

THE NATURAL AND SOCIAL GEOGRAPHY
OF
ARAUCARIA ARAUCANA

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Alta sobre la tierra
te pusieron,
dura, hermosa araucaria
de los australes
montes,
torre de Chile, punta
del territorio verde,
pabellón del invierno,
nave
de la fragancia.

Pablo Neruda

High above the earth
they put you,
hardy, beautiful araucaria
of the southern
mountains,
tower of Chile, tip
of green territory,
pavilion of winter,
ship
of fragrance

Translated by Author

INTRODUCTION

This thesis assesses the relation of human activities to the distribution and conservation of *Araucaria araucana*, a long-lived conifer found in the Andes of southern South America. It also considers the experience of two indigenous communities. Specifically, it analyzes their use of the tree, changes in this use, their reactions to these changes, and their interest in promoting the conservation of *A. araucaria* in particular and the environment in general. This introductory chapter outlines the conceptual questions addressed in this thesis: environmental conservation and indigenous peoples, and indigenous territorial autonomy within protected areas. The actual nature of the study, including specific objectives, data collection and organization, and methodology, are discussed in the following chapter.

A CONVERGENCE OF INTEREST

The world today faces a variety of critical environmental threats. Some natural resources have been greatly depleted; genetic diversity is being drastically reduced; wildlands are under relentless and increasing pressure; stratospheric ozone depletion and global climatic change pose unprecedented risks; and contaminated air, water and soils are the norm in many places. Continued population growth and economic activity will almost certainly increase the pressure on natural resources and ecological systems.

International organizations, governments, non-governmental organizations, community groups, and individuals have struggled to reverse or reduce the trend of environmental degradation. Environmentalism, so little known some twenty years ago, has developed into a potent force. The United Nations Conference on Environment and

Development in 1992, for which some 106 heads of state traveled to Rio de Janeiro to participate, was the largest gathering of national political leaders in history (Brown 1993). Locally based environmental movements have also escalated in recent years. In an effort to ameliorate environmental insecurity, policy initiatives at various levels have been devised and implemented. Despite manifestations of rising concern and some limited effectiveness, the overall trend of planetary degradation continues.

The world has witnessed the blossoming of another movement over the past two decades. Indigenous peoples have organized to become a powerful lobby, and they are increasingly asserting their rights to self-determination (Gray 1991).¹ One of the main concerns of indigenous peoples is their legal rights to land and resources. In September 1989, the Kuna organized the first Inter-American Indigenous Congress on Natural Resources and the Environment. More than seventy indigenous representatives from seventeen countries met to explore the connections between land rights and natural resource management (Chapin 1992b). States and multinational corporations frequently carry out agricultural colonization plans, construct dams, establish mines, destroy forest cover and extract resources on indigenous lands (Durning 1993).

As environmentalists and policy makers seek ways to halt the trend of environmental degradation, indigenous peoples grope for political empowerment and ways to assert claim to their territory. Clad (1985) reports that the environmental movement and indigenous peoples can be the closest of allies. He states that the issues of land rights and environmental conservation may be approached in a complementary

¹ Defining indigenous peoples is a complicated task. Durning (1993) refers to them as the original inhabitants of an area taken over by powerful outsiders. Indigenous culture is distinct from the country's dominant culture. Most indigenous peoples have a custodial concept of land and resources, and they commonly live in or maintain strong ties to subsistence economies. They are often connected to their land through practical, spiritual, and historical relationships. Durning notes, however, that virtually no indigenous communities remain entirely isolated from national economies and societies, and very few follow the ways of their ancestors unchanged. Self-determination is defined by Gray (1991) as a concept which allows indigenous peoples to live their lives as they wish and develop according to their needs and desires. It implies maintaining control over their land and resources.

fashion. Brandon (1991) writes that conservationists have increasingly promoted the development of mixed-use areas as a way of integrating conservation and the needs of local peoples. Nietschmann (1991) reports that in their efforts to protect habitats and wildlife, conservationists and protected-area specialists are increasingly turning towards indigenous peoples for assistance and collaboration.

INDIGENOUS PEOPLES AND ENVIRONMENTAL STEWARDSHIP.

Bernhardson (1986), in his examination of reconciling conservation and indigenous interests in efforts to protect the vicuña, writes that ecological issues in indigenous communities are a far more powerful reality than they seem in industrial societies. Indigenous peoples, whose life is so intimately tied to their land, must confront these issues on a daily basis. As such, they have developed successful and ecologically sound resource management strategies when they live according to their own cultural premises (Gray 1991).

Nietschmann (1992) writes that in many parts of the world the territories of indigenous peoples coincide with the most pristine natural environments. He points to indigenous homelands and biologically rich environments in lowland tropical South America; eastern Central America; the hills and mountains of mainland and insular Southeast Asia; the mountains of South Asia; the lowland forests of Africa; the northern lands of Europe, Asia and America; and tropical islands and coasts in the Pacific and Indian Oceans. Nietschmann also mentions that the converse is equally noticeable. On non-indigenous lands, environmental degradation, such as massive deforestation, dangerous levels of water pollution, and drastic reductions of genetic diversity, are often the most striking features.

Chapin (1992a), director of the Central American Program for Cultural Survival, a non-profit organization founded in 1972 to help indigenous peoples and ethnic minorities,

has worked with a team at the National Geographic Society to produce a map of indigenous lands and forest cover in Central America. The map clearly shows that indigenous lands are of exceptional ecological value. Chapin notes that the indigenous peoples of Central America "have adapted their way of life to their environment; they know how to use the jungle products while maintaining integrity, with minimal destruction, of the environment" (p. 234).

PROTECTED AREAS AND INDIGENOUS PEOPLES

Protected areas have been an important means of environmental protection and conservation since 1872, when Yellowstone was established as the world's first national park. Many of the planet's remaining natural resources and wildlands have since been incorporated within protected areas. The concept and objectives of protected areas have been defined and redefined over time and according to location. Broadly speaking, today some protected areas place absolute restrictions on resource use and extraction, while others permit controlled and sustainable use which does not threaten the viability of the area's resources. National parks and national reserves are the most common examples of protected areas, but there are a number of other types as well, such as wildlife refuges, private nature reserves and international parks.

Gray (1991) writes that most protected areas are demarcated on a map before any plans are made to deal with the people in or around them. Relocation has been a common strategy. However, Amend and Amend (1992) conclude that relocating people from protected areas, those who were there and used the resources before it was established, is not a feasible approach. When attempted, regulations are often not respected and the procedure can ultimately work against conservation objectives. Clad (1985) reports that those who advocate the creation of protected areas, usually policy makers and environmentalists in urban areas, often lobby for imposing land and resource use

restrictions on local inhabitants. Frequently, such measures preclude resource use by those who depend on these resources for their very survival. Dasmann (1984) indicates that most protected areas of the world have been established without either the advice or consent of the people most likely to be directly affected by their establishment.

Gray (1991) states that the challenge for environmentalists and resource managers is to incorporate human beings within the context of environmental conservation. Those most directly affected by a protected area must fully share its benefits. He makes specific reference to indigenous communities, saying that most plans for protected areas do not address the historical conflict over indigenous resource rights. A successful protected area will involve working with indigenous peoples from the very beginning. Clad (1985), however, writes that the incorporation of indigenous societies into conservation programs and protected areas hinges upon their willingness to participate. Many feel that involvement will compromise land claims, constrain traditional activities, and restrict and threaten resource use.

Nietschmann (1992) indicates there is much rhetoric about the participation of local peoples and communities in conservation projects. He notes that indigenous peoples were conspicuously absent from the IV International Congress on National Parks and Protected Areas in Caracas in February 1992. Gray (1991) reports that large international organizations have ignored or overlooked indigenous rights when considering the survival of the tropical rainforest. The Tropical Forestry Action Plan (TFAP), which is a mechanism to stop deforestation and implement alternative forestry strategies for local peoples in the tropics, was devised by the Food and Agriculture Organization without consulting communities or non-governmental organizations. The TFAP emphasizes the integration of local peoples rather than self-determination and autonomy.

Integrated conservation-development projects (ICDPs) aim to achieve conservation goals by promoting socioeconomic development and providing local people with alternative sources of income that do not threaten resources within protected areas. Brandon (1991) writes that she and two colleagues examined the experience of twenty-one ICDPs.² They found that few are successful in meeting conservation objectives. Few ICDPs have adequate funding, and they tend to be geographically extensive and administratively complex. The authors conclude that one of the most difficult aspects in establishing a successful ICDP is getting local inhabitants to recognize the connection between conservation and development.

Nietschmann (1991) reports that most indigenous peoples are not interested in economic alternatives to resource use, but rather in reestablishing or reinforcing their control and self-determination over their territory. This will allow them to employ their culturally based conservation and resource management strategies effectively. He concludes that self-determination may be the missing element from ICDPs. Perhaps if this concept were used as a starting point in the establishment of protected areas, there would be greater success in achieving the complementary objectives of indigenous autonomy and conservation.

THE MISKITO COAST PROTECTED AREA

The Miskito Coast Protected Area (MCPA) is an attempt to protect 11,000 km² of tropical forests, wetlands and coastal waters in Central America and simultaneously to provide development opportunities for its indigenous caretakers. Nietschmann (1992, 1991) reports on the creation of the project, which is based on the notion that indigenous self-determination and environmental protection are mutually reinforcing. The initiative

² Their work will be reported in Wells, M., Brandon, K., and L. Hannah. *People and Parks: Linking Protected Area Management with Local Communities*. Washington, D.C.: World Bank/World Wildlife Fund/AID, in press.

began when local Miskito communities requested assistance in their struggle against resource pirates, drug traffickers, threats of toxic waste dumping, and plans for strip mining in coastal areas. With the initial support of Nicaragua's Ministry of Natural Resources and Environment and international conservation organizations, seminars with seventy representatives from twenty-three communities were held to discuss possible approaches to the problem. The representatives decided to pursue establishing a protected area. They returned to their respective communities to inform residents and encourage participation in the development of a management plan.

The Miskito have defended their territory for over five hundred years. Nietschmann (1992) writes that this, as well as the area's relative degree of isolation, have been important components in maintaining environmental health and diversity. He goes on to say that in order to develop Miskito communities, their natural resources must be protected. This is ensured by defining ownership and use rights as a necessary first step, which is akin to the process of strengthening self-determination. Nietschmann (1991) writes that the MCPA is "an instrument of self-determination, an affirmation of rights and obligations, a declaration that they [the Miskito] and nature are conterminous and interdependent" (p. 373).

The MCPA may be one of the few cases in the world in which indigenous peoples, conservationists, and a national government initially agreed about a protected area and the means to establish it (Nietschmann 1992). From the outset, it seems to represent an authentic grassroots effort. The support for the creation of the MCPA originally came from Miskito communities, which asserted that strengthening control over traditional land and sea territories was critical to conservation. Perhaps its initial success will serve as an example for other protected areas which truly aim to incorporate indigenous concerns into conservation objectives and plans.

It is inaccurate to assume that indigenous lifestyles are by definition compatible with conservation objectives. Clad (1985) mentions that indigenous peoples employ resource management strategies which are not always ecologically sound. For example, Inuit hunters have used explosive harpoons and the Maori have relied on explosives to stun-kill fish. Clad counters by arguing that contemporary manifestations of traditional indigenous practices often no longer conform to what was once a harmonious prototype.

Gray (1991) writes that indigenous resource management strategies have been criticized because over-hunting often results in species extinction. Such criticism comes from those who assume that with technological means indigenous peoples would be eager to exploit resources for commercial gain and abandon practices which are anchored in their traditions. Gray responds to this criticism by arguing that threats to the environment do not stem from indigenous attempts to live on a sustainable basis.

Chapin (1992b) also addresses critics who argue that indigenous peoples are perfectly capable of wreaking havoc on the environment. He points out that given the opportunity, indigenous peoples in Central America will generally shoot and eat species such as macaws and quetzals, much to the dismay of environmentalists. Indigenous peoples also clear forest to plant crops and gather materials to build houses, as well as cut large trees to make dugout canoes. However, Chapin writes that they engage in these activities because their survival depends on it. He concludes by stating that although they do not always conform to the image of "perfect conservationists," indigenous peoples are usually much more noble environmental stewards than loggers, ranchers and peasant farmers.

The international indigenous movement attributes all ecologically disruptive activities to individualism, materialism, and contact with western societies (Clad 1985). Others lend support to this perspective. Durning (1993) writes that the traditional stewardship arrangements of indigenous peoples have been vulnerable ever since they have had to contend with the pressures of a cash economy, modern technology and encroaching populations. He states that in the face of these circumstances traditional approaches to resource management often collapse as indigenous peoples become prone to overuse and sell off resources to pay for consumer goods. Gray (1991) suggests that environmental degradation is a result of conquest and colonization.

The notion that environmental destruction began with the advent of industrial societies is not universally accepted. Denevan (1992) writes about pre-Columbian environmental conditions in the New World. He discredits the "pristine myth," which contends that in 1492 the Americas comprised a sparsely populated, untouched and unspoiled wilderness. Denevan examines evidence indicating that populations were much larger than previously believed, and he states that Native Americans modified forest composition, created grasslands, and disrupted wildlife. Their actions often resulted in severe erosion. Denevan goes on to say that after the massive disease-related indigenous depopulation, the environment recovered in many areas. He feels that a sound argument can be made that the human imprint on the New World landscape was less perceptible in 1750 than it was in 1492.

NATURE OF STUDY

The previous chapter introduced the conceptual themes of this thesis. This chapter outlines the nature of this study and the fieldwork experience. Specifically, it reviews objectives, data collection and organization, methodology, the relation to the discipline of geography, ethical considerations, and limitations.

OBJECTIVES

The first objective of this thesis is to provide a natural and social geography of *Araucaria araucana*.¹ The tree, which has ornamental, ethnobotanical, ecological, economic, and paleogeographical importance, is found in both Chile and Argentina. However, most studies to date have considered the characteristics and use of araucaria in either Chile or Argentina. There have been few attempts to document its situation in both countries. In fact, most Chileans met during the course of fieldwork were unfamiliar with the tree's plight and use in Argentina, and most Argentines had little knowledge of the Chilean experience. This thesis integrates information and synthesizes fragmented data. It examines both the Chilean and Argentine experience, and considers the factors which might account for any similarities and differences. This part of the case study is largely descriptive. It outlines the physical characteristics of araucaria and the area in which it

¹ Montaldo (1974) reports that *A. araucana* was designated to be typical of the *Araucaria* genus when it was established by the French naturalist Jussieu in 1789. The genus name is after the Chilean region of Arauco and its inhabitants, the Araucanos. The species designation *araucana* is relative to the genus name. *A. araucana* is commonly known in English as the monkey puzzle tree. Other vulgar names include Chilean pine and Neuquén pine. Indigenous inhabitants in the area call the tree pehuen, a word from their native tongue Mapundungu. The most widely understood common name used locally may simply be the generic araucaria. To avoid confusion the remainder of this thesis will adopt araucaria as a vulgar name, except in cases which require clarification between the Araucariaceae family, the *Araucaria* genus, and the species *A. araucana*., e.g., in the discussion of its distribution and paleogeographical significance.

grows, the cultural and economic importance of the tree, the effects of human activities on the health of the species, and efforts to conserve and protect it.

The second objective of this thesis, which stems from the collection and analysis of primary data, is to explore some of the conceptual issues discussed in the introductory chapter. The primary data, collected through open-ended interviews in two indigenous communities, address the indigenous use of araucaria, and the interruption, alteration or threat to this use. The data identify the actual or potential costs and benefits of such change. An effort to assess the indigenous people's interest in and commitment to the protection of araucaria is made, and their assertions of rights to land and resources are also considered.

Santos (1991) indicates that the lives of the indigenous peoples in the area are closely tied to their environment.² Since the deterioration of their environment lowers their quality of life, he concludes that the Araucanos should have a strong interest in protecting and conserving their resource base. In this thesis the applicability of the concepts discussed in the first chapter is considered. With respect to the two communities visited, are the Araucanos effective stewards of araucaria in particular, and their environment in general? What is their role and experience in the establishment and administration of nearby protected areas? Are self-determination and territorial rights important factors in the indigenous interest and participation in the conservation of

² This thesis is concerned with the indigenous inhabitants of Chile and Argentina who in some capacity use araucaria. There is no uniform or consistent terminology making reference to this group. For example, Molina and Correa (1992) call the indigenous inhabitants of the high Andes in Chile's VIIIth and IXth regions Pehuenche. Vargas (1993) refers to them as Pewenche-Mapuche. Valenzuela (1984) calls them mountain Mapuche. During the author's stay in Ralco-Lepoy (Chile), most of the indigenous inhabitants stated that Pehuenche and Mapuche were interchangeable, although one individual insisted that there is a definite distinction. Blanco et al. (1976), in establishing an empirical relationship between distance and genetic identity of indigenous populations in Chile, consider the Mapuche and Pehuenche to be separate peoples. In indigenous communities in southern Argentina nowhere is there self-denomination of Pehuenche. Mapuche is the accepted term. With these factors in mind, Araucano is perhaps the most appropriate, all-inclusive term for the indigenous inhabitants discussed in this thesis. It should be noted, however, that many use this term synonymously with Mapuche, and there are many Araucanos living in southern Chile and Argentina well out of the range of araucaria.

araucaria? To what degree are the findings concerning the environments and indigenous peoples in Central America relevant to diverse localities and contexts? Can analogies be drawn in South America's temperate forests, specifically for two Araucano communities which have traditionally depended on araucaria?

A third objective of this thesis is to generate ideas and propositions for further inquiry. The most valuable research seems to result from repeated visits to an area over an extended period of time. The author hopes to return to the study area to pursue some of the questions raised during the course of this investigation. An agenda for further research is outlined in the concluding chapter.

The fourth and final objective of this thesis is to make a contribution to the geographical literature on the temperate coniferous and broadleaf forests and indigenous peoples of southern Chile and Argentina, which have thus far received very little attention. Of the 6,647 members in the Association of American Geographers, only 30 list their areal proficiency as southern South America. Veblen (1982; with Delmastro 1976) has been the most active North American geographer in the study area for this thesis. His work has focused primarily on biogeography and forest dynamics. It is hoped that the more social orientation of this thesis provides a useful addition to what has otherwise been a dearth of geographical information.

DATA COLLECTION AND ORGANIZATION

The author became interested in this topic during a January 1992 trip to southern Chile. Some time was spent in the upper Bío-Bío watershed, where there had been a conflict over access and use rights to araucaria. There were competing claims between the Araucano community of Quinquén and a large timber company call the Sociedad Galletué. Prior to this trip, the author had been interested in resource conflicts and

indigenous territorial rights through conversations with Richard Griggs, a friend and fellow student in geography at the University of California, Berkeley.

Upon returning from Chile, the author decided to consider not only the Quinquén case per se, but also to undertake a more comprehensive study of the relationship of human activities to the distribution and conservation of araucaria throughout its range in both Chile and Argentina. An associated goal was to examine the findings of Nietschmann (1992, 1991) and Chapin (1992a, 1992b) in relation to the temperate forests of southern South America.

