally integrated into ministry policies. The focus is on production and neglects the sustainability of current practices, and the future of Chilean agriculture. Chile has very scarce arable land resources (approximately 5.3 million Ha.), and little attention is paid to economic costs of land degradation, losses to future agricultural production, and economic incentives and policies to promote improved resource management, i.e. incentives to make conservation practices economically viable in the short-term. Further, policies are not integrated nor complementary between resource sectors. For example, subsidies for reforestation which promote pine plantations are contributing little to soil conservation. Third, there is no requirement to evaluate environmental impacts of new technologies. Fourth, most technical assistance and R&D is oriented towards larger producers. Future policies should respect the export sector and its potential to contribute to Chile's economic development, but greater attention must be paid to improving small farmer agriculture, which represents approximately 80% of the rural population and more than 50% of the arable land, and 30% of the irrigated land. Finally, very little information is available on the status of existing agricultural resources, e.g. the actual extent of land degradation, erosion rates, and contamination of water and soil resources and human health impacts from the use of agricultural chemicals. There are few monitoring systems or programs that can guide establishment of priorities for research and program development. Actual shifts in land use, abandonment of once fertile land, declining yields and/or soil fertility or increased

need for inputs are poorly documented. The critical economic data are therefore, not available to persuade decision makers of the need for more environmentally sound agricultural development.

As is broadly needed in Chile, environmental policies must be integrated into all ministry policies. Policy changes can be promoted through the sectoral analyses that will form part of a broad policy and legislative review in this strategy. Support for an environmental profile will provide a forum through which key problems are highlighted, information is compiled and indicators of environmental quality and resource status can be developed. The external costs of agricultural chemical use for example, could be incorporated into agricultural environmental indicators. Support is needed for the development of regional plans for resource use, particularly to resolve conflicts over the use and management of scarce resources. The strength of the private sector should be maintained but the mandate and perspective must be broadened to increase environmental awareness and consciousness. Environmental forums for large scale agriculturists on sustainable agriculture and environmentally sound practices (e.g. biological control, water conservation, and organic agriculture certification) could be supported perhaps in collaboration with Fundacion Chile and SNA and large growers from the U.S. Study tours to organic operations in the U.S. would allow Chilean farmers to benefit from recent U.S. experience in this area. Similarly, to promote safety issues, farm labor leaders could meet with U.S. farm labor leaders on pesticide safety issues. Finally, work with NGOs and INIA in rapid rural appraisal (RRA) and agroecosystems analysis (AEA) through A.I.D. central projects represents a mechanism to incorporate sustainability considerations into diagnostics of farm operations and farmer production constraints.

2. Forestry Sector

a. General Conditions

Forestry has historically been an important economic sector in Chile, characterized in the past largely by exploitation of native forests and more recently by plantations of exotics, especially pines (Pinus radiata), first established in the 1950's and 1960's. Since 1974, establishment of plantations has been encouraged by a direct cash subsidy for reforestation and afforestation. This subsidy which pays 75% of the planting costs, has successfully promoted the expansion of forest plantations from 0.3 million Ha. to 1.24 million Ha., a rate of establishment of more than 70,000 ha. per year. This is making Chile one of the number one pine producers in the southern hemisphere.

Forest products accounted for 10.4% of the 1988 export earnings. Of this, nearly 90% is based on exploitation of pine plantations. This is nearly a 6 fold increase in earnings in 13

years. The success of plantation forestry is attributed to at least two factors. First, the terrain and climate is highly favorable for pine growth, registering average yearly productivity of 22 m³/Ha. Second, labor costs are low in Chile, thus facilitating labor intensive silvicultural practices. One estimate of plantation costs in Chile puts them at less than 50% of what they are in the U.S. While the cost of producing a metric ton of pine wood in Chile is U.S.\$23 compared to U.S.\$34 in Finland, the next lowest cost pine exporting country.

Exporters of forest products have substantially increased and forestry exports have diversified. Ten years ago, there were just 113 forestry exporters with 61 products while now there are 528 exporters that trade 328 products. Chile's main buyer of forest products is Japan, with a nearly exponential increase from U.S.\$3.9 million in 1981 to \$56.2 million in 1987. Investment in plantations has originated mostly in Japan and New Zealand, but new deals involve Chile's pioneering Chapter 19 mechanism for debt-equity conversion. A U.S.\$285 million investment has been financed for San Francisco's Simpson Paper Company by five U.S. banks. It will go into Celulosa Pacifica's new U.S.\$587 million cellulose plant in Renaica, near Concepcion. A U.S.\$350 million swap was previously arranged by Shell-Scott Paper/City Bank in a swap for another cellulose plant, the largest debt-equity conversion ever put together in Chile.

While pine plantations are used mostly for export of logs, cellulose and cellulose-based products, a new forestry related boom is being experienced in wood chip exports, 40% of which is coming from native forests. The income generated by this novel export line was U.S.\$33 million in 1988, over twice the value exported in 1987. The chip volume in 1988 was only 74,482 MT, and the total climbed to 315,967 MT in the first quarter of 1989, with 128,025 MT coming from native forests located in the 8th, 9th and 10th region.

b. Institutional Setting

While the private forestry sector has greatly diversified in recent years, it remains dominated by a handful of large companies or conglomerates, the largest being Compania Manufacturera de Papeles y Cartones (CMPC). CMPC controls forestry activities through forestal MININCO, and operates major cellulose and paper industries such as Papelera de Puente Alto, a Kraft paper mill in Laja, and Industrias Forestales, S.A. (INFORSA) with a plant near Concepcion. CMPC plans to build a new plant in the 9th region. Another industrial giant is Complejo Forestal and Celulosa Arauco (EFA), with a plant near Arauco and another in Constitucion. The list also includes Bosques de Chile, Forestal Cholguan, Forestal Bio Bio and Aserraderos Andinos.

Government supervision of the forestry sector is accomplished largely through two institutions, the 18 year old Corporacion Nacional Forestal (CONAF) and the Instituto Forestal (INFOR), which are affiliated with the Ministries of Agriculture and the Economy, respectively. CONAF has about 800 professionals and technicians and 2-3000 nonpermanent workers located in 13 regional and provincial offices. INFOR has a staff of about 50, most of whom are concentrated in Santiago. CONAF has responsibility for establishing and implementing norms of forestry practices, exerting control, evaluating and monitoring management plans, and providing technical assistance to small and medium forest owners. INFOR on the other hand conducts forest research with funds provided by the state and private sector and is not involved in outreach and technical assistance.