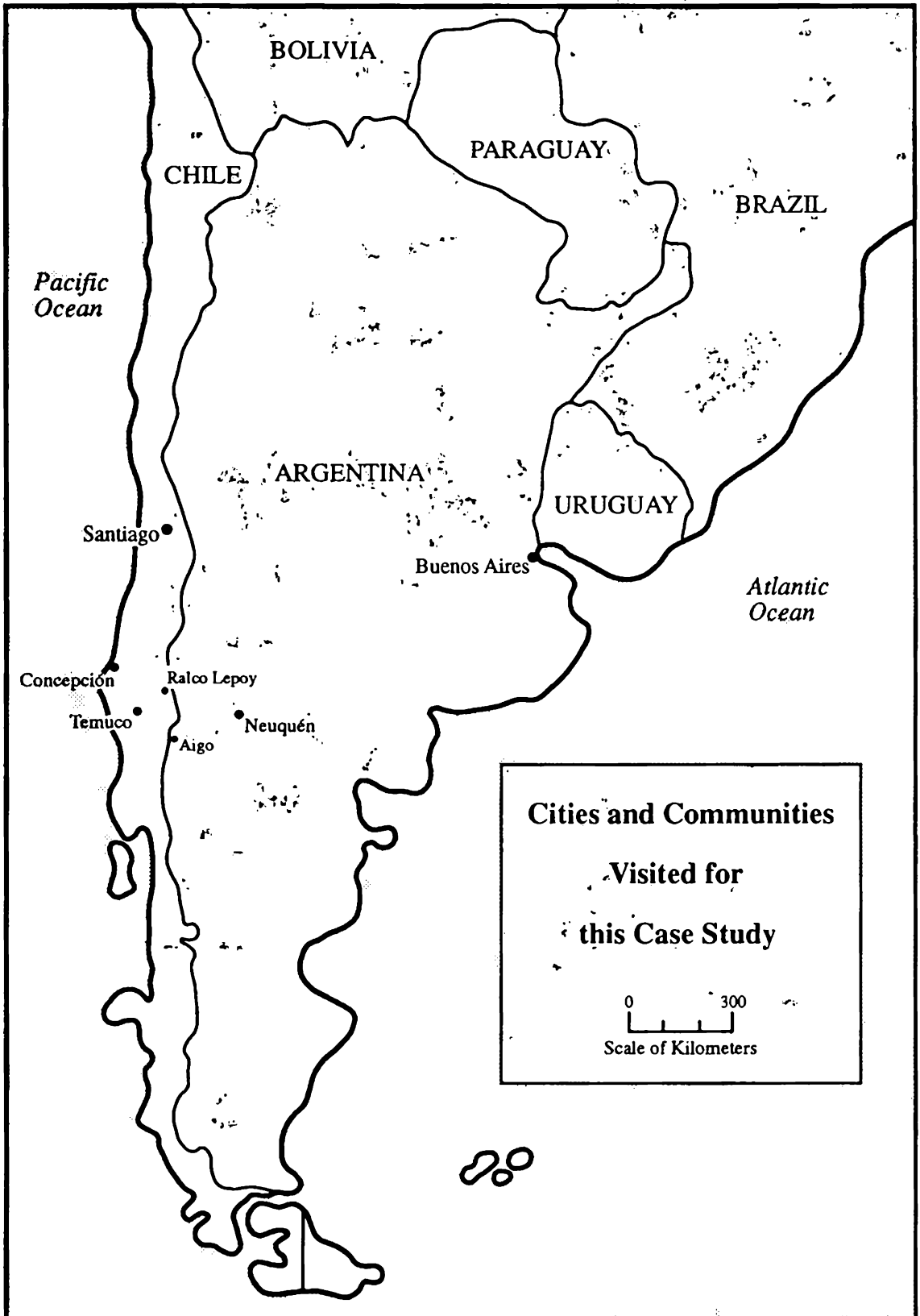
The fieldwork for this thesis was conducted from January through March 1993. It first involved stays in Santiago and Concepción, where background information was collected and contacts were made which allowed the author to select and enter the Araucano community of Ralco Lepoy (Figure 2.1). There the author stayed for twenty-five days. It was then necessary to return to Concepción to follow up on information already collected. Next the author traveled to Temuco, where forestry officials were interviewed and information was obtained from the Departamento de Asuntos Indígenas (DASIN). To begin the fieldwork in Argentina, the author's original intention was to cross an Andean pass and go directly to an Araucano community on the Argentine side of the border. However, there were difficulties in entering these communities unannounced, uninvited, and without the necessary names and contacts. For this reason, and to collect secondary data as well, the author decided to travel first to Buenos Aires and afterwards to the city of Neuquén. Then the Araucano community of Aigo was visited for twenty-five days. The author returned to Neuquén and Buenos Aires to follow up on information collected in Aigo. The fieldwork ended with a second visit to Santiago.

As the research proposal was being written and the research undertaken, flexibility was maintained as a critical component. Problems of data availability, contacts, infrastructure, time and finances were nearly always a concern. Many decisions

had to be made in light of such constraints, and plans and approaches were frequently subject to modification.

Figure 2.1

Figure 2.1



Most of the secondary data in this thesis is presented in Chapters 3 through 6, entitled respectively: The Environmental Context, The Human Context, The Degradation of Araucaria, and The Protection of Araucaria. In general terms, these chapters outline the natural and social geography of araucaria, and compare and contrast the Chilean and Argentine experience when appropriate. They also provide the descriptive context necessary to interpret the primary data collected in Ralco Lepoy and Aigo. Chapter 7, entitled Two Araucano Communities, also contains some secondary data concerning the characteristics and land-tenure history of the two communities.

In Chile, secondary data and maps were collected at the Corporación Nacional Forestal (CONAF), the Instituto Forestal (INFOR), the Comité Nacional pro-Defensa de Fauna y Flora (CODEFF), the Centro de Investigación de Recursos Naturales (CIREN), the Instituto Nacional de Desarrollo Agropecuario (INDAP), the Comisión Especial de Pueblos Indígenas (CEPI), the Departamento de Asuntos Indígenas (DASIN), the Museo del Araucano (Temuco), the Universidad de Chile, and the Universidad de Concepción. In Argentina, data and maps were collected at the Instituto Nacional de Antropología, the Administración de Parques Nacionales, the Instituto Forestal Nacional (IFONA), the Dirección de Recursos Forestales Nativos, the Universidad Nacional de Buenos Aires, the Universidad de Belgrano, the Consejo de Planificación y Acción para el Desarrollo (COPADE), the Dirección General de Bosques y Parques Provinciales (Neuquén), the Dirección General de Tierras y Colonización (Neuquén), the Subsecretaría de Acción Social y Asuntos Indígenas (Neuquén), the Oficina de Leyes y Decretos (Neuquén), and the Universidad Nacional de Comahue. In both Chile and Argentina, written and oral information and maps were also collected from individuals who have worked or who are currently working in the area.

Most of the primary data collected in Ralco Lepoy and Aigo are presented in Chapter 8. The data were collected through open-ended interview questions, and are supplemented by observations. The actual survey instruments, both the original Spanish versions and the English translations, are found in Appendices A through D. The questions are based on the assumption that the indigenous use of *araucaria* has changed or is currently threatened with change. The survey instruments differ slightly for the two communities, as they were modified according to local and historical conditions. The questions and variations are discussed as the primary data are presented.

The interviews usually resembled informal conversations. An effort was made to keep the discussions oriented towards the topics relevant to this study. If more than one individual was present, the author focused on the principal informant, or the individual providing the most information. When appropriate the author assured confidentiality. Permission to take notes during the interviews was requested, and responses were recorded on standardized forms. This procedure was complemented by writing more elaborate notes based on immediate recall after the interviews.

A preliminary questionnaire was made prior to the author's departure for South America. Before the author entered each indigenous community, the questions were reviewed by individuals who had worked there or were familiar with the topic being investigated. The questions were also reviewed by the local school teachers in each community. Furthermore, the author spent the first several days in each community making observations and informally chatting with the Araucanos in an attempt to gather relevant information. This strategy allowed a series of revisions to the original set of questions. With the revised set of questions a pilot interview was conducted in each community. Subsequent revisions were made to develop the final questionnaires. Again, there are slight variations in the final versions for Ralco Lepoy and Aigo. In each community, however, the same questions were asked of all informants.

Obtaining the trust of the informants was critical to collecting primary data. Permission to stay in each community and administer interviews was obtained from the *caciques* as soon as possible after arrival. The author began the interviews after some time had been spent in each community, and efforts were made to develop rapport with community residents. In a very straightforward way, the author told potential informants about his background and motivations for being in the community. Some seemed pleased to provide information, and others were willing, although they often appeared reluctant. Despite the precautions taken, several members declined to be interviewed, and many times the author was asked to return at a more opportune moment. This frequently turned out to be a polite way of declining an interview.

METHODOLOGY

There are a number of different ways one might approach the problem of site selection, determining sample sizes, defining the unit of analysis, and choosing a sample design. Before going into the field the author carefully thought through these approaches. Initially, all were problematic due to the lack of available information. It was assumed that the acquisition of further data in South America would make the process less complicated. This turned out to be the case for site selection, but ultimately had little bearing on sample size, the unit of analysis, or sample design.

Site Selection

There are many Araucano communities in and around the study area. The author originally hoped to visit as many of these as possible. The intention was to collect primary data in geographically dispersed communities, heterogeneous in terms of their size and ecological and socioeconomic characteristics. This would set the study in a comparative framework and allow inter-community analysis of the data.

While the author was able to maintain an element of contrast by visiting one Araucano community in Chile and one in Argentina, a number of constraints made it unfeasible to work in more than two communities. Perhaps the greatest of these was time, but the difficulty involved in entering indigenous communities to do research had also been greatly underestimated. On previous occasions, the author had been in several Araucano communities. People were generally friendly and amenable to conversation. However, the author had gone as a tourist and not a researcher.

The role change would mean a markedly different reception by and relationship with the Araucanos. Over the years they have been used and deceived by government officials, development workers, missionaries, students, and academics. Others have profited from working in their communities, but rarely have the residents themselves seen any tangible benefits of this work. As a result, many have become suspicious of those who enter the community as anything other than tourists. The author was advised to exercise extreme caution and patience. With this in mind, the author decided to pare down the number of communities selected for primary data collection. Visiting two communities and understanding the issues well were preferable to grossly infringing upon the rights of many and acquiring only superficial appreciation of their situations.

The community of Ralco Lepoy was selected in consultation with three Chilean geographers. Raúl Molina, of the Comisión Especial de Pueblos Indígenas (CEPI), recommended Ralco Lepoy because the inhabitants had a strong relation with araucaria. Rodrigo Vargas, a geography student at the Universidad de Chile who has recently completed a thesis on resource use in Ralco Lepoy and a neighboring community, provided the author with valuable background information, including a map of the individual landholdings in Ralco Lepoy and a list containing the names of heads of families. Gerardo Azócar, a doctoral student in geography at the Universidad de Concepción, recommended that Ralco Lepoy be selected because it has received little

attention compared to other Araucano communities. All three individuals provided the author with key names and contacts in the study area.

On one hand, accessible information was perhaps the most important criterion in the author's selection of Ralco Lepoy. However, an additional factor was also crucial. Ralco Lepoy shares a border with the Ralco National Reserve, a protected area administered by the Corporación Nacional Forestal (CONAF). The Araucanos use the land and resources of this area. Ralco Lepoy's adjacency to the Ralco National Reserve facilitated addressing one research objective, consideration of indigenous territorial rights within protected areas.

In Argentina site selection was done in consultation with Juan Carlos Radovich, an anthropologist at the Instituto Nacional de Antropología, another anthropologist named Raúl Aranda from the Museo Provincial Gregorio Álvarez (Neuquén), and a school teacher, Daniel Pérez, who had spent seven years teaching in Araucano communities. All three were helpful in providing the names of important contacts in the community of Aigo, such as the cacique, the school teachers, and likely key informants. Also, the author obtained census information for the eighty-five families in the community from the Subsecretaría de Acción Social y Asuntos Indígenas in Neuquén. A map of Aigo was provided by Neuquén's Dirección General de Tierras y Colonización.

The availability of information, as in Ralco Lepoy, was a critical factor in deciding to work in Aigo. Also, nearly half of the families in Aigo reside permanently within Lanin National Park, and during the summer months most residents of the community use national park land and resources. This facilitated an examination of indigenous territorial rights within protected areas in yet another locality and context. It also allowed for a comparison of protected areas between Chile and Argentina.

Sample Size

The author originally planned to conduct enough interviews to yield a representative sample of the residents of a selected community. Using the hypothetical example of community X, which has 136 units, a sample size can be calculated based on the equations outlined by Sheskin (1985). For a 95% confidence level and a 5% confidence interval, one would need to conduct 73 interviews. Sheskin provides a method for making adjustments in small populations, which is applicable in this hypothetical case. Making this adjustment, one would need to conduct 48 interviews in community X to obtain a representative sample.

Before leaving for South America, the author estimated that it might be possible to conduct a total of some 200 interviews. It soon became apparent that this figure was unrealistically high given the time allotted for the collection of primary data. The interviews themselves did not take a long time. They ranged only from one to three hours in duration. However, distances within the communities were substantial; and the author had no motorized or animal transport. Also, the summer months involve much work for the Araucanos. They were frequently collecting fuelwood or *piñones*,³ tending their animals, cutting grass, or harvesting crops. Furthermore, as noted above, some people were not willing to be interviewed, and many requested a return visit. On several days as many as six attempts were made to get an interview with no success.

A total of 48 interviews (25 in Ralco Lepoy and 23 in Aigo) were conducted for this case study.⁴ Throughout the research process it was necessary to organize time carefully. A truly representative sample of adults just for the community of Ralco Lepoy would have meant at least 150 interviews. The author simply did his best to conduct as many interviews as possible in the allotted amount of time. A sample size calculation

³ These are the nuts of the *araucaria* tree.

⁴ The total number of 48 has no relation to the hypothetical example in community X discussed in the paragraph above.

was not feasible, meaning that the numbers for this case study are not statistically representative.

Unit of Analysis

A problem that has plagued many investigators at the outset of case studies is defining the unit of analysis (Yin 1989). This was another issue the author thought about before going into the field. Initially it was planned to use the individual as a unit of analysis. However, there were concerns about a male researcher interviewing women and establishing an age criteria for those to be interviewed. Would it be possible to speak with women? Would an adolescent of thirteen years be too young to interview? Upon raising these questions in a course on field research methods, it was suggested that the household be used as the unit of analysis. It was pointed out that this might provide a clearer overall picture, as well as eliminate the need to screen individuals by age. However, there are drawbacks in using the household as the unit of analysis. One problem lies in the difficulty inherent in defining a household. Is it defined as those who live under one roof, as those who pool income and share expenses, as those with certain kin relationships, or by some other criteria? Also, interviewing men from some households and women from others does not yield comparable data.

The author left for South America expecting that the unit of analysis for this study would depend on the nature, accuracy, and availability of population lists for the sites selected. Although the unit of analysis finally used is the individual, a methodological decision was never really required. It is explained below how and why the author settled on interviewing any individual able and willing to be interviewed.

Sample Design

The author also thought about various approaches to sample design before going into the field. Since obtaining a reliable random sample from something like a telephone directory would not be possible, drawing names or households from a hat with the help of the cacique was considered. An alternative was to assign a number to each unit and use a table of random numbers to draw the final sample.

In Santiago the author obtained a list of heads of family in Ralco Lepoy. It was assumed that this would make the sample design issue much less complicated than initially anticipated. The list came with a map of individual landholdings which had been recently assigned in the community. The information was generated by the Instituto Nacional de Desarrollo Agropecuario (INDAP).

Upon arrival in Ralco Lepoy, the author divided the community into four sectors. Heads of family in each sector were assigned a number and numbers were drawn at random. This provided a random sample in each sector. The approach was soon abandoned for a number of reasons. The author was informed by a local school teacher, Juan Parra, that not every head of family was on the list because when the land was subdivided some individuals were excluded. Others on the list had died, and many were working outside the community. Furthermore, Juan Parra stated that some of the individuals selected would definitely not consent to being interviewed.

The author allotted some twenty-five days in Ralco Lepoy for the collection of primary data. The intention was to obtain sufficient information within the limited time available, and not spend more time than necessary locating potential informants. With this in mind, and in consultation with Juan Parra, a list of available individuals likely to provide information was made. The author chose many informants from this list. Some individuals met during the course of daily life in the community, e.g., along a path or road, were also interviewed. Ultimately, the author interviewed anyone willing to be interviewed, although an attempt was made to give adequate spatial coverage to the

community. By no means is the sample population in Ralco Lepoy statistically representative of the community at large.

In Ralco Lepoy it was difficult for the author to speak with women, even when accompanied by his wife. Women were generally reluctant to speak, regardless of their husband's presence. Only one of twenty-five informants was female. Manuel Neicuman, the cacique, and Antonio Ancanao, his secretary, were the key informants in Ralco Lepoy. Although they discussed many of the key questions found in the survey instrument, they were not asked the interview questions per se. As a result the information from them is not tabulated, but rather serves to supplement the data obtained through the twenty-five systematic interviews. Also, the key questions were asked of two settlers living in Ralco Lepoy to see if there were any obvious differences between their perspective and that of the Araucanos. This information is not tabulated in the data analysis.

The sample design experience in Aigo differed very little from the approach used in Ralco Lepoy. Initially, census information was obtained for Aigo from the Subsecretaría de Acción Social y Asuntos Indígenas in Neuquén. The census data were several years old, however, and reliability was a problem. The author discovered that some families were counted twice. With this in mind, and considering the time limitation (twenty-five days were also allotted for primary data collection in Aigo), as well as the author's intention to obtain information rather than unsuccessfully chase after elusive informants, a list of those likely to provide information was made in consultation with the director of the local school, Adrian Lima. Ultimately, the author spoke with any individual willing to be interviewed. Many informants were from the list and some were not. The sample population in Aigo is not statistically representative of the entire community.

People were generally more evasive and harder to interview in Aigo than Ralco Lepoy. Aigo has been the subject of much more study. In 1969 a documentary film on the community was made and received much attention throughout Argentina. This was influential in the subsequent influx of researchers, development workers, governmental authorities, and tourists. As a result, perhaps Aigo residents are more suspicious of and less likely to cooperate with outsiders. A number of potential informants agreed to speak only if they were paid for the information (the author politely declined). In Aigo, however, it was possible to speak with more women. Five of twenty-three informants were female. There were two key informants in Aigo, the cacique Amaranto Aigo and Desiderio Calfinahuel. They were systematically interviewed and their responses are tabulated in the data analysis. This was part of an effort to have approximately an equal number of interviews in both communities. Amaranto Aigo and Desiderio Calfinahuel were designated as key informants because they seemed frank and knowledgeable, and repeated visits were made to clarify and cross-check information obtained elsewhere.

RELATION TO THE DISCIPLINE

Bryant (1992) reviews current research in political ecology, which he broadly defines as the political sources, conditions and ramifications of environmental change. There are three major themes within this emerging field of study: (1) contextual sources of environmental change; (2) conflict over access to resources; and (3) the political ramifications of environmental change. This thesis is related to the second theme, conflict over access to resources. In more general terms, the competing actors are the state, the private sector, environmentalists, and indigenous peoples. In more specific terms, special attention is paid to territorial and resource conflicts between the Araucanos and protected areas, which are administered by the states of Chile and Argentina.

The interruption, alteration or threat to the indigenous use of araucaria may be understood in light of core-periphery relationships. The land and the resources of the Araucanos (the periphery), to which they have a historical claim, have been expropriated and annexed to maintain the viability of states (the core). Dominion over these resources has been asserted through military conquest, legal decrees, and forced acculturation. The periphery has had little or no say in this process. Much of this conceptual framework stems from Nietschmann's research, especially a 1986 article entitled "Economic Development by Invasion of Indigenous Nations." Although Bryant (1992) overlooks Nietschmann in his literature survey, Robinson (1989) points out that he has been at the forefront in looking at national and indigenous rights in the context of dominant state mechanisms or systems.

This thesis is also related to biogeography, as it considers the role of humans in modifying the distribution of araucaria. The effects that diverse interpretations and processes have had on the occurrence and conservation of araucaria are discussed. Taking this one step further, Veblen (1989) points out that biogeography provides an effective link between human and physical geography. In doing so he mentions that ethnobiogeography is strongly linked with cultural ecology. This research fits well within Butzer's (1989:192) description of cultural ecology, which "draws upon interdisciplinary roots within geography and anthropology in seeking to understand the interrelationships between people, resources and space."

ETHICAL CONSIDERATIONS

Ethical conduct in social science research has centered on problems in research sponsorship; research-participant relations; and the collection, analysis and dissemination of data (Burgess 1988). Specific concerns have been state interference, risks or costs and

benefits to the participants, covert research, and justification. One of the principal questions regarding this thesis is justification.

The collection of primary data for this case study raises the following questions:

(1) What right does the author have to study and record the perceptions and thoughts of his informants? (2) How will the communities of Ralco Lepoy and Aigo benefit from this thesis? In responding to these questions, the author hopes that this research will provide a vehicle to voice Araucano perceptions to a wider audience. Such work could ultimately result in incorporating their concerns into policy and decision making, which could be of some benefit to the participants.⁵ Also, the author is committed to sending a summary of the results (in Spanish) along with maps to the schools in Ralco Lepoy and Aigo. This will allow the teachers to transmit the information to students and community members.

LIMITATIONS

The principal methodological limitation of this thesis has already been mentioned. The sample populations are not statistically representative. An additional limitation concerns the reliability of some of the secondary data. Also, in collecting primary data it was necessary to be very sensitive about interviewing women. Most situations did not allow for this. Men are generally the undisputed heads of household in these communities, and they are very protective of women. Great caution was exercised to avoid violating cultural norms and practices of all kinds, and special attention was paid to avoid speaking with women inappropriately.

Still another limitation of this study is that the Araucanos' temporal, spatial, and measurement scales differ radically from those of the author. The accuracy of the quantitative data collected through interviews must be interpreted with great caution, as

⁵ As this is a master's thesis, it is not suggested that this is anything more than a remote possibility, but rather the research may be justified along these lines.

should the results which make reference to time. All locational questions proved to be of little value, primarily because the informants provided few specifics. For this reason this thesis does not contain any maps based on the primary data. During the interviews it was also difficult to keep informants focused on their individual experiences. Many wanted to speak for others or for the experience of the community as a whole. Getting every informant to understand every question well was also problematic, despite the number of different words and formations tried. Not all informants were able to answer every question. Also, it was often difficult to keep the informants focused on the interview questions. When more than one individual was present, group conversation sometimes influenced the responses of the principal informant. At times, in informants' attempts to be polite, it appeared as if they were telling the author what they thought he wanted to hear.

In spite of the limitations and constraints of this case study, there is still value in the information presented in the following chapters. Again, for the first time it synthesizes data and information available in Chile and Argentina, and it explores some findings from the tropical forests of Central America in relation to the temperate forests of southern South America.

THE ENVIRONMENTAL CONTEXT

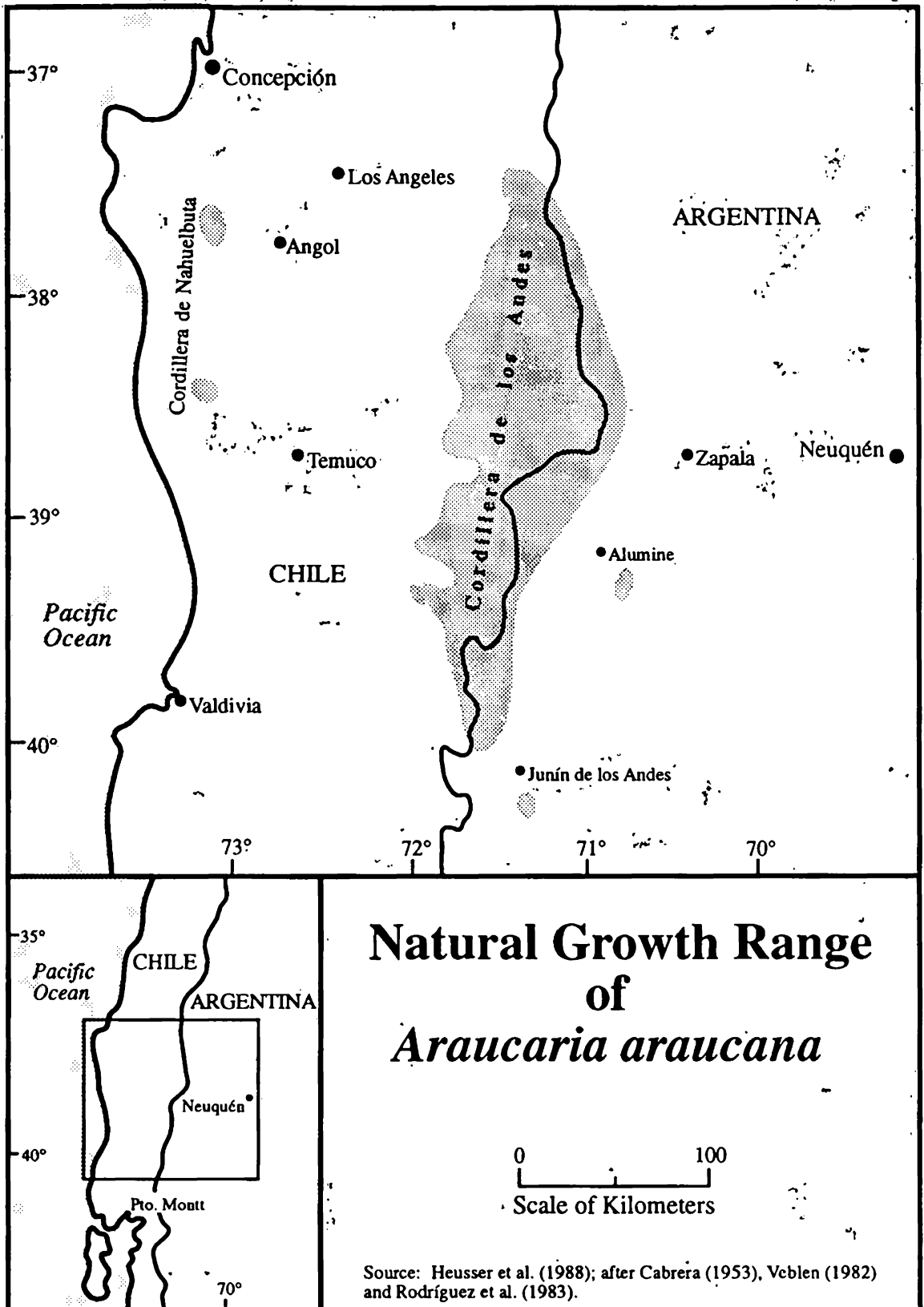
This chapter reviews the physical characteristics of *araucaria* and the area in which it grows. To fully appreciate the human use and conservation of the tree, it is necessary to have a basic understanding of its natural history. Specifically, this chapter discusses the distribution of *araucaria*; its paleogeographical significance; climatic and edaphic conditions; altitudinal range; vegetative associations; growth, form and structure; and reproduction and regeneration.

DISTRIBUTION

Araucaria araucana is endemic to the northern extremes of the temperate subantarctic forests in Chile and Argentina. Of the seventeen species in the *Araucaria* genus discussed by Serra and Gajardo (1988), *A. araucana* is the only frost-tolerant species. Most of the remaining species are found in subtropical environments of Australia, Norfolk Island, New Caledonia and New Guinea. The only other species found in South America is *A. angustifolia*, which grows in the northeastern Argentine province of Misiones and adjacent areas of Brazil and Paraguay.

The main natural growth range for *araucaria* (Figure 3.1) in Chile is in the high Andes from latitude 37°30'S to 39°30'S. Two disjunct populations also occur in the Nahuelbuta Range about 125 km west of the Andean range. In Argentina *araucaria* is found in the Andes and Andean pre-cordillera from latitude 37°45'S to 40°20'S (Veblen 1982). Rodríguez et al. (1983) suggest there are morphological variations between trees found in the Andes and the Nahuelbuta Range, but not enough to make a taxonomical distinction.

Figure 3.1



Although this thesis is concerned with the natural growth range of *araucaria*, especially the main Andean range, it should be mentioned that *araucaria* has long been an important ornamental plant in many parts of the world. Montaldo (1974) reports that the tree was introduced in England in 1795, and has subsequently been planted in a number of other European countries, the United States, South Africa, India, the Azores, Algeria and along the Black Sea coast. Montaldo does not describe the extent or size of introduced *araucaria* populations.

In the literature search the oldest map of *araucaria* distribution found is from Angli's (1918) comprehensive study of *araucaria* resin (Figure 3.2). His map shows a continuous distribution, as opposed to disjunct populations, of *araucaria* in the Nahuelbuta Range. He also failed to map the existence of isolated *araucaria* stands to the south and southeast of its main range in Argentina. At such small scales, and given concerns about cartographic accuracy and classification, it is difficult to reach any definite conclusions about differences in representation. Overall, perhaps excepting the situation in the Nahuelbuta Range, Angli's representation does not vary significantly from the generally accepted distribution today.

It would be inaccurate, however, to conclude that there have not been differences in representing and interpreting the distribution of *araucaria* over the years. One noteworthy example is the 1967 Instituto Forestal inventory, which states that in Chile there are 145,000 ha of *araucaria* forest, and the 1987 study (Bascur et al.), which concludes there are 315,000 ha. The former study classified a hectare of *araucaria* forest type if at least 20% of the trees were *araucaria*. The latter inventory mapped forest cover as the *araucaria* type if a hectare contained at least one *araucaria* tree.¹ There has

¹ According to the Bascur et al. study some 300,000 ha are found in the Chilean Andes and 15,000 ha in the Nahuelbuta Range. Rothkugel (1916) mentions 82,000 ha of *araucaria* forest in Argentina, although he does not discuss his classification system. Nevertheless, this figure is found in nearly all studies to date on the Argentine population. One may generally conclude there are approximately 400,000 ha of land on this planet which contain at least one naturally occurring *araucaria* tree.

also been controversy regarding the southern limit of araucaria's natural growth range in Argentina. Tortorelli (1942) puts the southern limit at Lake Lolog (latitude 40°03'S), claiming that an isolated stand at Lake Melequina (latitude 40°20'S) was planted. In a subsequent publication, Tortorelli (1956) contradicts himself by making reference to a natural old-growth stand of 112 trees at latitude 40°20'S. Alfonso (1941) found only seven araucaria trees south of latitude 40°03'S, including one near Lake Nahuel Huapi (latitude 40°47'S). Eloy López Cepero, from the Dirección General de Bosques y Parques Provinciales in Neuquén, believes the true southern limit is in the vicinity of Lake Tromen (latitude 39°32'S), noting that beyond this breaks in araucaria distribution are no longer attributable to factors other than summits and fire scars (pers. com. March 1993).

PALEOGEOGRAPHY

Serra and Gajardo (1988) mention that the Araucariaceae family was much more numerous, more diverse, and enjoyed a greater distribution during the Mesozoic.² In their detailed paleobotanical treatise, they claim that *Araucaria araucana* is a relic, meaning that the species is in a natural process of extinction. The authors cite Cerceau-Larrival (1968), who agrees the species once had a wider distribution, but since the Tertiary its geographic extent has been greatly reduced. Schmithüsen (1960) also feels that *A. araucana* is a relic which can no longer effectively compete with broad-leaved species.

Burns (1991) and Veblen (1982) refute the notion that *Araucaria araucana* is currently in regression. Their research on regeneration dynamics of *A. araucana* indicates that the species does not employ a competition-avoidance strategy and there is no trend of species replacement. Heusser et al. (1988) support their conclusion that *A.*

² Seward and Ford (1906) report the former existence of araucaria species in South America, North America, Antarctica, West Africa, southern Africa, Madagascar, India, New Zealand, Australia, Tasmania, New Caledonia, New Guinea, and Europe.

araucana has an adaptive ability to endure change. Its persistence through geologic ages has resulted from an equilibrium strategy, which has allowed the species to recover after frequent low-level disturbances such as fire, lava flows, ash falls and snow avalanches. In a 1983 grant proposal Heusser suggests that the current bicentric distribution is a result of migration during past glaciations.

There is no consensus on the paleogeographical interpretation of *Araucaria araucana*. However, its presence in the fossil record over some 200 million years has made it an important object of inquiry in attempts to reconstruct past environments and climate (Heusser 1988; Serra and Gajardo 1988; Cerceau-Larival 1968).

CLIMATIC AND EDAPHIC CONDITIONS

Despite its relatively small natural growth range, *araucaria* can persist under varied climatic and edaphic conditions. The climate can generally be characterized as west coast maritime, with a mild Mediterranean influence and a winter maximum in precipitation. Veblen (1982) writes of an annual precipitation range from 1200 mm on the Argentine side of the Andean Divide to over 4000 mm on west-facing slopes of the Chilean side. The northern part of the main range experiences a more pronounced summer dry period, which Veblen contends is responsible for a relatively sparse understory in northerly stands. Montaldo (1974) has looked at temperature data from ten meteorological stations in the area and reports a mean January temperature of 17°C and a mean July temperature of 4°C. *Araucaria* is capable of withstanding extremes much more pronounced than these temperatures. Maiz (1987) and Heusser (1983) conclude that *araucaria* favors equator-facing slopes, being adapted to stronger solar insolation,³ and west-facing slopes perhaps as a result of its preference for increased humidity. *Araucaria* grows primarily on thin, volcanically derived soils, although some *araucaria* are found on

³ *Araucaria*'s main competitor, *Nothofagus* sps., thrives on polar-facing slopes.

soils with granitic bedrock in the Nahuelbuta Range (Heusser 1983). Also, Serra and Gajardo (1988) note that in the Nahuelbuta Range *araucaria* is occasionally found on soils derived from sedimentary rocks, and Peralta (1980) points to cases in the Andes in which the tree is found on well-developed soils derived from metamorphic or sedimentary rocks.

ALTITUDINAL RANGE

Araucaria exhibits a relatively wide altitudinal range. Montaldo (1974) reports that the northern population of the Nahuelbuta Range is found between 1000 and 1400 m, and the southern Nahuelbuta population is found at 600 m.⁴ In the Andes *araucaria* generally grows between 900 and 1800 m, although Montaldo contends that isolated trees have been found close to 2000 m. Veblen (1982) mentions that in the northern part of its Andean range *araucaria* extends to timberline at 1800 m, while in the southern part it generally reaches timberline at 1500 m. He states that *araucaria* can be found as low as 600 m, especially on the Argentine side.⁵ Ideal conditions for *araucaria* are generally found between 1300 and 1600 m (Heusser 1983). *Araucaria* grows very well on steep slopes, where precipitation and wind are often intense (Montaldo 1974).⁶

VEGETATIVE ASSOCIATIONS

Araucaria grows in both pure and mixed stands. Pure stands, often with little or no understory, are found near timberline or in isolated pockets along the forest-steppe ecotone in Argentina (Tortorelli 1942). The heterogeneity of mixed stands makes it hard to generalize about their composition, which varies according to zone, elevation and aspect (Cortés Salas 1979). However, several of the principal vegetative associations can

⁴ In a 1951 study Montaldo mentions southern Nahuelbuta *araucaria* as low as 500 m.

⁵ Veblen discusses the possibility of *araucaria*'s natural distribution being altered by indigenous planting. This may account for chance and isolated patches found at 600 m.

⁶ For this reason the tree is especially important for erosion control and wildlife habitats.

be pointed out. In mixed stands araucaria is commonly associated with *Nothofagus* sps., or southern beech. Rodríguez et al. (1983) write that in mixed stands at higher Andean elevations araucaria grows with *N. antarctica* (ñirre) and *N. pumilio* (lenga). At intermediate elevations araucaria is often associated with lenga and the evergreen *N. dombeyi* (coigüe). At lower elevations araucaria is found with *N. obliqua* (roble) and *N. alpina* (raulí). In the Nahuelbuta Range araucaria grows primarily with coigüe. *Chusquea coleu* (caña de colihue) is a common understory species of mixed stands, especially in the southern part of the Andean population (Heusser 1983).

GROWTH, FORM AND STRUCTURE

In addition to being the northernmost Andean tree in the Coniferae order (Kozdon 1956), araucaria is a very long-lived conifer. Schmidt et al. (1980) claim some araucarias live to be nearly 2000 years old, although a more commonly accepted figure is Montaldo's (1974) age limit of 1300 years. Cuevas (1983) states that a typical tree is anywhere from 250 to 400 years old.

With time araucaria develops a robust and massive stature, occasionally having columnar trunks nearly 50 m high and basal diameters of 2.5 m (Rodríguez et al. 1983). Veblen and Delmastro (1976) write that the most common height is from 25 to 35 m with a basal diameter ranging from 1 to 1.5 m. Until a tree reaches 500 years, it grows at an average annual rate of 2.71 mm in diameter, 8.2 cm in height and from 5 to 6 m³ in volume. In the later years of a tree's life, this growth tapers off (Schmidt et al. 1980).

The juvenile form of araucaria looks like a pyramid or cone until it begins to lose its lower branches after 100 years (Appendix E). Between three and seven lateral branches extend from the trunk at regular intervals and arch upwards, with the lower ones being longer than the branches above. The mature form resembles an umbrella, with a well-defined crown 20 to 30 m above the ground (Appendix F). Its branches extend from

the trunk and dip gently towards the ground before arching slightly back up. *Araucaria* leaves are perennial, rigid, 2 to 3 cm long, spiraled, pointed, and shiny, with stomata on each side (Rodríguez et al. 1983). The trunk initially has leaves but sheds them with time (Montaldo 1974).

Araucaria has a thick, fire-resistant bark, which on older trees can be up to 20 cm thick (Heusser 1983).⁷ It develops in polygonal plaques, taking the appearance of a turtle shell. The exterior part is extremely hard, and the interior is soft and resinous (Nielsen 1963). Angli (1918) thoroughly reviews the properties of *araucaria* resin. It is transparent, pasty, sticky to touch, pleasant smelling and bitter tasting, and is quite volatile if heated to 85°C. The resin provides a defense for the tree, as it hardens upon exposure to air and keeps out microorganisms.

Araucaria has a superficial root system. Tortorelli (1942) measured a tree with a 90 cm basal diameter and found the roots extended 35 m from the base of the tree. The roots are well adapted to take advantage of interstices and fissures, and the root system is much more massive and extensive than the exposed portion of the plant. A two-month old seedling 5 cm in height can have 30 cm of roots below the surface (Montaldo 1974). Kozdon (1958) concludes that after two years the roots of an *araucaria* are fifteen to twenty times longer than the part above ground.

REPRODUCTION AND REGENERATION

Araucaria is a dioecious species, meaning that archegonia and antheridia are found on separate trees.⁸ Rodríguez et al. (1983) summarize the sexual reproductive process. Flowers on the masculine trees appear in August and September. They are

⁷ Although *araucaria* is considered to be quite fire resistant, considerable heat and wind can result in its destruction. Heat of at least 500°C is needed for five to seven minutes to kill an *araucaria* (D. Cozzo, Professor Emeritus, Universidad Nacional de Buenos Aires, pers. com. February 1993).

⁸ Serra and Gajardo (1988) report that on occasion monoecious examples are found. This was confirmed through a field observation by the author.

chestnut in color, 8-12 cm long and 4-5 cm in diameter and contain 10-20 pollen sacks in the center. Flowers on the feminine trees appear towards the end of November. Wind is the key agent in fertilization, which usually takes place in December or January. The cones develop very little until the last six months before maturation, which requires two vegetative periods.⁹ Feminine cones range from 15 to 20 cm in diameter and contain 120-180 seeds (Appendix G). The seeds resemble a light-colored, large almond, being 4-5 cm long and 1.5 cm wide (Appendix H). Seed production, which varies considerably from year to year, is notably affected by wind and rain, as are most anemophilous species. Seed dispersion is primarily through birds and rodents, and viability is limited to 90-120 days. Germination takes place after snow melts in September or October (Tortorelli 1942). The age of first fruition is around 25 years, although some precocious plants have been observed to fructify at 15 years (Benoit 1992).