CONAF's main agenda is oriented towards strengthening private sector involvement in forestry and expanding exports. They have the additional responsibility for protection and conservation. This has created definite institutional conflicts between protection and production responsibilities. Staff and financial resources are highly biased towards production and industrial forestry. While forest owners must register holdings with the Areas de Interes Forestal, and receive approval for a management plan from CONAF, this does not assure protection of native forests. Staffing constraints restrict evaluation to the more important plantation sites, and little oversight is given to native forests. In addition, the emphasis on production promotes exploitation of native forests that may neither be rational nor sustainable (e.g. chipping).

c. Environmental Issues

Of the 34 million Ha. of territory classified as suitable only for forestry use, 23 million Ha. is classified as protection and 11 million Ha. as sustained yield production forest. All but 2.7 million ha. of the production forest has been destroyed and 13 million ha. of the protection forest has been cleared. Nineteen million ha. of the 21 million ha. already cleared suffers from some degree of erosion. Clearing of native forests has been followed by changes in land use to pasture, plantation forestry and/or agriculture. There appears to have been historically, and recently, very little reforestation with native species. Exotic plantations have been established on nearly 1.3 million ha. of cleared forest land, and are expected to reach 2 million Ha. by the year 2000. According to INFOR/CORFO, there remains 9.9 million ha. of land available for planting, 5.8 million ha. of mature native forest and 0.587 million ha. of secondary native forest privately held, available for harvesting. Given these figures and past harvesting rates, it is clear that some of the forest held in private hands must be classified as protection forest and should theoretically not be available for production

forestry, thus questioning the need to examine current forest use and management policies and plans and their implementation.

The growth of plantation and industrial forestry poses several serious environmental and social problems. First, the installation of pulp and paper plants and exploitation of wood for chips has greatly expanded the extent of plantations of exotics. Native forests now being exploited for chips are not being replaced with native species. In fact, management of native forests for sustained yield production forestry is limited. Some effective management is going on with Rauli and Roble in the Pangui-Pulli region. While the reforestation subsidy has encouraged beneficial use of degraded lands, additional native forest (up to 0.4 million ha.) has been cleared for establishment of plantations. Pine plantations provide some cover on abandoned lands, but they do not represent the best means to reduce soil loss on eroded lands. Pine plantations are also particularly susceptible to fires relative to native forests. Finally, as is the case in most monocultures, pest and diseases, once established, can spread rapidly. The European Pine Shoot Tip Moth is established in Chile and is gradually spreading northward. The presence of the European Pine Short Tip moth directly threatens the capability of the forest sector to produce knot free, straight logs. Most of the forest policies and silvicultural practices are aimed at meeting this goal. While there is potential for biocontrol, the presence of this moth has been accompanied by rather indiscriminate spraying. About US\$5-6 million was spent on spraying operations in 1984-85.

The expanding wood chip industry represents a growing threat to native forests and the sustainable use of this resource. Native species exploited for chips included roble, rauli, hualle, lenga and avellano (Nothofagus obliqua, N. alpina, N. obliqua juv., N. pumilio and Gevuina avellana, respectively). These species growing in both primary and secondary stands, and are cut without regard for their stem diameter, since even thin saplings can be chipped. This practice precludes even natural regeneration of native stands. Also, relatively little is known about the regeneration of most native species. During the first quarter alone of 1989, 40% of the 315,967 MT (128,025 MT) of chips exported by Chile were obtained from native trees. The contribution of chipped native wood to the total exported is increasing, and within just the 8th, 9th and 10th regions, there is an estimated 452,529 ha. of native wood available for chipping. There is no clear policy or incentive to assure that these native stands are reforested with native species. Two chipping plants have been installed to date, one of which is owned by the Japanese firm Mitsubishi and the other by a Chilean-New Zealander-Japanese investment group.

Although little information is available, pulp and paper plants are notorious sources of water pollution. Pollutants such

as mercury and dioxin have been found in water ways used for dumping effluents from manufacturing facilities.

d. Conclusions and Opportunities

The scale of the Chilean forestry sector and the strength of the private sector relative to the regulatory capabilities of the public sector will require major actions to assure future sustainable use of forest resources. Management plans and forest use classifications cannot be adequately evaluated given current staffing levels. More importantly, the emphasis on industrial forestry undermines the ability of CONAF to effectively implement its protection responsibilities. Policies and subsidies should incorporate a scheme for management of native forests, incentives for reforestation of native forests and promotion of research to address silviculture and regeneration of native forests.

A.I.D. resources are disproportionately small relative to the needs in the sector. There is, however, a role for facilitating forest policy reform. Technical assistance to complement a forestry sector review may be available from the S&T/FENR Forestry Support Program (FSP). FSP may also be available to provide TA on management of the European Shoot Tip Moth although an IPM plan has been formulated. The nongovernmental (universities and environmental groups) active in forest research, conservation and protection can and are playing an important role to document the conservation status and trends of native forests and other endangered habitats. Support should be made available to complete floristic data bases, to promote coordination and thus communication among individuals involved in establishing data bases, and to gather habitat data to improve management decisions and policy formulation.

3. Protected Areas and Conservation of Biological Diversity

a. General Conditions

Located as a narrow band of land west of the Andes between 17:45 and 55:59 degrees of South latitude, and isolated from neighboring countries by the desert in the north and the Andean cordillera, Chile has a unique assemblage of biological communities. A count made in 1983 of Chilean flora listed 4,758 vascular plant species in 965 genera and 190 families. While the species diversity is low compared to neighboring tropical countries, Chile is unusual for the high rate of endemism of the flowering plant species--56.7% (2,698 species)--found. Approximately 8.3% (394 species) of the total species present are considered threatened or endangered. The most critical plant conservation problems however, occur on the Juan Fernandez, San Felix, San Ambrosia and Easter Islands, where 108 species are threatened. Some scientifically and economically valuable species

such as the Juan Fernandez sandalwood (Santalus fernandezianum) are already extinct. These islands contain 70% of the flowering plants with forms unique at the species, genus and even family level. Many plant species may in fact, face imminent extinction because they grow on privately-owned lands, outside the control of the State.

The Chilean fauna shows the same pattern of insularity as that noted for the flora, and is faced with many of the same threats. CONAF's Red Book on the Land Vertebrates of Chile lists 50 taxa as endangered, 92 as vulnerable and 53 as rare, and that 52 of the 91 land mammals registered in the country have an acknowledged conservation problem. Additionally, all fresh water fish species have been hurt by pollution and the widespread introduction of carnivorous exotics, such as salmon and trout, into rivers and lakes. The conservation situation for some species is becoming desperate.

Of 83 plant formations defined for the country, 51 (63%) are partially or fully represented in the Sistema Nacional de Areas Silvestres Protegidas del Estado (SNASPE). About 90% of the SNASPE units are in the southernmost half of the country, which contains the greatest diversity of plants, animals and plant communities. However, while a considerable area (17.5 percent) of Chile's total territory is in the SNASPE, 88% of that is located in the Austral Regions XI and XII, which until recently with the construction of the Austral Highway, faced little threat of development. The remainder of the protected areas, which is composed of 30 national parks, 36 natural reserves and 10 natural monuments, are small units of less than 60,000 Ha. each. Almost 2 million Ha. (14.8%) of the total territory is made up of the San Rafael and Parque Bernardo O'Higgins ice fields.

b. Institutional Setting

The SNASPE functions as a dependency of the Corporacion Nacional Forestal (CONAF), an autonomous corporation controlled and partially funded by the State. The SNASPE presently has 26 professional and 520 support personnel that is headed up and coordinated by just six professionals in the central Santiago office. Despite the limited staff, it has gained international stature for its dedication, ability, and accomplishments. The most recent and notable of these is the transfer of 100 Vicunas to a reserve in Ecuador from the wild herd kept by CONAF at Lauca National Park (Region I), following their successful management of the Vicuna populations at Lauca. This demonstrates not only the logistic capability needed to trap and transport Vicuna but also CONAF's success in developing a healthy population of these endangered animals.