Seed regeneration is generally poor, due to low dispersal rates and short seed viability. Also, only 20% of the seeds produced are fertile and many seeds get caught in the forest understory or fall on top of araucaria leaves (Rodríguez et al. 1983). However, seed regeneration is complemented by vegetative reproduction, which is a very effective strategy. Veblen (1982) concludes that sprouting and root suckering are very important in araucaria regeneration. Seed regeneration and vegetative reproduction taken together allow one to consider araucaria as having a very good natural regeneration capacity (D. Cozzo, pers. com. February 1993). Veblen and Delmastro (1976) support this by observing that trees of all ages are found throughout araucaria's habitat.

⁹ Maturation generally occurs 16-18 months after fertilization. Araucaria is one of the few conifers with a biannual production cycle (Kozdon 1958).

THE HUMAN CONTEXT

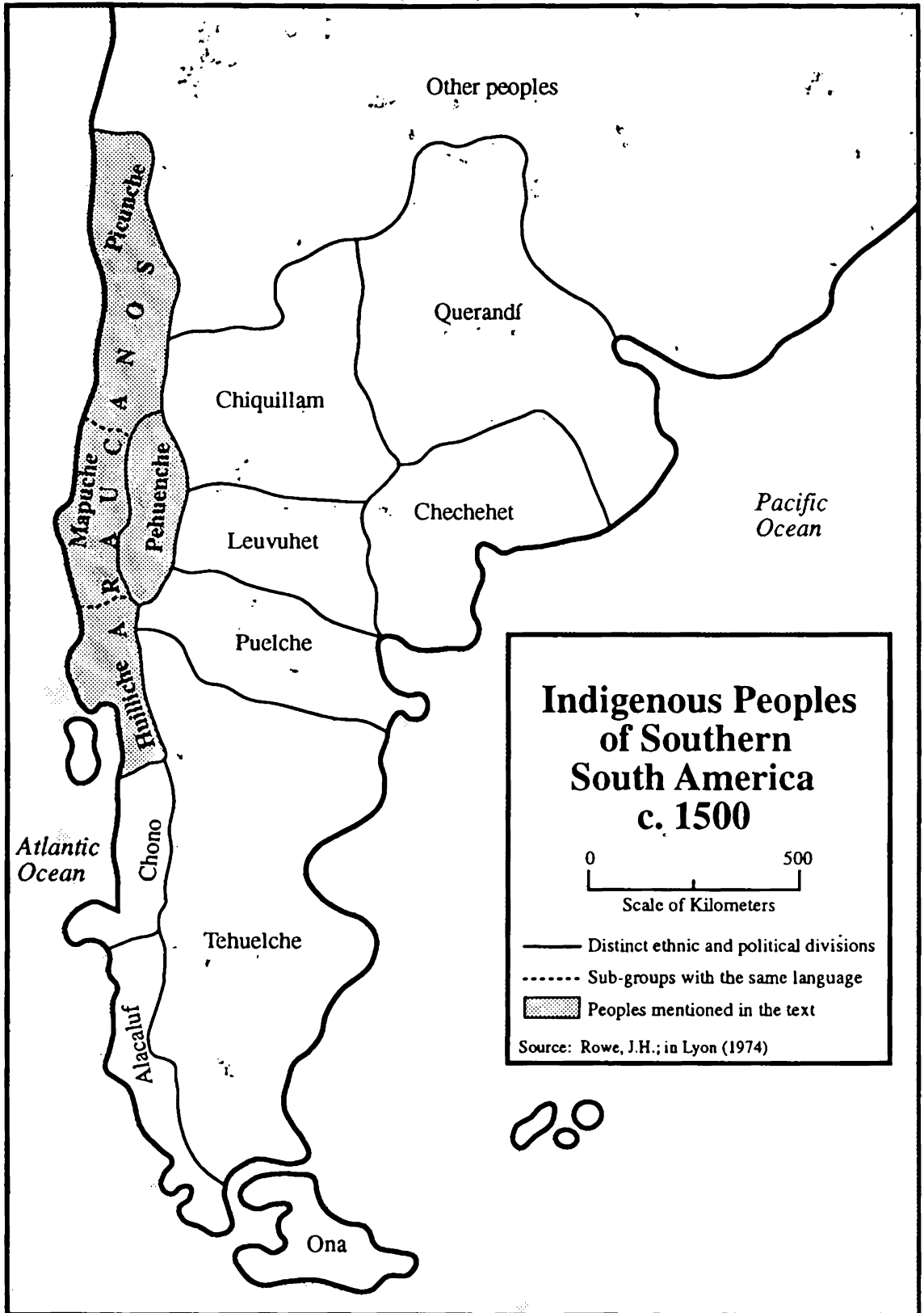
The previous chapter described the physical characteristics of araucaria and the conditions under which it grows. Araucaria, referred to by Poeppig¹ as the king of non-tropical American trees, has had exceptional significance to human beings. In addition to long being a staple food for the indigenous inhabitants of the area, araucaria has been prized for its high-quality and valuable wood. This chapter reviews the cultural and economic importance of araucaria. Specifically, it discusses araucaria's ethnobotanical significance and explains the logging industry's use of and interest in the tree. An outline of indigenous history in the area is initially provided.

THE ARAUCANOS

The first European *conquistadores* arrived in Chile in 1537 (Quarto 1990). Olson (1991) reports that they found one of the largest South American indigenous societies, the Araucanos, living between the Choapa River and the island of Chiloé (Figure 4.1). Within this population there were three groups: the northern Picunche; the central and dominant Mapuche; and the southern Huilliche. Some writers (Quarto 1990; Curruhuinca-Roux 1986) have taken these classifications to mean that fixed political and ethnic divisions existed among these groups, but Faron (1986) and Hilger (1957) claim there is no solid evidence to support this. The classifications presumably existed for purposes of orientation. For example, in the Mapundungu language, Picunche and Huilliche mean "people of the north" and "people of the south" respectively. Mapuche translates as "people of the land." Berdichevsky (1979) mentions only slight biological

¹ Poeppig, a German naturalist, was the first to provide a detailed written description of araucaria in its natural habitat. He is cited [1836] in Montaldo (1974).

Figure 4.2



and sociocultural differences between the groups, and the existence of one language, Mapundungu, with several dialects.

To the east of the Mapuche the conquistadores found a mountain people known as the Pehuenche, or "people of the pehuen (araucaria)." Interpretations of their geographical range have varied considerably. Molina (1978) claims they lived in the high Andes between latitude 34°S and 37°S. Villalobos (1989) believes the Pehuenche lived sporadically in the Andes north of Chillan (36°30'S), although their stronghold was slightly to the south along the eastern side of the Andean Divide and in high mountain valleys along the western side. Cooper (1946) states that the Pehuenche occupied the current growth range of araucaria and adjacent areas. In addition to the Araucanos and Pehuenche, many other societies are mentioned in the anthropological literature.

Before Spanish conquest the Araucanos practiced slash-and-burn agriculture, growing maize, potatoes, beans, chili, and quinoa. The Araucanos also domesticated the llama. Upon the arrival of the Spanish the Araucanos adopted wheat, and also cattle, horses, sheep, goats, mules and pigs (Olson 1991). The Pehuenche were a nomadic and foraging people, with the araucaria seed, or *piñon*, being central to their diet. Whatever overall area they may have occupied, during the main collection season from January to May they lived in the araucaria forests (Casamiquela 1969). The Pehuenche primarily hunted the guanaco and the ñandú. They spoke a different language than the lowland Araucanos and the peoples of the Argentine Pampas (Álvarez 1980-86). There is general consensus that the Pehuenche had a distinct ethnic identity. Bengoa (1985) suggests that there was little or no contact among the Araucanos, the Pehuenche and the peoples of the Argentine pampas before conquest. There were probably at least some sporadic contacts, however. Vargas (1993) mentions a pre-Columbian maize-meat trade between the Mapuche and the Pehuenche, and Villalobos (1989) reports an ancient maize-piñon trade.

Through a series of wars with the Spanish, the northern Araucanos, or Picunche, ceased to exist by the early 17th century (Olson 1991). This left the entire population of Araucanos south of the Bío-Bío River. Wars continued and many of the lowland Araucanos took to the mountains. Towards the middle or end of the seventeenth century, the Pehuenche fell under the influence of the Araucanos, who moved into the mountains not only as a result of direct conflict with the Spanish, but also crossed the Andes into Argentina to rustle and trade livestock (Breslin 1989; Berdichewsky 1979).² The Pehuenche, who often served as intermediaries between the Araucanos and groups of the Argentine Pampas, knew the mountain passes well, and the Araucanos needed this knowledge (Canals Frau 1953).³

Throughout the "araucanization" process the Pehuenche language slowly disappeared, and the people underwent a series of sociocultural and economic changes. The Pehuenche eventually lost their distinct ethnic identity.⁴ In essence, they merged with the Araucanos, and by the start of the nineteenth century the highland indigenous people differed from their lowland counterparts only in body size, numbers, several customs, and the environments in which they lived (Bengoa 1985).⁵

The Araucanos fiercely defended their lands in the eighteenth and nineteenth centuries, as violent conflict with the Spanish and their descendants continued. Only a handful of settlers and missionaries were able to penetrate the area south of the Bío-Bío (Olson 1991). In the early 1880s the Chilean state, which gained independence from Spain in 1817, made a determined effort to secure this territory. The military embarked

² Breslin (1989) and Canals Frau (1953) write that the Araucanos even reached Buenos Aires province. Canals Frau mentions that the Araucanos needed horses from Argentina to fight their wars in southern Chile.

³ A thriving trans-Andean trade developed (Molina and Correa 1992). In addition to livestock, González (1980) writes that potatoes, corn, wheat, chili, onion, garlic, dried pears, apple *chicha* (a fermented beverage), salt, woven goods, guanaco skins, dried meat, animal fat, feathers and piñones were important articles of commerce.

⁴ Canals Frau (1946) and Berdichewsky (1979) mention that many of the indigenous tribes living in the Argentine pampas were also "araucanized."

⁵ Bengoa provides few details here, except that the mountain people were taller and quite slender.

upon what the authorities called a "pacification" campaign. The Araucanos could not withstand the force and might of the well-armed Chilean troops, and by 1883 lands south of the Bío-Bío were conquered and the Araucanian War was over (Molina and Correa 1992).

At the same time the Araucanos were being decimated and subdued in southern Chile, the indigenous inhabitants of southern Argentina were experiencing military pressure of their own. The Araucanian War in Chile had its parallel in Argentina. It began in 1879 when General Julio Roca left Buenos Aires with a contingent of 6,000 men. Together they marched across the Humid Pampa, through Patagonia, and on to the Andes, waging what is known in Argentine history books as the Desert Campaign.⁶ The Argentine authorities were determined to secure access to the natural resources in southern Argentina and to solidify national sovereignty in the area (Curruhuinca-Roux 1984). Financed by both external and internal interests, Roca and his troops proceeded to decimate native inhabitants (Curruhuinca-Roux 1984).⁷ To avoid this systematic extermination, many tried crossing over into Chile, to find the situation only marginally better.⁸ On January 1, 1885, the last Araucanian group surrendered to the Argentine authorities in Junin de los Andes, ending 330 years of resistance to *huinca* (non-indigenous) claims and invasions (Curruhuinca-Roux 1986).

Although there is no evidence that the Chilean and Argentina authorities ever collaborated in their respective campaigns against the Araucanos, the principal result was the same. Vast amounts of territory, along with the accompanying natural resources,

⁶ Argentina's indigenous inhabitants refer to the campaign as the Attack of the White Man (Radovich and Balazote 1992).

⁷ Curruhuinca-Roux claims that from 1879 to 1885 the population of the Territory of Neuquén, which became a province in 1957, fell from 60,000 to 14,517. Of these 14,517 inhabitants, the author estimates that 5,000 were indigenous. She does not mention how many persons of the 1879 population (60,000) were indigenous.

⁸ Molina and Correa (1992) write that this simply gave the Chilean military more impetus to step up its own "pacification" campaign.

were lost by indigenous peoples. The new territorial organization which followed favored ranchers, settlers, traders, national and regional institutions, and the military. Indigenous land was effectively reduced to small patches (Osídala et al. 1992).

After the Araucanian War in Chile the Araucanos were obliged to submit to a reservation system. Bengoa (1992) summarizes the situation well. The Comisión Radicadora was established to "locate" the Araucanos. Areas into which they had been cornered were demarcated and *títulos de merced* (collective titles) were issued to extended families. The Comisión Radicadora never arrived in many areas where *títulos de merced* were solicited. Where the Comisión Radicadora did arrive, family divisions and lineage were often not respected. From 1883 to 1920 the Comisión Radicadora issued collective titles to only two-thirds of Araucano communities.⁹ As a result many Araucanos were considered to "occupy" lands.

In Argentina most of the conquered territory was divided up among those who financed or led troops in the Desert Campaign. Radovich and Balazote (1992), citing Páez (1970), write that 35 million ha were divided among twenty-four individuals. As the remaining indigenous population grouped around various caciques for sociopolitical organization, provisions were made to accommodate some of these communities on reservations, which usually contained the least fertile land and were located in inhospitable and isolated places. However, very few communities were afforded legal recognition. Curruhuinca-Roux (1984) mentions that the reservation system in Argentina facilitated land speculation, occupation and eviction. Fraudulent transactions and chicanery became commonplace, as the newcomers sought to take advantage of illiteracy, the language barrier, and desperation.

The ethnic contact and warfare outlined above have been the subject of many studies and diverse opinions over the years. Also, since 1883 in Chile and 1885 in

⁹ A total of 3,078 were issued.

Argentina, each country has dealt with the "indigenous problem" in a variety of ways. The details are covered well in Bengoa (1985, 1992) and Curruhuinca-Roux (1984). The intention here has been to describe in general terms the indigenous history as background for further discussion. It is within this context that this thesis will turn to the traditional use of araucaria by the Araucanos.

INDIGENOUS USE OF ARAUCARIA

Despite the profound historical changes outlined above, the piñon remains an important resource for the indigenous population living in and around the main range of araucaria.¹⁰ Although bread and potatoes are now the primary carbohydrate source for the Araucanos, the piñon was their principal staple before Spanish colonization (Cardemil and Reinero 1982).¹¹ Nevertheless, in late summer and fall the Araucanos still dedicate much time and energy to the *piñoneo*, or collection of piñones. The piñones are collected off the ground after being shaken loose from the tree by the wind, or they are knocked down by two species of parrots (*Herigcognatus leptorhynchus* and *Microsittace ferroginea*), which in the upper reaches of the trees feed on the araucaria seeds. Alternatively, the Araucanos use lassos to pull the cones down, or often they throw stones or use long sticks to knock the cones to the ground (Aldunate and Villagran 1992). Although a video entitled *Los Ultimos Pehuenches* (n.d.) shows an Araucano actually

¹⁰ Olson (1991) indicates that there are approximately 600,000 Araucanos living in Chile. Santos (1991) reports that 8,000 inhabit nineteen reservations in Chile's upper Bío-Bío watershed. The author estimates that in or near the southern Chilean part of araucaria's range some 5,000 Araucanos live, putting the total number of Araucanos in Chile who have a significant relationship to araucaria at 13,000. Radovich and Balazote (1992) indicate that there are currently 40,000 Araucanos living in Argentina. They estimate that some 9,000 of these live in the province of Neuquén in thirty-seven *agrupaciones* or communities, of which twenty-three have been legally recognized as reserves (meaning the land has been measured and collective title issued). In a personal communication with Juan Carlos Radovich (February 1993), the author was informed that approximately 5,000 Araucanos (seventeen communities) in Argentina have an important relationship to araucaria. By "important relationship" it is implied that some piñon gathering takes place.

¹¹ Pastore (1939) and Escudero and Landabure (1943), in their exhaustive reviews of the nutritional properties of piñones, have concluded that they are rich in carbohydrates.

climbing an araucaria tree to get at the piñones, this practice was never observed by the author.

Araucaria forests have always been managed collectively. No family may claim exclusive rights to any part of an araucaria forest. Depending on a family's relative location to an araucaria forest or stand, its members may go out for several days to collect piñones, sleeping at night in a rustic dwelling or taking refuge in the trunk of a large araucaria previously hollowed out by fire. Those living closer to the araucaria forests usually go on shorter outings. There is no age or gender division involved in gathering piñones (Hilger 1957).

The most complete study available on the preparation and consumption of piñones has been done by Valenzuela (1981). He reports that piñones are eaten raw, toasted (either directly in the ashes of a fire, in a pot, or on a wood stove), boiled, and boiled and then toasted. Piñones may also be ground into flour and used as a condiment in soups or to make bread. They are used to make a fermented beverage called *chavid*, and piñones are often masticated by the mother and then given to an infant as food (Hilger 1957).¹² Quarto (1990) reports that piñones are not entirely reserved for human consumption. The Araucanos sometimes use them as food for their livestock.

Aldunate and Villagran (1992) report that piñones may be preserved and stored for year-round use, either by hydration in a subterranean pit of cold running water, or by dehydration, most commonly achieved by drying the piñones in the sun or hanging them on necklaces over the family fire. By hydration piñones can be preserved for four years.

Piñones are also important for commercial purposes (Valenzuela 1984). Valenzuela (1981) cites the German naturalist Poeppig [1836] as saying that piñones were traded and sold in Concepción and Valdivia, and even exported through Valparaíso

¹² Lactating mothers may also eat piñones to lower their level of maternal milk (Graham [1969] cited in Montaldo 1974).

to Lima. Today, in order to obtain surplus cash, the Araucanos sell piñones to merchants who visit their communities. Often the piñones are traded for sugar, yerba mate, wheat flour, and other provisions. Merchants resell the piñones in lowland towns, and regional and provincial capitals. Some piñones are even seen for sale in the streets of Santiago and Buenos Aires.

Angli (1918) mentions that araucaria resin is used by the Araucanos to help wounds heal, for headaches (including migraines), to treat bruises and ulcers, and to set fractures. Gusinde (1936) points out that it is also used for colds, lockjaw and to normalize menstruation. Record and Hess (1943) also make reference to the medicinal uses of araucaria resin, and more recently Hoffman (1982) reviews its medicinal properties.

With respect to araucaria wood, only two references to its use by the Araucanos were found. Bragg (1980-81) reports that it is the wood preferred for house construction. Nielsen (1963) mentions how the polygonal plaques of bark, which have a high calorific value, are used for fuelwood. The author observed that araucaria was the preferred fuelwood species in Aigo. The *clavos*, or knarl-like chunks of extremely hard wood found where the branches protrude from the trunk, are especially sought after. Clavos burn at very high temperatures for hours, and have even been known to melt iron wood stoves.

Araucaria is also a symbolic and spiritual resource for the Araucanos. Bengoa (1985) writes that they see an araucaria forest as an extended family or *lobpewen*. The masculine tree, *domopewen*, and the feminine tree, *wentrupewen*, are thought to reproduce through the intercourse of their extensive root systems rather than by anemophilous means. González (1980) mentions that the Araucanos respect a pair of deities living in the araucaria forest, *pewenucha* and *pewenkuzé*. The will of this couple is believed to influence the reproduction of araucarias. To ensure a good harvest of

piñones, offerings are made during a ritual called *Ngillatun*. The sacred and central area around which this three-day open-air ceremony takes place contains an araucaria tree (Álvarez and Parra 1991). Álvarez (1980-86) writes about a sacred araucaria tree in the northern part of its range in Argentina. This tree, called *El Pino del Cajón del Manzano*, is the subject of an annual pilgrimage for many Araucanos. Vargas (1993) indicates that piñones are used in tombs and burials. Finally, the author observed several planted araucaria trees in an indigenous cemetery.

It should not be inferred that araucaria is the only plant of importance or value to the Araucanos. They also devote much of their time to collecting mushrooms, roots, fruits, leaves and firewood. Bragg (1980-81) investigated ethnobotanical relationships in a one-year study in the Araucano community of Icalma. She found that the inhabitants identified uses for 97% of 140 plants collected (both native and exotic). The uses included medicinal, pasturage, edible, combustible, constructional, dye, soap, ritual and veterinary ones. Their folk classification was designed to give order to nature. Bragg concludes that the Araucanos' relationship with their land and resources goes beyond a subsistence level. It also extends into their ideological and spiritual realms. Her study has been mentioned here to emphasize that the Araucanos do not simply identify with a single plant species, but rather with a complex or association of species.

NON-INDIGENOUS USE OF ARAUCARIA

Araucaria has long been valued for its excellent and versatile wood. Gunckel (1980) refers to the Spanish using the long, straight and durable araucaria trunks for the masts on their boats. He writes about the Crown's effort (year unknown) to secure forty trunks from Chile's upper Bío-Bío watershed. Local Araucano caciques gave two

captains permission to remove these trunks. Waterways were used to float the logs to the Bahía de Concepción, where they were used to repair the fleet of Captain Vacaro.¹³

Angli (1918) reports that one of the first industrial attempts to use araucaria wood was for railroad ties. On most of the North American lines, yellow pine had been used to support the tracks.¹⁴ In 1913 some araucaria samples were sent from Argentina to New York, where the wood was tested for its properties and durability. Although araucaria never became widely used as railroad supports, the conclusions of the tests led the Pan-American Chamber of Congress to state that in later years araucaria would become a very important timber species.

In due time araucaria did indeed become one of the most valuable timber species of the southern Andes.¹⁵ Montaldo (1974) lists some of the uses araucaria has been given over the years: floors, tunnels, carriages, pillars, drawing tables, ladders, skis, piano interiors, oars and rulers. Tortorelli (1942) wrote that araucaria was used in airplane construction. A timber guide put out by Gyllen y Asociado Limitada (1988) lists some more conventional uses of araucaria wood, including building construction, bridges, beams, doors, windows, blinds, stairs, plywood, particle board, crating and furniture. Alfonso (1941) considered the fibrous tree to be an excellent pulp species. The heart of the trunk, darker in color and not as valuable, is often used to make mining timbers.¹⁶

Araucaria wood is whitish-yellow in color, has soft chestnut grains, is shiny and moderately heavy, and has excellent mechanical resistance (Rodríguez et al. 1983). The wood contains few large knots and has no resin sacks. These features, and the fact that a large quantity of wood can be obtained from one tree (Kozdon 1958), increase its value as

¹³ One year later royal order was sent to collect seeds and small araucaria plants, which were to be sent to Madrid's Botanical Garden. The ship that was carrying the samples, *San Pedro de Alcántara*, sank on the return voyage. As mentioned in Chapter 3, araucaria was later destined to become an important ornamental plant.

¹⁴ Haden-Guest et al. (1956) indicate that araucaria and yellow pine share many similar properties.

¹⁵ Schmidt et al. (1980) state that araucaria is the most economically profitable native species in Chile.

¹⁶ Gana, J. 1988. Madera para siempre. *Las Ultimas Noticias*. November 6.

a timber species, even though at times the wood will possess twisted or crusty fibers and is subject to considerable warping when drying (Nielsen 1963). Araucaria's similarity to yellow pine has already been mentioned. Mutarelli and Orfila (1970) report that araucaria is also similar to Douglas fir. Cuevas (1983) highlights like properties between araucaria and that of its relatives, Paraná pine (*A. angustifolia*), hoop pine (*A. cunninghamii*) and bunyan pine (*A. bidwilli*), and also with Scots pine and European spruce.

Araucaria resin was never widely used for industrial purposes, despite Angli's (1918) study which was undertaken specifically to investigate this potential. In 1911 private interests¹⁷ began thinking about how araucaria could be profitably exploited. The commercialization of the resin was discussed as a possibility. Although the resin was found to have fairly good adhesive qualities, it never became popular industrially. This may have been due to an early lack of general interest and capital. The same private interests behind the resin study were also behind sending the wood sample to New York in 1913 and another sample to Italy (1912) to test its suitability as cellulose.

The literature search turned up very little information on the transport, sale and trade of araucaria wood products. Record and Hess (1943) mention the wood could be found in the lowland markets of Temuco, Mulchen, Victoria and Angol. Nielsen (1963) reported that the best market for Chilean producers was the external one, especially Peru and Argentina. Quarto (1990) claims there was an expanding international market for araucaria wood products several years ago. A search for statistics provided only limited trade data. In the *Boletín Estadístico*, published by Chile's Instituto Forestal (INFOR), there is no species-specific information on native trees. In *Exportaciones Forestales*, also published by the INFOR, there is some fragmented statistical information on araucaria, usually collected differently from year to year. It was possible, however, to extract

¹⁷ Angli provides no details about these interests.

amounts for exports of sawn araucaria wood from 1961 through 1992 (Table 4.1). The near halt in exports between 1980 and 1988 is striking. This is related to Decree 29, which prohibited the exploitation of araucaria from 1976 to 1987. This decree will be discussed in more detail in Chapter 6. Also, figures for 1989, 1990 and 1991 lend some support to Quarto's claim for an expanding international market.

Table 4.1

Chilean Exports of Araucaria Sawn Wood, 1961-1992

<i>Year</i>	<i>Total (m³)</i>
1961	1,126
1962	6,974
1963	1,091
1964	2,746
1965	1,130
1966	2,013
1967	1,549
1968	12,702
1969	21,782
1970	6,702
1971	26,570
1972	3,075
1973	4,482
1974	3,806
1975	2,793
1976	n.a. *
1977	8,318
1978	3,804
1979	9,112
1980	0
1981	0
1982	0
1983	0
1984	12
1985	0
1986	0
1987	0
1988	0
1989	218
1990	765
1991	1,520

Source: *Exportaciones Forestales* for the years cited.

* All native species were grouped together in 1976.

In the statistical search one item made reference to piñones. In 1977, 2.26 tons of piñones were exported from Chile. For unknown reasons, this is the only year for which such information is given. For selected other years the total dollar value and destination of araucaria sawn wood exports are given (Table 4.2). The relatively large quantities of araucaria sawn wood imported by Argentina and Peru support Nielsen's claim mentioned above.

Table 4.2

Markets and Dollar Returns for Exported Araucaria Sawn Wood, Chile, 1966-1973

<i>Importer</i>	<i>Year</i>							
	1966	1967	1968	1969	1970	1971	1972	1973
Argentina	12.2	0	524.9	1,098.8	982.1	1,241.7	17.5	68.3
Peru	164.7	44	103.3	105.3	187.3	13.7	0	0
Spain	0	0	0	0.7	0	0	0	0
Belgium	1	0	0	0	0	0	0	0
England	0	0	0	22.2	12.2	0	0	0
Holland	0	0	0	10.2	2	0	0	0
P. Rico	0	0	0	0.6	0	0	0	0
Italy	0	0	0	0	0.3	0	0	0
Australia	0	0	13.2	2.7	0	0	0	0
U.S.	0	0	0	2.5	0	0	0	0
Cuba	0	0	0	0	0	93.9	131.7	582.2
Total	176.9	44	641.4	1,245.7	1,183.9	1,349.3	149.2	650.5

Source: *Exportaciones Forestales* for the years cited.

Note: All figures are in thousands of U.S. dollars. Also, country destination (by volume) data were given for 1984 and 1989-1992. Argentina was by far the principal importer of araucaria sawn wood for these years, accounting for 95.5% of all Chilean exports.

In interpreting Table 4.1 and Table 4.2 great caution must be exercised. Not only must the reliability of statistics be questioned, but the author suspects that much clandestine exploitation and exportation of araucaria has taken place in both Chile and Argentina. An effort to obtain comparable trade and export data in Argentina proved unsuccessful, although some data on volume of araucaria extracted were acquired. This information is presented in the following chapter. To complement the trade, transport and market information given here, it should be mentioned that in the small town of Alumine the author did visit a mill currently processing araucaria lumber. The employees stated that the wood was strictly for local (Neuquén province) consumption.

THE DEGRADATION OF ARAUCARIA

The previous chapter contained a brief historical geography of the Araucanos, examined their traditional use of araucaria, and discussed the non-indigenous importance of the tree. This chapter provides more details regarding the use of araucaria. The effects of human activities on the health of the species are also reviewed. Initially, the non-indigenous pressure on araucaria is considered. Silviculture, the felling history of araucaria, the use of fire, and the impact of tourism are discussed. The indigenous role in the degradation of araucaria is also outlined.¹ Piñon collection, fire, grazing, and indigenous participation in logging are the factors considered.

THE NON-INDIGENOUS CASE

Silviculture

Research on the silvicultural management of native species in Chile and Argentina has not been a great priority. The faster growing and more profitable exotic species, such as *Pinus radiata* and *Eucalyptus* sps., have received more attention. Nevertheless, araucaria has been the subject of some studies. Tortorelli (1942) provides one of the most detailed treatments. More recently, Schmidt et al. (1980) have investigated silvicultural techniques in araucaria forests, concluding that appropriate strategies are not overly complicated. The authors cite the excellent regeneration of araucaria under all conditions and determine that selective cutting does not jeopardize species preservation. It is pointed out, however, that araucaria reaches a diameter to make its extraction economically profitable only after four hundred years. Cavieres states that only after six

¹ Degradation implies a net extractive process. More volume or products are taken from the araucaria forest than can be replaced, either by natural means or reforestation programs.

hundred years does araucaria become large enough to cut.² Also, in a 1977 study Schmidt et al. recommend at least a forty-year cutting rotation. It is not economically viable to have araucaria plantations, primarily due to the tree's slow growth and long rotation cycle (Cortés Salas 1979).³

Felling History

Quantitative information on the amount and location of araucaria cut is very difficult to obtain. In Chile the administration and regulation of forestry activity is undertaken by the Corporación Nacional Forestal (CONAF).⁴ In order for trees to be extracted legally, detailed management plans must be approved by CONAF. Copies of approved and rejected plans are not kept in Santiago, and during visits to CONAF's regional offices in Concepción and Temuco the author was denied access to all management plans on file.⁵ In Argentina, where institutional authority regarding forestry is primarily delegated to provincial administrations, a visit to the Dirección General de Bosques and Parques Provinciales in Neuquén yielded no precise data on araucaria felling. In this case, management plans were stored in the basement of another building and not immediately accessible.

The only concrete data available on the amount of araucaria extraction were found in the Instituto Forestal Nacional (IFONA) in Buenos Aires.⁶ The data, from 1956 to

² Poblete, F. 1988. Codeff llama a defender la Araucaria ante su explotación indiscriminada. *La Epoca*. - January 6.

³ Paraná pine (*A. angustifolia*), the subtropical relative of araucaria growing some 2000 km to the northeast, is a faster growing species and has been a successful plantation tree in Argentina. Tesdorf (1972) explains an interesting series of experiments he started in 1951. He planted hybrids of Paraná pine and araucaria in both northeastern Argentina and the southern Andes, hoping to combine araucaria's superior wood quality and the faster growth of Paraná pine. Further hybrid planting took place in 1971 and 1972. Tesdorf reports that his 1951 efforts were much less successful than expected, and in due time the results of the 1971-72 plantings would be known. The author presumes the second attempt also failed, as no further references in the literature were found.

⁴ Specifically, CONAF's responsibilities include fire management, promoting sound forest management and development, enforcing regulations, and administering protected areas (CONAF 1993).

⁵ Plan details are confidential. However, in Concepción, information from two management plans was given to the author, although he was not allowed to review these plans directly.

⁶ IFONA has recently been dissolved and its functions assumed by the Dirección de Promoción Forestal, the newly created Dirección de Bosques Nativos, and the Instituto Nacional de Tecnología Agropecuario.

1990, were obtained in a year-by-year search of the *Anuario Forestal*, and are presented with the intention of synthesizing fragmented information (Table 5.1).⁷ From 1956 to 1960 most araucaria was cut on Neuquén provincial land, and nearly all trees cut from 1957 to 1960 were live. Also, it is striking that some data were reported by Argentina's Administración de Parques Nacionales. These trees must have been taken from Lanin National Park, which is the only national park in Argentina to contain araucaria. Furthermore, the use of araucaria as a fuelwood species intensified during the 1980s.

There is still some confusion within Argentina as to which entity is responsible for certain activities. For simplicity's sake, reference in this thesis is made to IFONA. In this particular case, data were found in the library of IFONA, currently housed in the Edificio de Comercio, which has nothing to do with the three newly responsible entities.

⁷ There are numerous problems involved in collecting comparable and consistent data on araucaria. Not only do the data have to be found, but the information collected varies from one year to the next. The same caution used in interpreting the Chilean export data must be used when analyzing the Argentine figures.

Table 5.1

Extraction of Araucaria by Volume, Use and Land Tenure in Argentina, 1956-1990

Year	Volume Extracted			Use						Land Ownership		
	Total	Live	Dead	Logs	Firewood	Stumps	Posts	Piñones	Sticks	Private	Provincial	National Park
1956	6,000	n.a.	n.a.	6,000	2	0	0	0	0	688	5,313	0
1957	6,318	6,223	95	6,255	29	34	0	0	0	0	6,318	0
1958	2,257	2,257	0	2,257	0	0	0	0	0	600	1,657	0
1959	4,564	4,324	240	4,564	0	0	0	0	0	0	4,564	0
1960	3,367	2,621	746	3,338	29	0	0	0	0	348	3,019	0
1961	2,825	n.a.	n.a.	2,825	0	0	0	0	0	n.a.	n.a.	1,925
1962	3,480	n.a.	n.a.	3,480	0	0	0	0	0	n.a.	n.a.	0
1963	3,354	n.a.	n.a.	3,354	0	0	0	0	0	n.a.	n.a.	46
1964	4,440	n.a.	n.a.	4,273	167	0	0	0	0	n.a.	n.a.	0
1965	2,267	n.a.	n.a.	2,267	0	0	0	0	0	n.a.	n.a.	0
1966	2,590	n.a.	n.a.	2,590	0	0	0	0	0	n.a.	n.a.	0
1967	5,286	n.a.	n.a.	5,286	0	0	0	0	0	n.a.	n.a.	0
1968	1,886	n.a.	n.a.	1,185	1	0	0	0	0	n.a.	n.a.	31
1969	5,986	n.a.	n.a.	5,986	0	0	0	0	0	n.a.	n.a.	222
1970	7,425	n.a.	n.a.	7,416	7	0	2	0	0	n.a.	n.a.	0
1971	8,423	n.a.	n.a.	7,337	1,086	0	0	0	0	n.a.	n.a.	0
1972	4,871	n.a.	n.a.	4,649	222	0	0	0	0	n.a.	n.a.	0
1973	9,366	n.a.	n.a.	9,366	0	0	0	0	0	n.a.	n.a.	0
1974	7,966	n.a.	n.a.	7,966	0	0	0	0	0	n.a.	n.a.	0
1975	5,990	n.a.	n.a.	5,830	160	0	0	0	0	n.a.	n.a.	0
1976	6,458	n.a.	n.a.	6,388	70	0	0	0	0	n.a.	n.a.	0
1977	6,179	n.a.	n.a.	6,093	86	0	0	104	0	n.a.	n.a.	0
1978	6,011	n.a.	n.a.	5,921	90	0	0	0	0	n.a.	n.a.	0
1979	3,683	n.a.	n.a.	3,521	162	0	0	75	0	n.a.	n.a.	0
1980	6,588	n.a.	n.a.	6,265	323	0	0	0	0	n.a.	n.a.	0
1981	3,433	n.a.	n.a.	2,780	653	0	0	0	0	n.a.	n.a.	0
1982	6,540	n.a.	n.a.	5,942	598	0	0	0	0	n.a.	n.a.	0
1983	7,771	n.a.	n.a.	7,077	694	0	0	0	0	n.a.	n.a.	0
1984	8,761	n.a.	n.a.	7,183	1,578	0	0	0	0	n.a.	n.a.	0
1985	7,512	n.a.	n.a.	4,235	2,277	0	0	0	0	n.a.	n.a.	0
1986	8,266	n.a.	n.a.	4,235	4,022	0	0	0	9	n.a.	n.a.	0
1987	6,187	n.a.	n.a.	5,156	1,031	0	0	0	0	n.a.	n.a.	0
1988	6,211	n.a.	n.a.	3,206	2,970	0	35	0	0	n.a.	n.a.	0
1989	3,745	n.a.	n.a.	3,171	554	0	0	0	0	n.a.	n.a.	0
1990	1,130	n.a.	n.a.	618	512	0	0	0	0	n.a.	n.a.	0

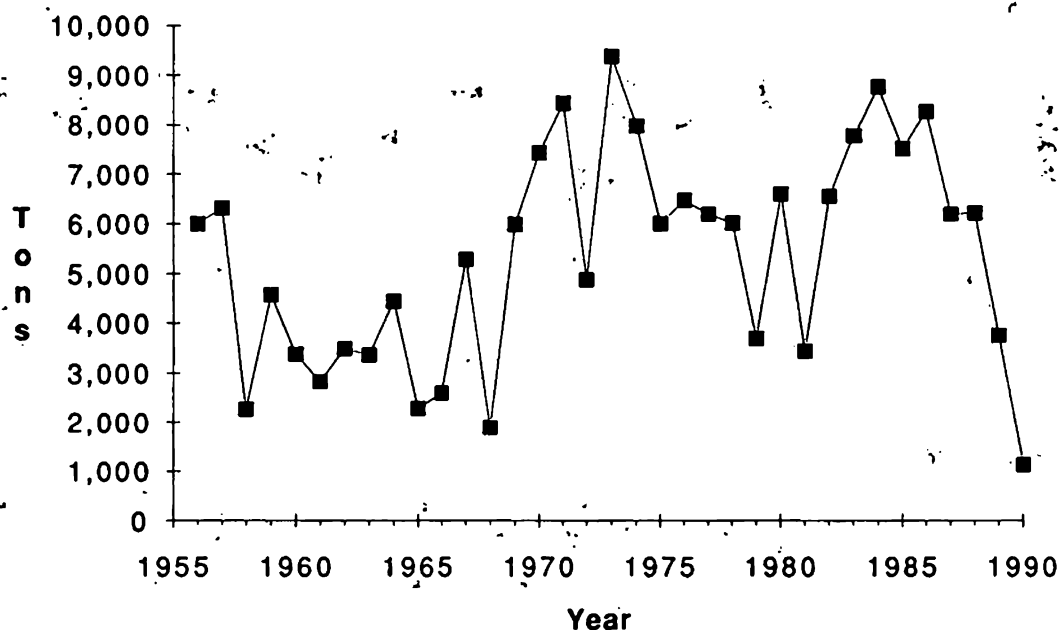
Source: *Anuario Forestal* for the years cited.

Note: All figures are in tons. Figures may not add correctly due to rounding. Data beyond 1990 were not available.

Figure 5.1 illustrates the trend of total extraction in Argentina from 1956 to 1990. The swift decline from 1988 to 1990 is noticeable. This coincides with Argentina's increased araucaria imports from Chile (see note in Table 4.2).

Figure 5.1

Total Extraction of Araucaria in Argentina, 1956-1990



Source: *Anuario Forestal* for the years cited.