CONAF maintains administrative and interpretive facilities in the SNASPE units, with adequate housing and logistic support

provided to staff and workers. Lodging and transportation facilities also are made available to scientists and other qualified visitors. CONAF sponsors wildlife studies by university scientists and students in the units, and organizes technical symposia and courses on subjects of special concern. Technical and promotional publications are produced in what is undoubtedly one of the most ambitious efforts anywhere in Latin America, and public response to these efforts continues to grow as witnessed by the 600,000 visitors that visited the SNASPE in 1988. The interpretive displays in the parks are limited, however.

While the SNASPE is staffed by a very committed and motivated group of professionals, and one of the best in Latin America, it is highly understaffed with limited resources relative to other departments in CONAF. CONAF does not have resources to purchase new habitats containing rare and endangered species, and private land owners cannot be easily persuaded to protect particular plants and animals. Rare and endangered species, such as the Burrowing Parrot Cyanoliseus patagonus, with an increasingly reduced range, cannot be adequately protected because CONAF does not own and/or manage critical rookeries.

The most active environmental group, CODEFF, is experiencing a boom in membership that has attracted the attention of several donors. The World Wildlife Fund has supported two projects on conservation of native forests and two on marine mammals by this NGO, and is currently involved in assisting it to strengthen its institutional base and in beginning environmental education activities focused on primary school teachers. The Frankfurt Zoological Society has provided support for CODEFF researchers to study Huemul (Hippocamelus bisulcus), and there are two other activities being funded by a Swiss and a German group. Currently a CODEFF native forest specialist is receiving post-graduate training at a university in the U.S.

c. Conclusions and Opportunities

Although the current emphasis on protecting tropical forests is well placed, it is worth highlighting that Chilean native forests are far more unique and localized than the extensive woody formations of the northern Neotropics. Although Neotropical austral forests are not nearly as biologically diverse as the tropical moist and wet forests, the fact is that austral forests have by far their greatest development in Chile, and if present logging practices continue, the entire extent of these plant communities can be almost completely wiped out worldwide, and with them many truly unique plant and animal communities.

Habitat destruction by deliberately-set forest fires and clear cutting of native forests outside of national parks and reserves looms as the major threats to conservation of the Chilean biota and the existing protected areas. If the Nothofagus and

Araucaria forests of the Sierra Nevada mountains near the Malalcahuello Reserve (Region IX) and wood chipping operations are representative of current trends, most reserves and parks will become nothing more than island habitats, threatening their very existence and contribution to conservation.

Uncontrolled exploitation of wild animals is a related and serious threat. Lax control has allowed hunting of marine mammals such as sea lions for crab trap bait, and occasional capture of small porpoises for shipping to foreign aquaria. Part of the difficulty seems to lie with administrative fragmentation among government agencies. All aquatic fauna, including pinnipeds and cetaceans, are the responsibility of the Servicio Nacional de Pesca (SERNAP) of the Ministerio de Hacienda. Terrestrial forms were formerly under the Servicio Agrícola y Ganadero (SAG) of the Ministry of Agriculture but have now been unofficially transferred to CONAF. Since the Chilean Senate has not completed the transfer, the land animals in fact are in a legal limbo which may explain why large spiders, birds, reptiles and other animals are leaving Chile in increasing numbers for the pet trade. Illegal exploitation of certain tree species (Alerce and Podocarpus) also threatens their survival.

The absence of protection for coastal waters and habitats threatens Chile's marine mammal fauna some of which should be protected under the International Convention on Trade of Endangered Species (CITES). Protected areas along the coast stop at the shoreline. Marine parks and reserves need to be established to enable needed protection.

There is clear need to review carefully the conservation status of the Chilean flora and fauna. This could be coupled with activities and interests of The Nature Conservancy, coordinating the work being undertaken by CONAF, the University of Chile, Fundacion Claudio Gay, CODEFF, and others. CONAF could greatly benefit by some modest computer hardware. Careful review of the distribution of threatened and endangered species on both public and private lands is needed. An important contribution of the S&T/FENR Biological Diversity project could be made by working to review the status and distribution, but more importantly to address reserve management, habitat fragmentation and buffer zone management of lands surrounding parks and reserves.

Assisting with policy analysis and institutional organization could be facilitated. Current fragmentation of administrative responsibilities, legal requirements and private/public sector interactions should be assessed within such an analysis. Institutional conflicts for resources and staff between production and protection forestry requires review and policy changes. Greater integration is needed between management of production forests and protection of reserves.

A final opportunity lies in assisting and/or facilitating improvement of interpretive displays and promotional materials for the national parks and reserves. Collaboration among CONAF, CODEFF and university faculty and students could bring all the necessary skills to bear.

4. Fisheries and Coastal Resources

a. General Conditions

During the past 11 years, the fishing industry has been the fastest growing sector in the Chilean economy, with an average annual growth rate of 10 percent. The total 1988 fisheries catch was over 5 million MT (97% for export), which totaled U.S.\$837 million. This is a 27% increase over 1987, placing Chile in fourth place among world fisheries countries. Fishmeal and fish oil are the most important fisheries products, representing 88% of the total catch and 56% of the total exports.

The modernized and technologically sophisticated fishing industry is largely responsible for the recent boom in exploitation of coastal resources. The industrial sector (classified with vessels over 50m long) was responsible for 92.4% of the 1988 total catch, and accounts for 97% (87,710 m³) of the total capacity of the fishing fleet. The trend is towards much larger vessels and nets, capable of locating and capturing greater catches by a single vessel.

The artesanal sector varies considerably in the diversity of vessels, equipment and technology. While artesanal fisheries only accounted for 7.6% of the total 1988 catch, they provide the primary proportion (90%) of fish caught for internal consumption.

b. Environmental Issues

The capacity of catch and processing facilities in the industrial sector significantly exceeds the sustainable production capabilities of the Chilean hydrobiological ecosystems. Excessive exploitation of fisheries is greatly depleting these resources. For example, the 310 pelagic fisheries vessels have a storage capacity of 18.5 MT. Of the 5.3 million MT disembarked in 1988, overfishing was evidenced by reduction in average length, age, etc. of the most important commercial species. Some fisheries management calculations for Chile set a sustainable maximum harvest at 3.5 MT. While these figures are based on incomplete data, there is a definite disparity between current and growing exploitation and sustainable catch. Overexploitation is one of the most serious factors facing Chilean fisheries. A decline in the fish populations will result in a serious loss of investments not to mention the loss of coastal biological communities.

As has been described for other sectors, fisheries exploitation and management depends on the prudence and judgement of private sector interests. The industry is highly deregulated which is demonstrated by its explosive growth and expansion and catch capability, and in the absence of careful management of the fisheries resources. The proposed Ley de Pesca would fix the number of fishing vessels operating within a specific area at current levels, and would establish catch quotas for species in danger of overexploitation. If current levels already exceed sustainable harvests, then fixing these levels (number of vessels and quotas) will only slow the degradation of fisheries resources rather than reverse the patterns of overfishing.