A more precise understanding of araucaria's felling history would require not only access to management plans, but also a series of aerial photographs to verify information from the management plans and to account for illegal exploitation. Aerial photographs of the area do exist, but not at regular time intervals, and access would prove

photographs of the area do exist, but not at regular time intervals, and access would prove too costly for this study. There is also some sensitivity on the part of the authorities in releasing detailed information about border areas.⁸ Given these limitations, published references to felling were organized to obtain a general idea of its distribution and intensity. Also, an effort was made to acquire relevant information through conversations with those having knowledge of the area and industry. A brief discussion of the results is found below and a map appears in Figure 5.2. Only the areas which seem to have experienced the most intense exploitation of araucaria are mapped. Lacking the precise quantitative information which could be provided by a series of aerial photographs, it is problematic to map these areas at a larger scale.

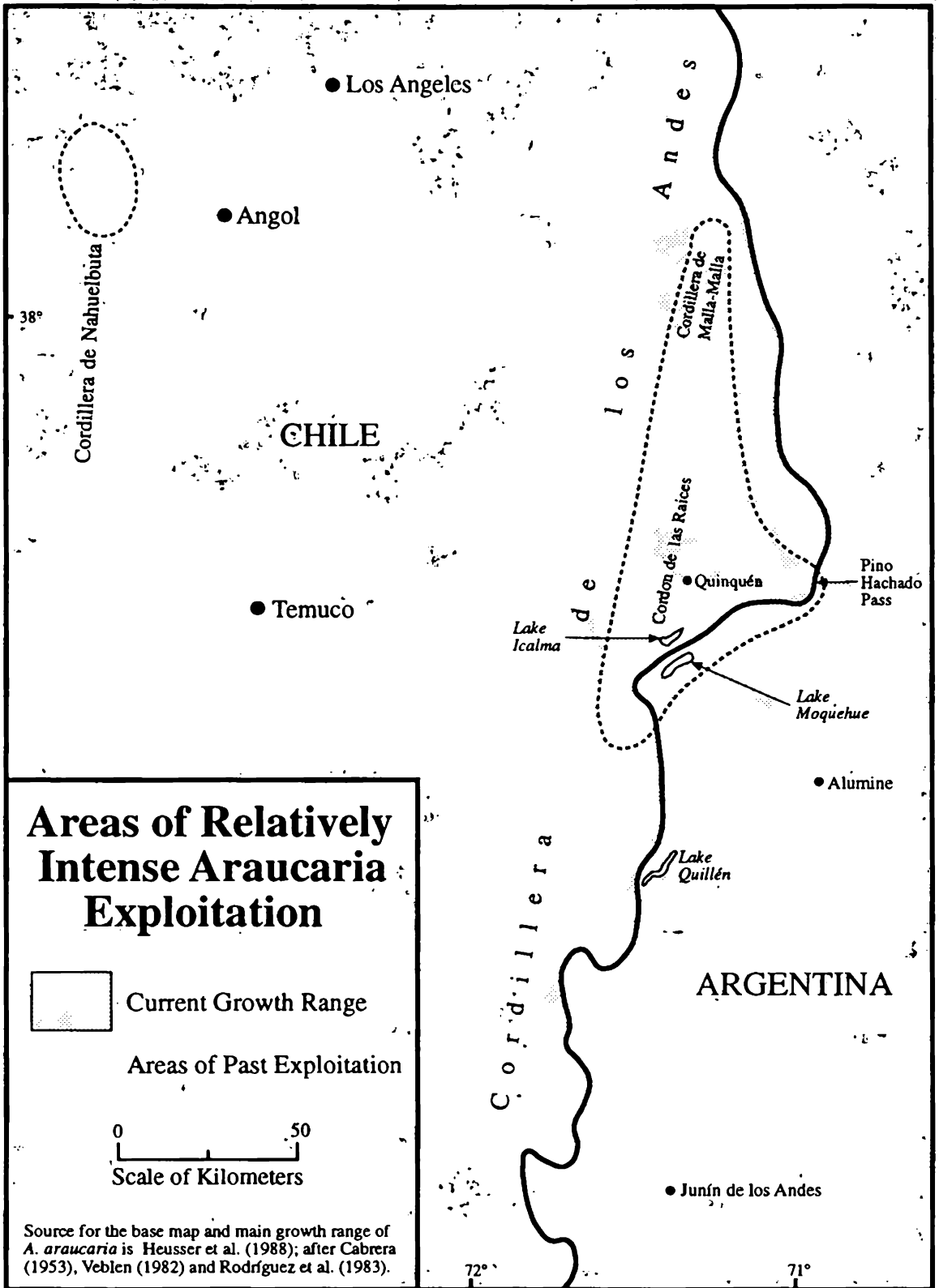
Nielsen (1963) mentions that araucaria exploitation began much earlier and was much more intense in the Nahuelbuta Range than in the Andes. Access to the Nahuelbuta stands and transport to nearby port facilities were considerably easier. Other references contain details of araucaria felling in the communes of Lonquimay and Curacautin. Agrícola y Forestal Casagrande was authorized to cut nearly 6,000 araucaria trees in 1989 to supply its mill in the Cajón del Trueno.⁹ The Sociedad Galletué cut araucaria in the same area in the late 1960s.¹⁰ Molina and Correa (1992) cite the felling of araucaria during the 1960s near the Callaqui Volcano, in the northern parts of araucaria's Andean growth range. These and other references indicate that in Chile araucaria felling was most intense in the Nahuelbuta Range, and in the Andes the araucaria forests of the Cordón de las Raíces and the Cordillera de Malla-Malla were subject to considerable exploitation. This was corroborated in a conversation (April 1993) with Leonardo Araya, the director of CONAF's Departamento de Manejo y Desarrollo Forestal.

⁸ The author, however, had no problems in obtaining several 1:50,000 topographic maps along the Argentine side of the international border.

⁹ *El Mercurio*. 1990. Plantación de 70 Mil Araucarias en Temuco. February 11.

¹⁰ Declaration of Mapuche-Pewenche Community of Quinquén to the National and International Community. January 26, 1993.

Figure 5.2



In Argentina the exploitation of araucaria has its actual beginnings in a great fire which occurred in 1943. Mutarelli and Orfila (1970) write that this fire entered Argentina from Chile and burned large amounts of forest cover near Lake Moquehue. Despite heavy losses, araucaria's protective bark was responsible for many of the dead trees still being useful for wood. An unnamed company¹¹ salvaged this wood, and pressure was eventually exerted on the Administración Nacional de Bosques to extract live araucaria. Permission was obtained and in due time several firms moved into the area. Lake Moquehue became the center of araucaria exploitation in Argentina. A conversation with Carlos Álvarez (March 1993), the ex-owner of Álvarez Hnos. y Duran S.A.,¹² revealed there was also minor activity in the vicinity of Lake Quillen and Pino Hachado. This was corroborated by Eloy López Cepero of Neuquén's Dirección General de Bosques y Parques Provinciales (pers. com. March 1993).

Araucaria was classified as a vulnerable species in the 1985 Symposium on Threatened Chilean Native Tree and Shrub Flora. Serra and Gajardo (1988) claim the older trees, more valuable and sought after for their wood, should have been classified as endangered. Anthropogenic action has undeniably been detrimental to the species.¹³ In 1897 Neger wrote about the possible extinction of araucaria. Although the wood was not commercially important at the time, Neger predicted that improved human access to the

¹¹ The financial interests behind the timber companies are generally not known. There has been some degree of foreign investment, however. Bragg (1980-81) mentions a foreign timber company exploiting araucaria around Icalma, although she provides no details. Elizalde Mac-clure (1970) also reports logging concessions being awarded to foreign companies.

¹² This company was given numerous concessions by the Neuquén provincial government to cut araucaria.

¹³ All native forest cover in Chile and Argentina has been greatly reduced since colonial times. Cozzo (1992) reports that Argentina formerly had 1,700,000 km² of woody vegetation. Currently the country claims only 1,000,000 km², implying a reduction of 41%. The situation in Chile is not much better, especially in the central and southern Andes, where nearly all of its native forest is located. Currently it is estimated that 120,000 ha of native forest are either totally destroyed or severely degraded every year, primarily to meet the demands of the thriving wood chip industry (H. Verscheure, Comité Nacional pro-Defensa de Fauna y Flora, pers. com. April 1993).

area would have grave consequences for the tree. He warned that the Chilean and Argentine governments would eventually need to protect araucaria to prevent its disappearance. Kozdon wrote in 1956 that araucaria was likely to be extinct within ten years. A 1967 *El Mercurio* article mentioned the probability of araucaria's disappearance before the end of this century.¹⁴

This section has thus far been concerned with the location and intensity of logging activity. The focus will now be on the resulting degradation and damage. Serra and Gajardo (1988) note that the diminution of araucaria has been strictly due to overexploitation and the failure to employ sound silvicultural methods. Empirical data and precise information on the degradation of araucaria forests by logging are difficult to come by. The literature, however, is replete with general references to the detrimental effects of timber activity. Montaldo in 1951 writes that uncontrolled and irrational araucaria exploitation was taking place, noting that even a massive reforestation program would have been unlikely to reverse the damage already done. In a 1974 publication Montaldo cites an example of a company cutting 1,000 ha of araucaria from very steep slopes in 1951. He returned to the area in 1968 and observed severe erosion and little animal life. Veblen and Delmastro (1976) state that the current distribution of araucaria covers an area much less than it did when the Spanish arrived in Chile. In the lowest and most accessible sites araucaria has essentially disappeared. Donoso (1981) also reports that the failure to see many trees at lower altitudes is a result of past exploitation. Schmidt et al. (1977) write that the net extractive process has totally or partially destroyed what was once a productive forest. Mutarelli and Orfila (1970) tried to find a healthy 100-hectare plot for silvicultural experiments in the Lake Moquehue region, but were unsuccessful due to the heavy commercial extraction and damage that had taken place.

¹⁴ Cited in Montaldo (1974). No specific reference is provided. *El Mercurio* is the largest and oldest daily newspaper in Chile.

In logging operations the least valuable or diseased trees were often the only ones left behind. Puente (1980) criticizes the timber industry for this practice, known locally as *floreo*. Bascur et al. (1987) observed very heavy selective cuts in some areas, with only the best trees being taken out. Veblen and Delmastro (1976) mention that felling has always been done in the absence of reforestation plans, and natural regeneration had never been sufficient to sustain production necessary for replacement. Eloy López Cepero informed the author (pers. com. March 1993) of a common strategy formerly used by timber companies in Argentina to get araucaria wood. In many approved management plans permission was granted to extract lenga, a species with much less value than araucaria. In order to reach the lenga, however, the companies would need to cut through stands of araucaria. Once the best araucaria trees were extracted, the initial management plans for lenga extraction were abandoned, with any number of implausible excuses (e.g., the start of the rainy season) being invoked.

Fire and Tourism

Although timber activity has been one of the principal anthropogenic threats to araucaria, fire has also accounted for incredible damage. Kozdon (1958) writes that settlers in the southern Andes saw the forest as nothing more than an enemy, and commonly referred to it as a "green hell." Intentionally set fires destroyed vast areas of native vegetation, as land was cleared for grazing or farming (Bascur et al. 1987). This phenomenon was particularly acute in the Nahuelbuta Range (Veblen 1982). Fernández (1990) writes about the observations of J. I. Alsina, a member of an expedition to Neuquén in 1899. Alsina estimated that at least one-third of the araucaria forests near Pino Hachado, a place name which translates as "axed pine," were destroyed by intentionally set fires. Montaldo (1974) writes of timber companies setting fires to facilitate the extraction of araucaria. Leonardo Araya (pers. com. April 1993) confirmed that this was common practice during the 1960s.

Veblen and Delmastro (1976) suggest that one of the most serious threats to araucaria is the demand for its habitat for tourist and recreation activities. There is little literature per se on this topic.¹⁵ However, it was recently determined that the araucarias of Caviahue, a small resort town popular for its thermal baths, are especially susceptible to insect damage. This increased susceptibility relative to other araucaria trees is apparently the result of human pressure exerted on the area's araucaria forests.¹⁵

THE INDIGENOUS CASE

Piñon Collection

Tortorelli (1942), in writing about the anthropogenic effects on the health and regeneration of araucaria forests, claims the Araucano tradition of collecting piñones is quite detrimental. He says the Araucanos "cometen toda clase de barbaridades"¹⁶ in their quest to obtain piñones. Professor A. Medina informed González and Valenzuela (1979) that Araucanos in the Villarrica area even cut down trees to get at the piñones.¹⁷ The Araucano practice of knocking down cones before seeds fall to the ground disrupts araucaria's flowering cycle, and thus affects the pollination and regeneration process: CONAF regulations prohibit the use of lassos to pull down cones (V. Soto, forest ranger, Ralco National Reserve, pers. com. January 1993). Veblen and Delmastro (1976) and Bragg (1980-81) mention the impediments to araucaria regeneration caused by the Araucano collection of piñones. Bragg states that she observed more seedlings in araucaria forests in which no gathering had taken place.

Fire

¹⁵ N.d. *Río Negro*. Temor por la baja regeneración de las araucarias.

¹⁶ This is translated by the author as "commit all kinds of atrocities."

¹⁷ Such activity goes against the traditional respect and reverence the Araucanos have had for araucaria. González and Valenzuela relate a story told to them by an Araucano from the community of Cauñicú. In an attempt to obtain piñones, a man fell from an araucaria tree and broke his leg. Bystanders blamed the incident on the deities who were angry with the man's actions.

Several authors report that settlers in the southern Andes were not the only ones responsible for burning large tracts of forest cover. The area's indigenous inhabitants have also been responsible for fire damage. Neger ([1897] 1944) writes about the Araucano practice of lighting fires to cook and keep warm during collection outings. On occasion a fire would get out of control. Neger points to a case in which 20 to 30 km² of araucaria forest were burned near Lake Ñorquinco. Montaldo (1974), Cozzo (1980), and Serret (1984) also mention fire damage by the Araucanos. Veblen (1982) indicates that fire was probably used to reduce undergrowth to facilitate piñon collection.

Grazing

The most important economic asset in most Araucano communities is livestock. Sheep and goats are the most commonly found domesticated animals, but cattle, pigs, poultry and horses are frequently seen. Piñones often serve as food for these animals, especially the goats, pigs and poultry. A number of authors, including Tortorelli (1942), Mutarelli and Orfila (1970), and Bragg (1980-81), point to the detrimental effects that grazing practices have on araucaria regeneration.¹⁸ Serret (1984) writes that domesticated animals often crush seedlings. Also, during the winter months goats eat seedling leaves which are above the snow (V. Soto, pers. com. January 1993).

Logging

Two cases regarding the participation of Araucanos in the felling and processing of araucaria were discovered in the author's search for secondary data. The written sources, both newspaper articles,¹⁹ report on the first situation in the Cajón del Trueno, located near the indigenous community of Quinquén. The articles are about CONAF's enforcement of a management plan which had approved the cutting of araucarias. They

¹⁸ Damage from grazing is not exclusively an Araucano phenomenon, although most references found seem to suggest that it is.

¹⁹ *El Mercurio*. 1990. Plantación de 70 Mil Araucarias en Temuco. February 11; and *El Sur*. 1990. Planes de manejo de la araucaria están bien. January 27.

mention that 80% of the 130 people logging in the area were Araucanos. Ten other Araucano families were also soliciting permission to cut araucarias. A related case is documented in a video called *Los Ultimos Pehuenches* (n.d.). The Araucanos in El Naranjo, also near Quinquén, sold their rights to the araucaria trees. Timber companies moved in to cut these trees. The inhabitants are currently suffering from the effects of erosion and soil loss, and live in deeper impoverishment than before the araucarias were cut.

THE PROTECTION OF ARAUCARIA

The previous chapter discussed basic silvicultural management, the location and intensity of araucaria felling, and both non-indigenous and indigenous contributions to the degradation of araucaria. This chapter focuses on the conservation and protection of araucaria.¹ The most effective way to ensure survival of the species has been the subject of debate in both Chile and Argentina.² Specifically, the chapter reviews conservation efforts through the creation of protected areas,³ legislation to regulate felling, and silvicultural management and reforestation. The effectiveness of these approaches is also considered. The chapter concludes with a brief discussion on indigenous conservation and protection.

PROTECTED AREAS

Chile

Chile has a very extensive system of natural areas which enjoy some sort of protected status. Araya and Cunazza (1992) write that approximately 18% of Chile's surface area falls within the Sistema Nacional de Áreas Silvestres Protegidas del Estado (SNASPE).⁴ SNASPE was formed in 1984 to consolidate all laws and regulations pertaining to protected areas (Gutiérrez Vilches 1992). SNASPE defines specific

¹ Conservation implies sustainable use strategies which ensure the health and viability of trees and the species. Protection, normally thought of as more of a hands-off approach to resource management, is used here with a regulatory connotation. To protect araucaria is to prohibit its felling and ensure its conservation.

² There have been no regional or bilateral attempts to manage araucaria as a trans-border or international resource. Ricardo Romero, an adviser to the executive director of CONAF, attributes this to the history of border skirmishes between the two countries (pers. com. April 1993).

³ Protected areas include national parks, national reserves, natural monuments, provincial parks, and private reserves.

⁴ The distribution of this area is quite skewed. Approximately 86% of Chile's protected areas are located in the southernmost XIth and XIIth regions (CONAF 1993).

conservation objectives for the country, clarified the categories of protected areas, is administered by CONAF, is charged with drawing up elaborate management plans for each of Chile's eighty protected areas, sets inspection provisions and fines, and regulates concessions:

There are currently four types of protected areas within SNASPE: national park,⁵ national reserve, natural monument, and pristine reserve.⁵ A national park is an area which preserves ecological diversity, natural environments, cultural features and scenery, and permits educational, recreational and scientific activities which are compatible with this objective. A national reserve allows limited and regulated use of its natural resources. A natural monument is a small area characterized by native fauna or flora, or by geologic sites which have scenic, cultural, educational or scientific value. Absolute protection, except in cases of scientific research and public works, is given to a natural monument. A pristine reserve allows no commercial activity of any kind and can have no motorized traffic.

Throughout the long history of protected areas in Chile,⁶ boundaries have been drawn and redrawn. Some protected areas have disappeared and others have been added. Often only the status of an area has changed. This is not surprising since most protected areas were initially created without thorough study of the resources and land-tenure history (Cunazza 1989). Araucaria and its habitat have not been exempt from this dynamic process. The tree is currently a natural monument, which means its felling is prohibited on both public and private lands. This has not always been the case, however. In 1976 araucaria was declared a natural monument for the first time. In 1987 the prohibition of its felling was lifted. In 1990 araucaria was once again declared a natural monument.⁷ Before 1976, and from 1987 to 1990, when araucaria did not have species-

⁵ Pristine reserve is translated by the author from "reserva de región virgen."

⁶ The country's first forest reserves were created in 1879 (Cabeza 1988).

⁷ Details of this process are provided later in this chapter.

wide protection, no more than 25% of the area where it occurs was ever included in either a national park or national reserve at any given time (Maiz 1987). Today, assuming that araucaria were not classified as a natural monument, it would be given some kind of protection in thirteen SNASPE areas (six national parks and seven national reserves).⁸

In early 1990, not long before araucaria was declared a natural monument for the second time, Chile's first private nature reserve was created to conserve exemplary tracts of araucaria forest (Straka 1992). The Cañi Forest Reserve near the Villarrica Volcano is titled to Fundación Lahuen, a Chilean non-governmental organization which is active in native forest issues. Funds to buy the 480-hectare reserve were raised in the United States, and since its inception adjacent governmental lands have been ceded to the reserve. Currently, all of its conservation objectives are being met (N. Mintz, Fundación Lahuen, pers. com. May 1993). Fundación Lahuen, and others as well, have plans to establish more private nature reserves in Chile. In 1991, Douglas Thompson, a wealthy investor from the United States, paid \$7 million for large tracts of land (over 200,000 ha) in southern Chile to be reserved for protection of native forest.⁹

Argentina

In the early part of this century, Francisco P. Moreno, the relentless Argentine explorer, was given public lands in Río Negro and Neuquén in exchange for his survey work. This was in essence the genesis for the creation of protected areas in Argentina. Fourcade de Ruiz and S. de Uríbelarrea (1992) summarize the history and outline the system well. In 1903 Moreno donated the lands back to the Argentine government, stipulating that they be used for a national park. Many years later, in 1922, Argentina's first protected area (Parque Nacional del Sur) was established on the property donated by

⁸ The national parks are: Laguna del Laja, Conguillio, Nahuelbuta, Tolhuaca, Huerquehue and Villarrica. The national reserves are: Ralco, Malleco, Malalcahuello, Nalcas, China Muerta, Galletué and Hualafalquén.

⁹ *El Sur*. 1991. Inversionista extranjero compró bosques para reservas ecológicas. March 24.

Moreno, as well as on adjacent lands. In 1934 Law 12.103 created the foundation for the current system of protected areas in Argentina. Initially three categories were defined: national park, national reserve, and natural monument. The criteria for each are almost identical to those in Chile. In 1990 Argentina added a fourth category, the strict reserve. This is nearly identical to a pristine reserve in Chile. The category was created to comply with the 1940 Washington Convention, which standardizes definitions and categories for protected areas worldwide. Argentina currently has thirty-two units within its system of protected areas which cover nearly 1% of its national territory.

Lanin National Park is the only park in Argentina's national system of protected areas to contain araucaria. A significant portion of Argentina's 80,000 ha of araucaria is contained within this park. Montaldo (1974) states that with foresight the Argentine government created Lanin National Park in 1937 to protect araucaria from the intense exploitation which had yet to arrive in the area. It is more likely that this national park, along with a number of others in southern Argentina, was created as part of the government's strategic defense goals and to consolidate the country's position in frontier areas (Osídala et al. 1992).

Araucaria is also protected in several provincial reserves. The Neuquén government established the reserves of Batea Mahuida (1,206 ha) and Chañy (2,038 ha) in 1968 with the explicit intention of protecting araucaria. Another protected area, the 25,000-hectare Copahue Provincial Park, was created by the Neuquén government in 1963 to protect the area around the thermal baths at Caviahue. The park contains several stands of araucaria.

LEGISLATION

Chilean Legislation

The legislative history of araucaria in Chile has been a complicated one (Table 6.1). The nature of legislation changed markedly beginning with Decree 292 in 1974. For the first time araucaria was noted not just for its economic value, but also for its cultural, historical, and scientific importance. Decree 29 of 1976 built upon this fresh perspective by mentioning the educational, recreational, and ecological significance of araucaria. Decrees 29, 141 and 43 have been among the most widely discussed and debated pieces of forestry policy in Chile.

Table 6.1

The Legislative History of Araucaria in Chile

<i>Year</i>	<i>Decree</i>	<i>Principal Characteristics</i>
1969	94	Establishes minimal regulations for araucaria felling
1969	157	Slightly modifies Decree 94
1970	439	Further modifications and annulment of Decree 94 and Decree 157
1974	292	Declares some of the araucaria in the Nahuelbuta Range a natural monument
1976	29	Declares the entire Chilean population of araucaria a natural monument
1987	141	Declares araucaria a natural monument in certain areas and generally allows for regulated felling on private lands
1990	43	Declares the entire Chilean population of araucaria a natural monument

Source: Observaciones de CONAF referente a la demanda de la Sociedad Galletué. N.d.

Decree 29 went into effect (April 26, 1976) at a time when the Chilean military government was attempting to improve its tarnished international image (Bengoa 1992). There was also concern about the heavy exploitation of araucaria which had been occurring. Decree 29 gave araucaria absolute protection, and was met with considerable dismay by the timber industry. The decree prevented the Sociedad Galletué, a corporation with land holdings in the area, from cutting 1,200 ha of araucaria forest.

Seven months after Decree 29 was signed, the Sociedad Galletué filed a lawsuit demanding indemnification for lost profits, the value of its araucaria wood, and unusable infrastructure. In 1981 the Supreme Court ordered the Chilean government to pay the Sociedad Galletué an undetermined amount of money. In 1984 the Sociedad Galletué demanded an indemnification payment of \$15.1 million. This amount was rejected by the state; and negotiations over the indemnification payment continued over the following years.¹⁰

In 1987 (December 26) Decree 141 replaced Decree 29, which had been in effect for over eleven years and had absolutely prohibited the cutting and destruction of araucaria. Decree 141, signed with little prior notice, lifted this prohibition. It states that "estudios técnicos y científicos realizados en los últimos años concluyen que el tipo forestal araucaria es factible de manejar a través de la aplicación adecuada del sistema de manejo."¹¹ Gedda (1988) reports on the dubious conditions under which Decree 141 replaced Decree 29. He mentions that the authorities put too much faith in the Bascur et al. (1987) araucaria inventory sponsored by CONAF and undertaken by the Universidad de Chile. Gedda claims that the investigation was poorly intentioned and manipulated.

It is likely that ecologically sound management strategies for the araucaria forest do exist, as implied in Decree 141. This has been the conclusion of most technical studies, and was mentioned to the author during a conversation (April 1993) with Leonardo Araya, a forester currently working for CONAF, but formerly of the Comité Nacional pro-Defensa de Fauna and Flora (CODEFF), one of Chile's most active environmental organizations. In any event, the text of Decree 141 fails to mention the

¹⁰ All information regarding the Sociedad Galletué legal proceedings is from an internal CONAF document entitled *Juicio ordinario rol N° 1.534*. N.d.

¹¹ This is translated by the author as "technical and scientific studies undertaken in recent years conclude that adequate strategies for the management of araucaria forests do exist."

most significant factor behind the annulment of Decree 29 -- the long and costly trial initiated by Sociedad Galletué.

Sanhueza (1988) writes that the state lost the Sociedad Galletué trial because it conducted a poor defense and misinterpreted many laws and norms. However, it did succeed in obtaining a deferral on the indemnification payment, which, as mentioned above, became the subject of protracted negotiations. To avoid having to pay a large sum of money and to fend off other indemnification claims, the Chilean government felt it was more cost-effective to lift the protection given to araucaria by Decree 29 (Gedda 1988; Bengoa 1992). Decree 141 permitted renewed exploitation but waived further indemnification claims.¹² Environmentalists strongly objected to Decree 141, stating that just two years earlier araucaria had been declared vulnerable in the 1985 Symposium on Threatened Chilean Native Tree and Shrub Flora.¹³

Decree 141 was only a partial relaxation of the restrictions imposed by Decree 29. It stipulated that araucaria remain a natural monument in Chile's national parks, anywhere it was found on slopes greater than 80°, and where it was growing on soils determined by CONAF to be degraded. No specific provisions were made to protect the tree in national reserves. Beyond the limits and conditions mentioned above, araucaria could legally be extracted, provided a management plan had been approved by CONAF.¹⁴ Rafael Asenjo, an environmental lawyer for CODEFF, mentions that Decree 141 subjected approximately 80% of Chile's araucaria trees (by volume) growing over 50% of its range

¹² In 1991 the state eventually paid some indemnification to Sociedad Galletué, but it was an amount much smaller than originally requested (*Juicio ordinario rol N° 1.534*. N.d.). Gedda (1988) claims that this payment violates the 1940 Washington Convention on the Protection of American Flora, Fauna and Scenic Beauty, to which Chile subscribed in 1967. The Convention does not consider resources classified as natural monuments to be subject to indemnification.

¹³ Aldunate, C. 1987. El ochenta por ciento de las araucarias será explotable. *La Epoca*. December 28.

¹⁴ The requirements for an approved management plan were much stricter than they had been before 1976. Also, reforestation requirements were ambitious. Ten seedlings had to be planted for every tree extracted (*El Mercurio*. 1990. Esto no es tala rasa sino corta selectiva. February 13).

to potential exploitation.¹⁵ Bengoa (1992) reports that renewed exploitation was pursued with vigor.

In Decree 141 there was the notable omission of a phrase which had appeared in Decree 29. The text reading "la araucaria simboliza las más auténticas y nobles tradiciones del pueblo mapuche"¹⁶ was dropped. It turns out, however, that the Araucanos were instrumental in getting Decree 141 replaced by Decree 43, which less than three years later declared araucaria a natural monument once again.

Bengoa (1992) writes about the Araucanos of Quinquén and their relentless defense of the araucaria. With the lifting of felling restrictions in 1987 a company called Agrícola y Forestal Casagrande¹⁷ began exploiting the araucarias which had traditionally provided piñones to the inhabitants of Quinquén. The community tried to obtain an injunction against logging in these forests, but because it had no legal title to the land, the case did not hold up in court. A long, well-publicized controversy followed. The araucaria forests and land in question were eventually bought by the Chilean government (nearly 30,000 ha for \$6.15 million) and are currently in the process of being transferred to the residents of Quinquén or being incorporated into the Galletué National Reserve. The Quinquén case sensitized the Chilean people to the plight of the country's indigenous inhabitants, and became a symbol not only for indigenous organizations, but also for environmental and human rights groups.¹⁸

On April 3, 1990, only several months after Patricio Aylwin became Chile's first elected president in over sixteen years, Decree 43 went into effect. Araucaria currently enjoys the status of a natural monument. Its felling is strictly prohibited, except in cases which involve scientific investigation, construction of public works, national defense, or

¹⁵ Aldunate, C. 1987. El ochenta por ciento de las araucarias será explotable. *La Epoca*. December 28.

¹⁶ This is translated by the author as "araucaria symbolizes the authentic and noble traditions of the Mapuche."

¹⁷ Agrícola y Forestal Casagrande is a subsidiary of the Sociedad Galletué.

¹⁸ *El Mercurio*. 1990. Tala de Araucarias. February 15.

state management plans filed with the intention of saving or improving the species.

Decree 43 is not quite as strict as the 1976 Decree 29. If a management plan is approved by CONAF, and only if in the following season at least one thousand seedlings are planted, the exploitation of dead wood¹⁹ may legally occur under Decree 43.

Through their struggle the people of Quinquén were influential in renewing the ban on araucaria exploitation. They were successful in getting the clause about the importance of araucaria to the indigenous people, which had been dropped from Decree 141, reinstated in Decree 43. President Aylwin also had made a campaign promise to resolve the conflicts over land rights and indigenous access to araucaria forests (A. Cavieres, CONAF, Departamento de Control Técnico, pers. com. April 1993).²⁰ Leonardo Araya, head of CONAF's Departamento de Manejo y Desarrollo Forestal, points to the growing environmental consciousness in the Chilean population at large and the increased political will under the new democratic system as other important factors in the implementation of Decree 43 (pers. com. April 1993).

The timber industry, represented by its trade organization Corporación Chilena de Madera (CORMA), adamantly opposed Decree 43 (Araucaria: Forest and Cultural Heritage 1990). CORMA argued that absolute prohibition is justifiable only when a species is under the threat of extinction. Owners of land with araucaria appealed to President Aylwin to reconsider Decree 43. Being unsuccessful, the timber industry's next strategy involved entering the courts once again. The Sociedad Galletué is reacting to Decree 43 no differently than it did to Decree 29. A new lawsuit has been filed asking for

¹⁹ Dead wood is from trees which have permanently lost foliage so that photosynthesis has ceased. CONAF will not approve the exploitation of dead wood if it is suspected that anthropogenic action was involved in a tree's death.

²⁰ President Aylwin's son is actively involved in Chile's indigenous affairs. Currently he is working with the Comisión Especial de Pueblos Indígenas (CEPI), an entity recently created by the Chilean government to handle indigenous affairs and distribute loans and resources to indigenous communities.

approximately \$16 million in indemnification payments.²¹ Juan Vargas, one of the CONAF lawyers involved in the case, states that the Chilean government must prepare a better defense this time (pers. com. April 1993). Until the case is resolved, araucaria's status as a natural monument may be in jeopardy.

Argentine Legislation

The legislative history of araucaria in Argentina, where all species-specific forestry legislation occurs at the provincial level, has not been as controversial (Table 6.2). There are no federal laws pertaining solely to araucaria. Neuquén is the only province which contains naturally occurring araucaria. The author found no references to this legislation in the literature. In fact, very few individuals interviewed had knowledge of araucaria legislation. Eloy López Cepero informed the author that the most recent law, Law 1890, was passed with little discussion and lobbying (pers. com. March 1993).

Table 6.2

The Legislative History of Araucaria in Argentina

<i>Year</i>	<i>Law</i>	<i>Principal Characteristics</i>
1965	489	Restricts araucaria felling between the Cajón de Trolope and Lake Espejo
1968	559	Annulment of Law 489
1991	1890	Only the cutting of diseased, fire-damaged and overmature trees is permitted. The Dirección General de Bosques y Parques Provinciales must authorize the collection and sale of piñones.

Source: Oficina de Leyes y Decretos, Provincia del Neuquén.

Note: An overmature tree is one with an advanced age. Photosynthesis and flower and seed production may still be taking place, but the tree has reached a biological state in which its extraction would not be detrimental and may be beneficial to forest maintenance. There is usually a good deal of subjectivity involved in defining

²¹ Information regarding this lawsuit was obtained from an internal CONAF document entitled *Observaciones de CONAF referente a la demanda de la Sociedad Galletué*. N.d.

overmaturity (C. Mohn, College of Natural Resources, University of Minnesota, pers. com. July 1993).

Law 489 did little to restrict existing logging activity, although it did prohibit companies from making further infrastructure investments within the specified zone. The text of Law 489 is redundant and contains a number of contradictions and errors. For example, the Cajón de Trolope is given a location of latitude 49°S, which puts it in the province of Santa Cruz, over 1,500 km south of araucaria's growth range. The actual latitude of the Cajón de Trolope is 37°46'S. Even when making this correction, much of the araucaria within the zone specified by Law 489 is in Lanin National Park, and was already protected under park regulations. Law 559 reversed the limited protection given to araucaria by Law 489, stating that araucaria was an important economic resource for the province. Then there is a gap of twenty-three years before araucaria shows up again in the legislative records. Law 1890, which went into effect on August 8, 1991, makes no other provisions than those mentioned in Table 6.2. Its most interesting aspect is perhaps the regulation of piñon collection, the only law in either Chile or Argentina which makes reference to this activity.

The three laws described above apply to public and private lands in the province of Neuquén. The araucarias located within Lanin National Park fall under the jurisdiction of the Administración de Parques Nacionales, which strictly prohibits araucaria felling. In Argentina the tree has never been declared a natural monument as it has in Chile. However, given the provisions of Law 1890, and the absolute prohibition on araucaria felling by the Administración de Parques Nacionales, there are relatively few araucarias in Argentina which may be cut. The only real differences in regulations between Chile and Argentina involve the control of piñon collection and the extraction of overmature trees.

International Legislation

Araucaria is regulated under the terms of the Convention on the International Trade of Endangered Species (CITES). CITES, which was founded in 1975 and currently has 112 member countries, provides a mechanism to administer, monitor and control international trade in threatened and endangered species. Efforts focus strictly on trade and do not regulate extractive activities.

CITES defines three categories of regulation. Appendix I of this charter lists those species which are already threatened, and trade is strictly prohibited except for scientific or conservation purposes. Even in these cases, both an export and import permit are needed. Appendix II includes species which will be threatened if trade controls are not imposed. An export permit is required, which is issued only if it can be shown that the species was obtained legally. Appendix III includes species subject to some kind of regulations within a particular country and for which collaboration on trade restrictions from other countries is desired. Representatives from CITES signatory countries meet every two years to discuss progress and modify the appendices as they deem appropriate. The Chilean population of araucaria is currently listed in Appendix I, and araucaria in Argentina is an Appendix II species.²²

SILVICULTURE AND REFORESTATION

Some researchers conclude that the most effective strategy to ensure the perpetuation of araucaria involves sound utilization practices and silvicultural management. Although in 1976 Veblen and Delmastro wrote that silvicultural methods to ensure araucaria regeneration were not known, Schmidt et al. (1977) claimed one year later that there are technical approaches which permit not only the use of the species, but also its improvement, and that these measures offer more effective means of protection

²² All information is from a 1992 internal document obtained from the Dirección de Recursos Forestales Nativos, Argentina.

than legal prohibitions. Cortés Salas (1979) also feels that the health and viability of araucaria are not ensured through legal protection alone, and that silvicultural interventions offer great potential. Schmidt et al. (1980) reiterate the notion that technical management is the most effective conservation strategy.

Santiago Gomez, director of the Departamento de Áreas Protegidas for CONAF in Temuco, points to the excellent growth and regeneration capacity of araucaria (pers. com. February 1993). Intervention, if done properly, can actually improve this capacity. Trees over 1.5 m in basal diameter begin to rot inside, and Gomez sees no point in letting these trees fall to the forest floor. He informed the author that araucaria management plans are easy to control because the tree is not a common one, and emphasized that 95% of the technical studies to date have recommended managed intervention in the araucaria forests. Gomez mentioned that if the Araucanos wanted to ultimately increase their piñon harvests and also benefit from wage labor, they would consent to silvicultural interventions in their araucaria forests.

Plantations are seen by some to be an effective conservation strategy, as they often take pressure off naturally occurring trees of the same species and other species as well. However, plantations cannot be considered in the case of araucaria. In Chapter 5 it was mentioned that araucaria, due to its slow growth and long cutting rotation, is not an economically viable plantation species.

There have been several attempts at araucaria reforestation. López Cepero and Pintos (1984) report that the Neuquén provincial government plants araucaria seedlings in sites damaged by fire and in areas which have suffered heavy grazing damage. The provincial nursery is located on the shores of Lake Moquehue at La Angostura. The Dirección General de Bosques and Parques Provinciales (1981) reports that araucaria seeds are collected in March and stored over the winter. Sowing takes place in October and germination in November, and the plants emerge in December. After two growing

seasons, seedlings are transplanted to the mountains. The reforestation program began in 1962 with a direct planting strategy, but after failing to show favorable results, transplanting was begun in 1980.²³ Currently, there are 428,000 seedlings in the nursery, although there are plans to reduce this number to 100,000 (J. Ravelotti, Dirección General de Bosques and Parques Provinciales, pers. com. March 1993).

In Chile there are currently no araucaria reforestation programs. Previous attempts have all been responses to requirements to get management plans approved. Decree 141 in 1987 stipulated that ten araucarias be planted for every tree cut. During the period for which Decree 141 was in effect, there is a report of a nursery with 50,000 one-year-old seedlings and 25,000 two-year olds which were to be used for reforestation in logged areas. This was part of a requirement to plant 70,000 araucarias to compensate for the cutting of 5,720 trees over a two-year period.²⁴ There is another report about a company which cut 2,200 araucarias in 1989 and afterwards planted 30,000 seedlings, boasting that in a century there would be more araucarias than ever before.²⁵

EFFECTIVENESS

Protected Areas

Straka (1992) writes that although Chile has the most national parks of any country in the world, many are simply "paper" parks, meaning that they do not have well-defined regulations and comprehensive management plans. Those that do often lack the necessary financial, technical and personnel resources to enforce them. In Argentina, Fourcade de Ruiz and S. de Uribe Larrea (1992) state that half of the national protected areas are adequately managed. One of the biggest problems lies in coordinating the

²³ Mutarelli and Orfila (1970) mention a direct planting program undertaken by the federal government in 1953, saying that the results were variable.

²⁴ *El Mercurio*. 1990. Plantación de 70 Mil Araucarias en Temuco. February 11.

²⁵ *El Sur*. 1990. Planes de manejo de la araucaria están bien. January 27.

efforts of the Administración de Parques Nacionales with provincial conservation programs. An example of this is the redundancy of Law 489 discussed above. Also, it was the author's general impression that the national park authorities knew little about the Neuquén provincial reserves, which do not have any management plans.