Artesanal fisheries are based on a number of pelagic species (in areas reserved for artesanal fisheries), some high value species (e.g. swordfish), significant harvests of algae, principally for agar and dry forms, (extraction in Region X increased five-fold from 1979-84), and harvest of shellfish, crustaceans and other benthic forms. Many species such as abalone and crab are seriously threatened by excessive harvesting activities. Crab harvests are also devastating marine mammals which are slaughtered as bait for king crabs. Some of this is happening in the unprotected coastal waters off of national parks. Benthic and demersal species are further affected by effluents and discharges from urban areas, mining, agriculture and industry. A complete study of these impacts was made by IFOP in 1987 and outlined problem areas. None of this information has been translated into management action, however. Water pollution will pose an increasingly greater problem for nearshore fisheries in the future as the level of contaminants grows without effective pollution controls.

While there is strong agreement among experts that overexploitation is occurring, the extent and severity of the problem is less well understood. Data on population dynamics, reproduction, acceptable catch is not widely available for most species. This makes it difficult to establish sustainable catch levels. While quotas have been established for some species, it is impossible for the Servicio Nacional de Pesca (SERNAP) to monitor compliance given limited staff and lack of vessels. There is clearly very little policy priority placed on management beyond expansion of fisheries industries.

Mariculture is producing a number of products currently threatened with overexploitation. The emphasis is however, mostly on introduced species, rather than managing native species. Introduced species may pose some threats to species diversity, outcompeting or preying upon native species. Mariculture production practices have also contributed to local water contamination and management problems.

c. Conclusions and Opportunities

Chile is a country of coastline and mountains, and this geographic complexity and diversity pose special coastal resource management problems. First, the coastline is long, 4,200 km from north to south and drains some 10,000 km of coastline. Marine waters and its inhabitants are thus affected by virtually all coastal and inland uses of natural resources, including industrial pollutants and urban discharges. The climatic extremes of the land areas along the coast demand local or regional action to address specific resource problems. Second, the narrow continental shelf, averaging 6.5 km in width, means that nearshore marine resources are concentrated where discharges from continental waters or coastal industries are greatest, and can therefore have a devastating impact on those organisms inhabiting or reproducing in these waters. Finally, the exceptionally productive coastal currents, due to the upwellings along the continental shelf, are periodically interrupted every 7 to 12 years by water temperature and current changes associated with the "El Nino" phenomenon. The populations of species of major commercial importance may be greatly reduced or disappear following an El Nino event, thus reducing the predictability and ability to plan fisheries management.

There is a virtual absence of attention given to integrated coastal resources management in Chile. In fact, the coastal zone has not been defined as such in Chilean legislation, and there is no protection conferred to coastal water habitats. A.I.D. resources are limited, but assistance provided to support policy analyses and legislative issues should focus on this sector. The protection status of coastal waters should be reviewed. The industrial fisheries sector should be drawn into the discussion and emphasis should be placed on heightened awareness and the potential long term costs faced by the continuing decline of the fisheries stocks. Immediate action may be taken to promote integrated resources management by supporting and/or facilitating a seminar on Coastal Resources Management (CRM) with the participation of members of the Ecuador CRM project currently being supported by A.I.D. Such a seminar could also draw on the experience and expertise of the CRM staff based at the University of Rhode Island. Finally, important work being done by environmental NGOs such as CODEFF to protect critical marine resources should be supported through public awareness and education campaigns.

5. Mining, Energy and the Industrial Sector

a. General conditions

These three sectors of the national economy have received major consideration under the development policy adopted by the government, and as a result have been very important elements in

the recent economic growth of the country. The mining sector has concentrated a significant amount of private foreign investment and as a whole, the sector had a 4.2% growth rate in 1988 and it is expected to continue to grow in 1989. Given the increased production projections of the state owned large copper mines, operated by CODELCO, together with the new companies formed by private capital, foreign and national, mining exports will exceed their current 50% of the total exports of the country in the near future.

Energy generation has covered the needs of the expanding economy through basically the efficient work of ENDESA (National Energy Company), involved since its creation in 1948 in mid and long term planning of investments required to cope with projected energy demands. At present, there are many hydroelectric projects in different stages of development responding to energy demand projections into the next century. Private companies are now responsible for the distribution of energy through an integrated national system and have shown positive economic results.

The industrial sector as a whole has significantly recovered since 1984. Last year, it showed an 8.7% growth rate, the highest among the productive sectors of the economy. Product diversification, from non-metallic minerals to glass and furniture, and a growing participation of private foreign capital, the industrial sector is showing a dynamic capacity to increase employment and expand its contribution to national development.

b. Institutional Setting

With the emphasis on privatization of the economy, control of mining, energy and industry now lies primarily in the hands of the private sector. The state has tried to maintain a normative role, setting "the rules of the game," and create the institutional and financial mechanisms needed to guarantee a favorable climate for private investment and economic growth. Formerly powerful and influential public institutions, like CORFO (State Development Corporation), have been assigned the role of studying and developing new opportunities for private investment in the different sectors of the economy.

Within the public sector, two Ministry oversee the mining, energy and industrial sectors. The Ministries of Mining and of Economy, Industry and Commerce are responsible for the definition of policies and the overall orientation of sectoral activities. In recent years, these Ministries have maintained a good working relationship with the powerful private sector institutions, SONAMI (National Mining Association) and SOFOFA (Chilean Manufacturers Association). At the same time, the absence of central government policies for environmental protection has relegated responsibility to numerous lower level public institutions. These agencies lack coordination and often conflict in policy and mandate.

Two exceptions to the privatization policy are worth noting since in at least one case (CODELCO), suit was brought against a government agency for violation of environmental protection requirements. In mining, a public corporation, CODELCO, operates the largest copper companies in Chile. CODELCO was created after the nationalization process of the early 1970's. ENAMI (National Mining Enterprise) is a public company that purchases from medium and small size miners, and operates mineral smelting and processing plants. The second case is the National Energy Commission, a high level technical group with a supraministerial capacity for long-term energy planning, and whose approval is required for every energy generation project. The most important projects in the past have been developed by the public company, ENDESA, with approval by the commission and implemented by ENDESA. ENDESA has just been privatized and this may change the State/agency coordination.

c. Environmental Issues

Aside from the absence of a uniform environmental policy, the most important environmental issues associated with mining and industry are contamination produced by mining, processing and manufacturing activities. Most of it is very site specific, point source pollution, such as sulfur and arsenic in the air and water in the North and near Santiago, and dioxins released in water from the pulp processing facilities further south. Air pollution problems in Santiago are caused by a combination of particulates from diesel exhaust (70%) and industrial processes (80% of the sulfur oxides).

Mining, industry and energy have been criticized for the lack of adequate, independent environmental impact studies (EIS) prior to making final decisions on investments and construction. There is no legal requirement for an EIS in Chile and the studies that have been made respond more to corporate interests than to specific regulations. As a result, when EISs are conducted, they are treated more as a formality, and recommendations for mitigations are generally not incorporated into project design and implementation.

Another area of public concern has centered on problems associated with waste and residue disposal by industrial and mining operations. Almost no information is available about the amounts, final destiny nor environmental impact on the environment of the solid and toxic wastes generated by these activities.

d. Conclusions and Opportunities

The size and importance of the mining, energy and industrial sector have put some companies or some of their specific projects in the center of the public discussion about the environmental impact of their activities. Sometimes, this situation has led to

conflicts that could have been avoided had adequate information been made available to concerned and interested citizens, and had the company executives developed a deeper understanding of the issues involved and their relationship to a growing public sensitivity to environmental quality.

From this multisectoral perspective, there is a need to promote the definition of a global environmental policy, sectoral resource management strategies, integrated with other sectors, and the development of the corresponding institutional coordination mechanisms inside the public sector.

A.I.D.'s limited resources, at the present time, cannot significantly affect the serious problems of contamination associated with mining, energy and industry. Nevertheless, it could be very useful to support, from a technical point of view, the needed policy definitions and changes and the institutional restructuring, by facilitating opportunities for policy dialogue between concerned social actors.

As part of this effort, USAID/Chile could promote roundtables or workshops where high level business officials could meet with experts and foreign business representatives to evaluate different experiences and discuss about ways in which the private business community can improve its performance in the environmental arena and strengthen its relationship with the general public. This could be enabled by dissemination of information on their activities and the opening of their operations for adequate environmental impact studies and follow through and monitoring.

Economics of pollution management could help industries to understand the costs and benefits of pollution management in terms of increased efficiencies, etc. It could permit the study and comparison the full direct and indirect costs of industrial productions, internalizing costs of environmental protection, that have not generally been considered in the past, costs that could affect in the near future the long term sustainability of the free market economic model.

6. Urbanization and the Environment

a. General Conditions

Chile is a highly urbanized country. Over 80% of its total population of 12 million people live in urban areas, and 60% of these live in the three major cities of Santiago, Valparaiso and Concepcion. While no Chilean city escapes its share of problems, the highest concentrations of urban environmental issues can be found in the greater Santiago region.

Santiago reached a population of approximately 4.4 million in 1989 which represented nearly 40% of the population of Chile.

Although the city's rate of growth has slowed somewhat during the past decades, slipping from 3.2% for the period 1960-70 to 2.5% from 1970-80, and an estimated 2.1% for the period 1985-90, the urbanized area of the greater Santiago region has continued to grow. From 1982-1985, the urbanized area grew at the rate of nearly 900 hectares a year. According to the last census, 20% of the growth of the metropolitan region resulted from in-migration.

b. Environmental Issues

The growth of the Santiago-Valparaiso Metropolitan region has been accompanied by critical urban environmental problems. The rapid expansion of Santiago has encroached on rich agricultural lands and led to the deterioration of the central urban core, the growth of peripheral areas, and the costly expansion of the city's basic infrastructure. This phenomenon of horizontal urban sprawl has been accentuated by a relatively liberal free market approach to urban development and transportation policy.

The major environmental problems in Santiago are air pollution and the lack of treatment for sewage and waste water. Thick smog settles over Santiago due to prevailing winds and the city's geographic position at the foot of the Andes and surrounded by mountains on three sides. Produced by the combination of vehicular exhausts (most of which are emitted by a fleet of approximately 8000 diesel vehicles), dust particles that rise into the air from the severely eroded surrounding hillsides and unpaved low income settlements, and industrial point sources, air pollution often reaches dangerous levels during the winter months. Such conditions are associated with increased upper respiratory infestations and disorders, which in the longterm may lead to higher probabilities for reduced developmental lung capacity in children, emphysema, asthma and pulmonary cancer.

The precise dimensions of the air pollution are now being studied more thoroughly and systematically, and with a view towards developing more effective strategies for monitoring and controlling the problem. With funding from the Inter-American Development Bank, the Santiago regional government (Intendencia) has been carrying out studies to monitor air quality, identify the sources of emissions, examine epidemiological problems, monitor industrial wastes, measure noise levels, develop a meteorological model for testing the effects of alternate pollution control strategies, review air quality standards and institutional mechanisms for managing air quality control programs. These studies are nearing completion, and it is expected that the severity of the problem and public pressure will make the reduction of air pollution in Santiago one of the highest environmental priorities on the agenda of the next government.

Water contamination is also a critical issue in Santiago-Valparaiso region. Although 90% of Santiago is provided with

potable water and sewage infrastructure, 100% of the sewage effluents are discharged untreated into the old sewage canal that runs through the city and the Mapocho River. Waters from both these sources are used in summer months to irrigate surrounding croplands, which has led to outbreaks of typhoid fever. In Valparaiso, water and sewer infrastructure is also high, but wastewater also goes untreated and flows directly into the ocean. The ocean is also contaminated by industrial wastes and sewage from other cities in the region, including Santiago which are carried by rivers to the ocean.

In both Santiago and Valparaiso, future plans envision the construction of treatment plants and the expansion and modernization of water and sewer infrastructure. Both the WB and the IDB are assisting in other efforts although the magnitude of the costs involved necessarily means that solutions are not close at hand.

One final issue affecting Santiago-Valparaiso, as well as other less urban areas in the country, should be noted. That is that urban environmental management, like urban planning and management systems, generally is not conducted in an integrated and coordinated way. In the greater Santiago area, for instance, the functions of the Intendencia exist side by side with the separate responsibilities of some 34 municipal governments, and both must relate to national governmental ministries or interministerial bodies, such as the Urban Transportation Commission. Such a disparate, fragmented institutional structure makes it difficult to develop coordinated metropolitan growth and management policies, and even more difficult, to implement effective metropolitan wide programs. The question of improving metropolitan government and urban management systems is one that also will find its way onto the public agenda in the not so distant future.

c. Conclusions and Opportunities

The magnitude of the investments required to monitor and control urban air and water pollution in the Santiago-Valparaiso region is well beyond the limited resources available to USAID/Chile. However, A.I.D. may be able to play a role as supporting and facilitating policy discussion and technical assistance for the solution of these problems. USAID/Chile already has been instrumental in fostering EPA involvement with the Santiago Intendencia Air Quality Program. Coordination with EPA could continue with A.I.D. promoting special workshops on interagency coordination for pollution control or facilitating EPA's review of the results of the IDB sponsored monitoring studies. In addition, A.I.D. might draw upon the resources of USAID/Ecuador's Coastal Resources Management project to facilitate discussion on the management of coastal contamination in the Valparaiso-Vina del Mar and Concepcion-Talcahuavo regions.

Working with the Center for Disease Control in Atlanta or the PanAmerican Health Organization, USAID/Chile might also sponsor workshops and conferences designed to increase the public's understanding of the real costs of environmental contamination and the benefits of alternative protection and control strategies. Finally, opportunities exist through the Institute for Urban Studies (IEU) of the Catholic University and the Center for Development Studies (CED) to foster discussion among public officials and professionals on the need for improved management systems in urban areas.

IV. ENR STRATEGY FOR AID/CHILE

The ENR strategy for AID/Chile includes two overall goals and basic strategic objectives necessary to achieve those goals. The rationale for each of these goals and objectives has been developed fully as a guide for future actions.

In addition, a number of potential projects, or activities have been identified which AID/Chile might support in order to reach the outlined strategic objectives. Some of these present opportunities for action in FY 90 while others would probably take longer to develop and implement. Some of these projects are contained in formal proposals presented to AID/Chile while the ENR strategy was being developed and others are merely suggestions or ideas that surfaced during that process. They all represent concrete actions that AID/Chile might take but each would have to be formally developed and funded by A.I.D. or other sources.

A general discussion of issues related to implementation and funding of the ENR strategy follows the explanation of its rationale and potential projects. Once AID/Chile decides on a definite course of action and selects concrete projects, specific funding and implementation mechanisms can be identified.

GOALS

o Improve the Quality of the Environment and the Sustainable Use of Natural Resources in Chile

The long term sustainability of Chile's economic growth is one of the central issues that will face the future democratic governments. While free market policies have produced remarkable returns, particularly in the export sectors of the economy, the long term success of these policies may be undermined by their long term environmental impacts as outlined and discussed in earlier sectoral discussions. These issues are of growing concern to Chile's future. AID/Chile's ENR strategy is aimed at contributing to the development of policies and practices that can help

bring economic development, social equity and resource conservation into a more sustainable, long term balance.

o Promote Improvements in Environmental and Natural Resources Management

While the achievement of more sustainable patterns of development may be the ultimate aim of this strategy, its more immediate goal is promoting better management of the environment and the use of the natural resource base. Within the Chilean public sector today, the elements of such a management system are either absent, inactive or focused on short term growth objectives and facilitating free market expansion. Public actions and sectoral policies promote increased production and exports, but pay scant attention to the environmental impacts of those activities. Although the Chilean constitution does guarantee its citizens the right to a clean environment, no national environmental policy or coherent regulatory framework exists to assure implementation. The absence of policy is also reflected in the low priority given to environmental planning and management within public agencies. In the future, the functions of government agencies will require judicious revitalization to manage more effectively the Chilean resource base and environment.

Within the private, non-governmental sector, interest in environmental issues and a concern for more prudent ways of managing natural resources has grown considerably during the past few years, despite, or perhaps, because of the government policies. This interest is scattered in groups at universities, NGO's, research institutes, regional organizations and some private business groups.

While the interest is strong, most people acknowledge that public discussions often suffer from a lack of data, research, and economic analyses framing the issues in terms that public policy makers and the business community can appreciate. Without such information and analysis these groups and the public at large are ill-equipped to contribute constructively to the discussion and formulation of policy and programs for environmental management in the future.

STRATEGIC OBJECTIVES

The strategic objectives of AID/Chile's ENR strategy focus on three basic elements of environment and natural resource management: 1) comprehensive environmental policy; 2) basic research and analysis and an adequate base of information upon which sound decisions may be made; and 3) formal educational programs to train professionals in critical disciplines and public

awareness campaigns that deepen and broaden understanding of the issues among the general public. The strategy proposes to support and strengthen activities and existing institutions that address these vital concerns.

As explained earlier, the opportunities for actions associated with each of these objectives are examples of potential projects which are of a character and scale that fit within the bounds of A.I.D.'s Advanced Developing Country approach. They represent national and regional initiatives which address cross-sectoral, as well as sectoral issues. Those which address an immediate need and for which funding might be available during the coming fiscal year (FY90) have been viewed as potential near-term projects. Immediate projects are those which are considered key to undertaking future actions (e.g. environmental policy research), to building a stronger consensus (e.g. public awareness), and which may easily get started during this period of political transition.

Strategic Objective: Support the Development of Public Policy and Institutional Initiatives for Improving Environmental Quality and the Management of Natural Resources

One of AID/Chile's central ENR program areas will support activities which contribute to the development of responsible public policy, and legislation for environmental protection. The nature of these new policies and laws, the types of institutions, functions and regulations they generate, and the effects they may have directly and indirectly on the management of natural resources and the economy are all subjects which need to be carefully analyzed and understood by policy makers. A.I.D. can contribute to this process by supporting research and analysis on policies and institutions, and by bringing public officials and experts together to discuss common experiences and the alternative policy options.

Opportunities for Action

Opportunities for action in this area exist in non-governmental policy study centers and universities. Supporting activities at these centers not only can contribute to the immediate development of new policy and institutional options, but over the long run may also help strengthen the role and practice of environmental public policy analysis. A number of opportunities for immediate action exist.

First, the Chilean Association of Environmental Law (ACHIDAM) and the Center for Development Studies (CED) have proposed formulation of an environmental "blueprint" analyzing new environmental policies, institutions and public participation mechanisms that a new government might adopt. This project will draw on examples of

experience from other countries which could enrich public discussion in Chile. As presently conceived, it involves a participatory process which would include representation of various political, social and economic sectors from both the private and public sectors. It can get underway immediately and would form a foundation for policy reform once a new government is established.

Second, the methods and concerns of resource economics could be introduced into public policy research centers like CIEPLAN (Corporación de Investigaciones Económicas para América Latina). Greater attention to environmental economics is also needed at the sectoral level to encourage the integration of environmental management into economics and development planning. The World Resources Institute is currently seeking a Latin America counterpart to develop case studies on the environmental effects of alternative agricultural policy incentives. CIEPLAN might be receptive to such collaboration. A related project might team the manufacturer's Association (SOFOPA) with CIEPLAN to study the economics of pollution management.

In the mid-term a number of opportunities may exist to work on regional urban environmental policy studies. Both CED and the Institute of Urban Studies at the Catholic University are developing projects in these areas.

In the long-run, A.I.D. strategy might encourage the establishment of an environmental policy center which would finance and conduct basic policy research. Ideas for such a center have been discussed at the Catholic University and CIPMA, and AID/Chile might take the initiative with other donors to explore the feasibility.

Strategic Objective: Foster Research and Analysis on the Environment and Natural Resources

The development of effective policy and environmental management systems ultimately will depend on the quality and quantity of data and information developed through basic research and analyses. In Chile, while the quality of research professionals is generally high and very experienced, interdisciplinary research is generally lacking. Greater integration of basic scientific, social science and economic research is needed and needs to be better applied to the research information requirements of private and public policy makers and managers. Existing information and the results of research need to be more widely available, systematically collected and in forms that indicate the state of the environment. The ENR strategy will support basic multidisciplinary research and analysis that can be applied to more effective management and decision making.

Opportunities for Action

The primary immediate opportunity for action lies in supporting a comprehensive profile environmental inventory. Research and information availability on Chilean environmental conditions is considerable but no overall analytic study has been done that links information on environment and resource issues to economic development.

AID/Chile could foster such a study by working with a number of organizations that have already initiated such research. One is the Catholic University's Institute for Urban Studies (IEU) which just finished an Inventory of Major Environmental Problems in Chile. Developed with regional groups throughout the country, this Inventory is Phase I of a two part analysis of environmental issues. When both phases are complete, they will constitute a unique review of the state of the national environment and may contribute significantly to heightened public policy dialogue and to public awareness.

In addition to the IEU work, the Centro de Estudios del Desarrollo (CED) is working closely with regional development groups -- including CEPLAN in Arica and CODESA in Coyaique, capital of the region of Aisen -- and has proposed to conduct in depth analyses of regional development issues. Both these regions have difficult environmental problems which if well analyzed and documented could provide valuable case-study material to the overall IEU profile. An opportunity exists for AID/Chile to link these two studies into a comprehensive analysis of national environmental issues and policy solutions which could make a valuable contribution to future government programs while strengthening the participating institutions.

Other opportunities which the ENR program might explore in the mid-term involve specific sectoral studies. CIPMA has proposed studies in forestry, mining and fisheries which it would seek to develop with private business participants.

To strengthen the information base on the status of biological resources in Chile, the impact of current conservation efforts and the impact of habitat fragmentation in maintaining biological communities, A.I.D. support could be given to the University of Chile to complete the Flora of Chile. These initiatives should be coordinated with CONAFF and CODEFF which are already active in this area. CODEFF might also be a candidate for funding from S&T/FENR's Conservation of Biological Diversity Project.

In the longer term, AID/Chile may look to support further sectoral analysis as well as scientific research on biological diversity and environmental health. A Conservation Data Center (CDC) might be established with assistance from The Nature Conservancy. Collaborative relationships could continue to be encouraged

between the U.S. Environmental Protection Agency and the governmental authorities responsible for air quality control in Santiago such as through environmental risk communication workshop.

Strategic Objective: Support Activities in Environmental Education, Training and Public Awareness

This objective of the ENR strategy addresses the educational requirements for improving environmental policy making and management. As noted earlier, although university education in the natural sciences, economics and the other social sciences is advanced in Chile, interdisciplinary environmental studies are relatively new, and the links between university-based research and public or business sector applications are relatively weak. Similarly, environmental training is needed for community development workers and/or extension agents working in rural areas. Along with specialized training concerns, greater public understanding of the complexities, potential hazards, costs and possible solutions to environmental problems is needed.

Opportunities for Action

Numerous opportunities are open to AID/Chile in this area if adequate funding can be found. Chile's universities are increasingly interested in the field, and a number of NGO's and training centers are interested in carrying out environmental education, training programs, as well as public awareness campaigns. In the near-term, several initiatives may be supported.

In the first case, the University of Concepción is interested in holding workshops on Coastal Resources Management and Environmental/Natural Resources Economics in conjunction with its Bio-Bio Watershed Study. This offers an excellent opportunity to introduce resource economics into the methodology of the Bio-Bio Study and to establish a cooperative link between the University and A.I.D.'s Coastal Resources Management Project in Ecuador and the University of Rhode Island. These workshops could begin in the near future.

Secondly, opportunities may exist for A.I.D. and USIS/Chile to work together to sponsor university-level seminars and/or exchanges which focus on environmental management, resource economics, and other questions of public environmental policy. Such collaboration could help initiate a longer term program with a Chilean university or research center.

Other activities may be considered in the near term to heighten public awareness and sensitize the business community. The first is funding the publication of the Environmental Inventory (Phase I) just completed by the Catholic University's Instituto de

Estudios Urbanos. The second is backing an edition of CIPMA's magazine "Ambiente y Desarrollo" which contained selections from the proceedings of the Tercer Encuentro, and the third is to explore the feasibility of securing private sector, possibly AMCHAM funding for a series of television "spots" on environmental problems and solutions in Chile. Television is a powerful medium to heighten public awareness and generate change. These could be joint efforts between business and universities. The Institute of Urban Studies at the Catholic University also has initiated a project of this sort which might bear further exploration.

In the mid to long term, there are a number of specialized training activities which would be productive. In the area of sustainable agriculture, AID/Chile could work with Fundación Chile and the Sociedad Nacional de Agricultores (SNA) to develop a workshop with large-scale growers from the United States who are investigating new, lower-input agriculture production techniques. Issues such as biological control and certification of organic produce for the export market could be discussed. Opportunities may also exist to carry on training in Agro-ecosystem Analysis (AEA) and Rapid Rural Appraisal (RRA) techniques with the training centers at Canelo de Nos or the Instituto de Investigaciones Agropecuarias (INIA) to better integrate sustainability with production goals.

With the private business sector, AID/Chile might explore opportunities to link university or vocational training programs in environmental areas with mining or industrial enterprises. A suggestion has been made by a representative of AMCHAM's environmental committee that private businesses might be interested in supporting the costs of graduate student thesis work on environmental management related to industries.

Business sector involvement in environmental improvement activities also might be enhanced by organizing a high level business roundtable on Environment and Economic Development. Influential senior business figures from the United States and Europe could be drawn together with their Chilean counterparts to discuss these issues and the role of business in pollution management.

Journalism seminars and awards for environment and conservation reporting are another possibility that might be developed with USIS and AMCHAM collaboration. Public awareness of conservation issues and the purpose of national parks could also be supported by working with CONAFF, CODEFF, university departments on the development of interpretative displays and parks access guides.

IMPLEMENTATION

The ENR strategy has been designed as a flexible approach which can adapt to the management capabilities and levels of funding

available to AID/Chile at any particular time. In general, there are three broad approaches available for managing the activities which may be carried out under the strategy.

The first option is for AID/Chile to manage the ENR program with its current staff. Among other activities this will involve: 1) identifying, developing, and evaluating project proposals; 2) negotiating agreements with Chilean grantees; 3) disbursing funds; 4) administering contracts and grants; 5) closing out projects; and 6) developing annual budgets and project descriptions. Whether or not this level of management activity is feasible depends on AID's level of staffing and the number of projects undertaken by the ENR program.

The second option would be to contract directly with a Chilean NGO to manage these ENR activities. While such an arrangement might be administratively feasible, none of the NGO's examined during the development of the strategy had the management capability to carry out such responsibilities. Another, perhaps more important consideration is that any Chilean organization chosen for such a role might be put in a difficult position with regard to other local organizations. This second option, also would not relieve AID/Chile of its routine supervisory tasks.

A third option is similar to the approach AID/Chile already has used to develop the ENR strategy. In that case, A.I.D. bought into S&T/FENR's Environmental Planning and Management Project which is implemented through a cooperative agreement with the World Resources Institute and its Center for International Development and Environment. Under this arrangement WRI started to work with AID/Chile on the definition of the program, managed the contracting and disbursement of funds to CIPMA for the Tercer Encuentro and organized and directed the ENR strategy team. From an administrative and financial management point of view, WRI is responsible to AID/Washington primarily. Other AID Central Programs with which similar arrangements might be made are S&T/FENR's Fragile Lands Project and the Bio-diversity Project.

The advantages of this third option are that AID/Chile is relieved of a considerable administrative burden; can draw on the expertise and core funds of the cooperating institution, and through the good offices of a Washington advocate, may also develop access to other sources of private as well as governmental funding.

Assuming that the cooperating institution has the expertise to work effectively with A.I.D. in Chile, the disadvantages of the arrangement are two fold. First, its cost includes overhead and travel for the cooperating institution that might otherwise go directly to grants or to the presumably lower overhead and administration costs of a Chilean organization. Second, regardless of the expertise of the Cooperating Institution, the fact that it is not based in Chile means that A.I.D. must still

perform certain coordinating functions if the program is to run smoothly.

FUNDING SOURCES

Until specific projects and a management mechanism are selected for an ENR strategy, precise sources for funding its implementation cannot be identified. At this point however the primary sources of program funds are:

- o USAID/Chile
- o S&T/FENR:
 - o EPM Project
 - o Conservation of Biological Diversity Project
 - o Fragile Lands Project
 - o Forestry Support Project
- o LAC Bureau/Development of Environmental Management Systems
- o Other AID programs in housing, health, etc.

While AID/Chile would be expected to "buy-in" to programs such as EPM and the Biological Diversity Project, a certain amount of core funds from these projects may also be available, particularly for technical staff support and travel.

AID/Chile may also be able to mobilize funds from other sources. Though many private foundations with environmental interest are primarily concerned with tropical countries, Chile's return to democracy may stimulate the flow of additional private funds. In addition, as mentioned earlier AID/Chile might be able to leverage additional funds for programs by coordinating with other development assistance donors.

Immediate Action FY90

For FY90, AID/Chile could support several initiatives which may help establish the foundations for the development of environmental policy during the next government. These proposals not only offer the opportunity to foster new research and analysis but also represent projects which will provide participatory forums for the discussion of public policy at the national and regional level. They should be seen as a series of interrelated activities all of which contribute to the basic strategic objectives of the ENR program.

Appendix 1. List of Projects

STRATEGIC OBJECTIVE	ACTIVITY	ORGANIZATION	TIMING	FUNDING SOURCE
Support for Development of Public Policy and Institutional Initiatives for Improving Environmental Quality and Natural Resources Management	Policy and Legislative Study	Asociacion Chilena de Derecho Ambiental (ACHIDAM)	Immed.	USAID/C REM con
	Strengthen resource economics	Corporacion de Investigaciones Economicas para Latinoamerica (CIEPLAN)	Mid	USAID/C WRI
	Santiago Urban Environmental Mngt Studies/Seminar	Centro de Estudios del Desarrollo (CED) & Instituto Estudios Urbanos (IEU)	Mid	AID/H Pvt. Pct
	Economics of Industrial Pollution Management	CIEPLAN/CIDERE SOFOFA	Long	CF/WRI/ REM
	Regional Management of Environment & Natural Resources	CED	Mid	USAID/C REM
	Environment & Natural Resource Accounting	CIEPLAN/CEPAL	Mid	CEPAL
	Fondo para el Medio Ambient	—	Long	USAID/C BID
Foster Research and Analysis on Environment and Natural Resources Management	Phase II Profile and Environmental Inventory	Instituto Estudios Urbanos	Immed	USAID/C REM
	Regional Environmental Profiles	CED/IEU	Immed.	USAID/C REM
	Environmental Info. Center	Centro de Invest. y Planificacion del Medio Ambiente (CIPMA)	Immed.	USAID/C REM
	Studies of Flora & Fauna of Chile	CONAF/CODEFF/U.Chile Fundacion Gay	Immed.	SRT/VER BicDiv.
	Air Quality Data Review Epidemiological Study Review	—	Mid	EPA/ FMO
	Continue Epidemiological Studies	Intendencia	Long	FMO/CD BID

STRATEGIC OBJECTIVE	ACTIVITY	ORGANIZATION	TIMING	FUNDING SOURCE
Poster Research and Analysis on Environment and Natural Resources Management	Study Effects of Global Climate Change on Chile	U.Chile & others	Long	Uncertain
Support Activities in Environmental Education, Training and Public Awareness	Phase I Publication of Environmental Profile	IEU	Immed.	EPM/USIS
	Environment & Natural Resources Seminar Series	USAID & Fulbright	Immed.	USIS
	Coastal Resources Management Seminar	U.Concepcion	Immed.	S&T/FERR CRM Proj. EULA
	Resources Economics Seminar	U.Concepcion/CIEPLAN	Immed.	USIS/WRI
	Ambiente y Desarrollo Revista	CIFMA	Immed.	USAID/C
	Vocational ADC Training Farmers & Farm workers	USAID/C	Immed.	USAID/C
	Informal Env. Education	CINDA/SECAB	Mid.	Uncertain
	Regional Universities Pvt. Sector Env. Studies	AmCham/Mining	Mid	Pvt. Sector
	Sustainable Agriculture Seminar Series	Fundacion Chile SNA	Mid	EPM Pvt.Fdn.
	Training in Rapid Rural Appraisal & Agroecosystem Analysis	INIA and El Cascolo de Nos	Mid.	IAP/EPM
	Environmental Risk Communication Workshop	EPA/Intendencia	Mid	EPA
	Environmental Health Education	CINDA/SECAB	Mid	Uncertain
	Business Roundtable	Private Sector	Mid.	WRI/USIS
Formal Environmental Education	CODEFF/U.Chile	Mid	USAID/C	

STRATEGIC OBJECTIVE	ACTIVITY	ORGANIZATION	TIMING	FUNDING SOURCE
Support Activities in Environmental Education, Training and Public Awareness	Environmental Seminars and Awards for Press	..	Mid	USAID/C USIS
	Pesticide Safety Training	Partners of the American	Mid	USAID/C
	Policy Analysis Center of Excellence	Universities	Long	Pvt. Fdn.
	Regional Universities Environmental Technology Transfer	CNSA	Long	Uncertain
	Park Interpretive Displays & Parks Guide	CONAG, STATE Universities	Long	BioDiv. S&T/FBR

<u>FY90 Activities</u>	<u>Source</u>	<u>Est. cost FY90</u>
1. Develop study of environmental policies, institutional alternatives, and participatory mechanisms. This study involves broad based discussion from a variety of public and private groups. Sponsor is ACHIDAM/CED.	AID/EPM	US\$ 90,000
2. Develop country wide environmental inventory indicators and regional analysis through Catholic University, Instituto de Estudios Urbanos and CODESA, CEPLAN.	AID/EPM others	Phase I Inventory 15-18,000 Phase II Profile 10,000
3. Establish WRI/CIEPLAN research collaboration on economics of agricultural policy incentives.	WRI/CIEPLAN	50,000
4. Introduce natural resources economics methodologies to public policy discussions through seminars with Universidad and/or USIS environmental seminars.	AID/USIS University of Concepcion	10,000
5. Conduct coastal resources management seminar with University of Concepcion (Bio-Bio Watershed Project) and others.	CRM Project EULA	15,000
6. Support completion of Flora and Fauna of Chile with University of Chile. Buffer zone and management of surrounding areas	S&T Biodiversity Project	15-20,000
7. Support operations of CIPMA Environmental Information and Documentation Center	AID/EPM	40,000
8. Initiate arrangements for business roundtable on environment and development.	AID/WRI	--
AID/Chile/EPM total		\$255,000
Other sources total		<u>85,000</u>
GRAND TOTAL		\$350,000

APPENDIX C. LIST OF DOCUMENTS CONSULTED

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