Although many of the best stands of araucaria have been heavily exploited, some have been spared felling, most notably those within the limits of national parks and reserves. Protected areas have had some success in protecting araucaria. However, there have been problems and violations. Elizalde Mac-clure (1970) reports that timber companies have not always recognized the felling prohibition in protected areas. He points to the past destruction of araucaria in Conguillio National Park. Veblen and Delmastro (1976) write that within national parks illegal araucaria cuts and grazing damage occurred. In Argentina official statistics for araucaria extraction within national parks are provided for the years 1961, 1963, 1968 and 1969, even though araucaria timber activity has always been prohibited within Lanin National Park. The statistics may be related to some kind of exclusion for several private property owners within the park or may have been the result of a complete violation of national law (R. Romero, Administración de Parques Nacionales, pers. com. March 1993).

Araucaria's status as a natural monument in Chile has given the species much of the protection it needs after a history of intense overexploitation. Decree 43, which declares araucaria a natural monument, specifically provides for the protection of araucaria but fails to mention any other species. At issue is the effectiveness of single-species protection as opposed to habitat or ecosystem protection. A graphic example of the shortcomings of single-species protection is depicted in Appendix I. The entire native forest around this solitary araucaria has been clear-cut, and one must wonder about the fate of this tree which is no longer living in its associated community. One must also

question the approval of a management plan, if one existed, which would allow this to happen.

Legislation

Schmidt et al. (1980) write that legal measures to protect araucaria have always been sporadic and limited in effectiveness. Serret (1984) mentions that enforcement of laws buckles under economic and social pressure, and with respect to araucaria by no means do laws guarantee the survival of the species. Rafael Ansejo points out that even with the complete prohibition of felling activity araucaria may still be threatened due to the general lack of respect for forestry laws and regulations on the part of the timber industry.²⁶

When Decree 141 was implemented in 1987, CONAF created a special unit to handle and enforce araucaria management plans. Aerial photographs, accurate forest inventories, and precise details of the proposed extraction were required in all solicitations. Personnel and financial resources were allocated to ensure compliance with approved management plans. However, there are indications that CONAF's objectives were not met. CODEFF, in an independent investigation of a management plan in the Cajón del Trueno, announced that araucaria was being extracted at 300 m³/ha instead of the approved 182 m³/ha. This amounts to 67% more than the amount approved.²⁷ Also, a complaint filed by La Sociedad de Vida Silvestre in Temuco mentions that a company was illegally extracting araucaria from the Lake Icalma region, only several km from the Argentine-Chilean border. The wood was apparently being cut for export to Argentina.²⁸

Eloy López Cepero believes that araucaria legislation in Argentina is being respected and is currently effective (pers. com. March 1993). However, there is an issue worth mentioning here. Law 1890 allows for the exploitation of fire-damaged trees,

²⁶ Aldunate, C. 1987. El ochenta por ciento de las araucarias será explotable. *La Epoca*. December 28.

²⁷ *El Mercurio*. 1990. Esto no es tala rasa sino corta selectiva. February 13.

²⁸ *El Mercurio*. 1988. Denuncian la Tala de Bosques de Araucarias. June 7.

diseased trees, and overmature trees. One of the dangers in allowing the exploitation of dead and aged wood is that this often leads to the extraction of live trees. During a visit to a mill in Alumine, the author observed one fresh araucaria log in a stack of otherwise dry logs. When questioned, the workers replied the live araucaria was cut because it interfered with road construction. Extraction of live trees, in plans which permit the extraction of only dead and aged ones, has been an acute problem with alerce, another long-lived conifer found in the southern Andes.

Chile has been a signatory member of CITES since its inception in 1975. The Chilean population of araucaria is subject to a complete ban in international trade.²⁹ However, in the March 1993 issue of *Exportaciones Forestales* it is reported that Chile exported 35 m³ of araucaria for a price of \$10,129. An attempt to investigate this situation at CONAF proved unsuccessful. In trying to clarify the matter with CODEFF, the author was informed that limited exports of araucaria could be from stock wood, or trees cut before April 1990 when Decree 43 came into effect. This would still constitute a violation of CITES Appendix I regulations. Sources at CODEFF also mentioned that CONAF officials have several interpretations of the CITES treaty. Some feel that araucaria is an Appendix I species and others believe it is listed in Appendix II. The author obtained a list of CITES-protected species and found the information to be ambiguous and confusing.³⁰

²⁹ Again, this is stated in a 1992 internal document from the Dirección de Recursos Forestales Nativos, Argentina. It is also reiterated in *El Mercurio*. 1990. Plantación de 70 Mil Araucarias in Temuco. February 11.

³⁰ The 1990 CITES meeting listed araucaria under Appendix I as: *Araucaria araucana* **+216. The (**) means that one or more of the populations, geographically separated, are in Appendix II. The (+) means that only some of the population is included in Appendix I. The number 216 refers to the Chilean population. Does this mean the entire Chilean population is included in Appendix I, or is some of it excluded and listed in Appendix II? Under Appendix II araucaria is listed as: *Araucaria araucana* *-117≠1. The (*) means that one or more of the populations, geographically separated, are in Appendix I. The (-) means that only some of the population is included in Appendix II. The number 117 also refers to the Chilean population. The (≠1) refers to all parts of the tree except the seeds, spores and pollen. Does this information mean that some of the Chilean population is excluded from Appendix II, or is the entire Chilean population included? Can the information given for Appendix I and Appendix II be interpreted consistently and produce logical results?

It is well beyond the scope of this thesis to assess the effectiveness of silvicultural management in araucaria forests. Again, general consensus indicates that from an ecological perspective the tree can be adequately managed. However, it is important to point out that all silvicultural measures proposed for araucaria conservation assume compliance by the timber industry and sufficient resources to enforce measures of control. These factors are also important in the ultimate effectiveness of protected areas and legislative efforts. In any attempt to protect araucaria, perhaps the most important component is a popular commitment to environmental conservation.

INDIGENOUS PROTECTION

One of the key questions addressed in this thesis relates to the Araucano protection of araucaria. In the previous chapter reference was made to the indigenous degradation of araucaria through collection activities, fire, grazing practices, and participation in logging. There are also references in the literature which point to the strong conservation ethic of the Araucanos. These references are reviewed below. The specific cases of Ralco Lepoy and Aigo are assessed in Chapter 8.

Indigenous participation in the logging of araucaria seems to have been much more the exception than the rule. The Araucanos have often come to the defense of the araucaria forests, claiming that they have managed them properly since time immemorial and are excellent stewards of their own lands and resources (Santos 1991). Elizalde Macclure (1970:121) tells the story of several caciques from indigenous communities in Chile's upper Bío-Bío watershed who traveled in 1965 to Santiago to speak with government officials and timber executives in an effort to prohibit the felling of araucarias. Upon their return from Santiago, the cacique from Marimanuco, Lorenzo Millanzo Cañumiro, told a group of Araucanos:

Todos juntos debemos hacer lo posible para obligar a los señores que cortan nuestros pehuenes y que Dios nos dio como alimento, a irse de la región y no venderles un solo árbol, porque después de cortados ya no tendremos piñones y nuestros hijos van a sufrir por esto. Debemos acusar a todo hombre o mujer que queme los bosques que son los que nos permiten criar nuestros animales, sin bosques nuestros suelos se secarán y tendremos que huir de nuestras tierras porque no correrá agua y todo será un desierto.³¹

Elizalde Mac-clure claims that the Araucanos have a very advanced concept of environmental conservation.

Other authors also point to the indigenous defense and protection of araucaria forests. Specifically, Quarto (1990) mentions Araucano resistance to logging. Bengoa (1985) writes of araucaria's supernatural protectors and how these deities strictly prohibit cutting the tree. For this reason, writes Bragg (1980-81), the Araucanos protect the araucaria forest and do nothing to mistreat the trees. Bengoa (1992) reports that the people of Quinquén have always protected their araucaria forests against indiscriminate cutting. In the Declaration of the Mapuche-Pewenche Community of Quinquén to the National and International Community (January 26, 1993), it is mentioned that in the late 1960s and early 1970s the Araucanos themselves were responsible for attempts to stop illegal extraction. The declaration also states that the Araucanos have always worried about caring for nature, and only recently has the *huinca* (non-indigenous) been developing a sense of environmental consciousness.

³¹ This is translated by the author as "All of us must do everything possible to see that our araucarias, which God left us as a source of food, are not cut. We must see that those who want to cut our trees leave the region and we must not sell them a single tree, because once the araucarias are cut we will no longer have piñones and our children will suffer. As for those who burn the forests, we declare that these very forests allow us to raise our animals, and without these forests our soils would dry out, our lands would become a desert, and we would be obliged to leave."

TWO ARAUCANO COMMUNITIES

This thesis has thus far provided an overview of the relation of human activities to the distribution and conservation of araucaria. Specifically, the previous chapters have considered the environmental context, the human context, the degradation of araucaria, and the protection of araucaria. Attention will now focus on the particular experiences of two Araucano communities. This chapter surveys the characteristics and land-tenure history of each community. Ralco Lepoy is an Araucano reservation located in the Chilean Andes 272 km from Concepción. Aigo is an Araucano reservation 25 km west of the Argentine town of Alumine (Figure 7.1).

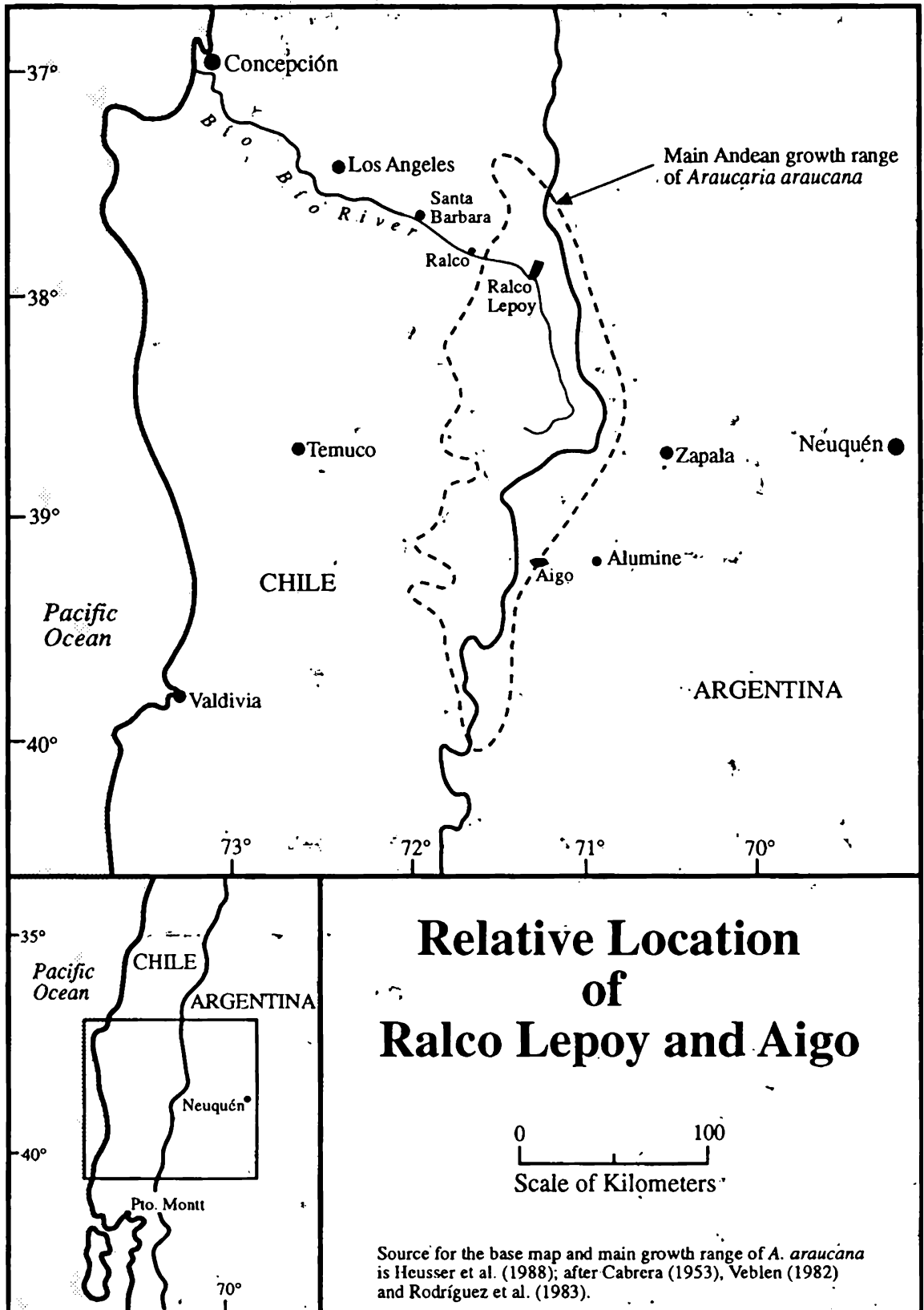
RALCO LEPOY

Characteristics and Productive Activities

Ralco Lepoy, a Mapundungu place name which translates as "someone who goes running through waters in the sand,"¹ is located on the southern and eastern flanks of the Callaqui Volcano in a remote part of the upper Bío-Bío watershed. The reservation is situated on a strip of land approximately 20 km long and 5 km wide. The community is accessible by a one-lane dirt road along the precipitous banks of the Bío-Bío. There is daily bus service from Los Angeles during the summer, with the 147-km journey often taking up to eight hours.

¹ This is translated by the author from "alguien que pasa corriendo por aguas en la arena." This was originally translated from Mapundungu by Manuel Neicuman in Álvarez and Parra (1991).

Figure 7.1



Ralco Lepoy has approximately 125 families and 800 persons. Twelve of these families, or approximately 70 persons, are non-indigenous and live primarily on the northern part of the reservation.² A report from the Universidad de Concepción (1988) indicates that the average age in the community is twenty-three and the inhabitants obtain an average of four years of formal education. Ralco Lepoy has a primary school with boarding facilities, and a health clinic which is permanently served by a nurse and visited by a physician every fifteen days. Basic provisions may be purchased locally in two small stores. Only those families living in the immediate vicinity of the school have electricity, which is provided by a small turbine placed in a nearby stream.

Houses are dispersed throughout the community, and are usually made from native trees and fabricated entirely by ax. A typical house has two disjunct parts, the sleeping quarters and the kitchen. All cooking is done over an open fire in the center of the kitchen, and wood is the exclusive fuel source. Several houses made of exotic pine and with zinc roofs have recently been delivered to some families through a program of rural subsidies.

The principal economic activity in Ralco Lepoy, in terms of space used, income earned, and time involved, is the raising of small livestock. Goats and sheep are the most common domesticated animals. Many families also have cattle, pigs, poultry and horses. The animals are either consumed or sold for their meat to merchants who arrive in trucks from the lowlands. Wool is also sold after an annual shearing which takes place for goats in October and sheep in late December or early January. The inhabitants of Ralco Lepoy practice transhumance, a seasonal pattern of livestock migration. It involves taking animals to higher alpine meadows and pastures during the summer. Winter dwellings,

² There is some variation in the census information for Ralco Lepoy. A 1965 Departamento de Asuntos Indígenas (DASIN) census concluded there were 798 inhabitants, a 1982 Instituto Nacional de Estadísticas survey counted 727 persons, a 1984 census done by the municipality of Santa Barbara listed 792 individuals, Molina and Correa (1992) write of approximately 800 inhabitants, and most recently Vargas (1993) counts 881 inhabitants. A population of approximately 800 is the most commonly accepted figure.

located as low as 700 m, are left after the shearing season. Someone usually stays behind to look after the family garden and cereal crop. Other family members take to higher lands, in some cases as high as 1300 m, where rustic summer dwellings are maintained. Some families must travel nearly 40 km to reach the summer grazing grounds, or *veranada*. There they stay with their animals until the first snow falls, usually in April or May.

The gathering of piñones is an important subsistence and economic activity for the inhabitants of Ralco Lepoy, and this will be discussed in more detail in the following chapter. There is also some collection of mushrooms, rosehips, and several other wild plants. The cultivation of wheat, rye, barley and oats is significant in Ralco Lepoy. Also, beans, potatoes, cilantro, carrots, lettuce, celery, garlic, squash, onions, chili peppers and radish are grown in small subsistence garden plots. Cultivation is primarily confined to the winter lowlands, or *invernada*. Fishing in local rivers and streams is of limited importance to the community. Likewise, hunting is not a primary subsistence or economic activity. It is usually done to protect crops and livestock against predators such as the feral European hare and the puma. Finally, the sale of woven goods provides supplemental income for some families, and many persons find wage work outside the community in agriculture or as domestic employees.

Land-Tenure History

The history of land tenure in Ralco Lepoy is a long and complicated one. Molina and Correa (1992) provide a detailed treatise for seven Araucano reservations in the upper Bío-Bío watershed, with one of them being Ralco Lepoy. They trace both the official and unofficial changes in land tenure from the time in which the Araucanos had exclusive dominion over the entire area until the present. The information in this section, unless otherwise noted, comes from the recent work of Molina and Correa.

The Araucanian War, or "pacification" campaign, meant an abrupt change in the traditional Araucano sovereignty south of the Bío-Bío river. It marked the beginning of military control over indigenous lands. With time civilians obtained legal dominion over these lands through fraudulent, fixed and spurious transactions. Rafael Antigua, the first to own legally the land on which Ralco Lepoy is currently located, was able to acquire property even before the Araucanian War had officially ended. In April 1881 nearly twenty Araucanos, who did not speak Spanish and communicated through interpreters, apparently sold the rights to some 40,000 ha of land in exchange for a modest amount of money. This precluded the acquisition of a *título de merced* (collective title), which would have given the indigenous inhabitants legal possession of the land.

For the next one hundred years legal title to this land, which came to be known as the Fundo Ralco, changed hands a number of times. Limits were drawn and redrawn, and there were repeated attempts to expel the Araucanos from lands they had traditionally occupied. At times the authorities were successful in physically relocating the Araucanos, but the most common response was to return to their original lands, where they were considered to live as squatters or "occupants." Most Araucano claims of ownership were ignored or struck down by the judicial authorities. In 1942 the Araucanos were awarded rights to live on the Fundo Ralco by the Comisión Radicadora, but this decision was reversed by the Chilean Supreme Court three years later.

The intention here is not to repeat the details of the case researched so thoroughly by Molina and Correa. In order to understand the issues raised in this thesis it is sufficient to start in the year 1949, when most of the Fundo Ralco was purchased by Dionisio González. By this time its size had been slightly reduced to 36,419 ha, through partial sales by previous owners. In 1952 Dionisio González invested in the Sociedad Agrícola Forestal La Leonera Limitada, which was formed with the intention of exploiting the forest resources of the Fundo Ralco. The company never started extractive

activities, and its assets were liquidated in 1955. Years later González and three other ex-shareholders formed the Comunidad Forestal Ralco. In 1964 the Comunidad Forestal Ralco was transferred to a new entity called Maderas Ralco S.A., which also had explicit plans to exploit the native forest of the Fundo Ralco and several adjacent properties.³

Maderas Ralco S.A. constructed a mill to process timber in the small town of Ralco, located 55 km from Ralco Lepoy. On the lands used by the inhabitants of Ralco Lepoy, the firm, in which González was the principal shareholder, was primarily interested in araucaria because of its high market price. Most of the araucaria forests were in the veranada of Ralco Lepoy. In 1966 Maderas Ralco S.A. started taking out the first araucaria trees from a zone called La Mula. The Araucano inhabitants of Ralco Lepoy immediately opposed all wood extraction on lands which they claimed were indigenous. Manuel Neicuman, the current cacique for Ralco Lepoy, but at the time a common defender of Ralco Lepoy's forest resources, is quoted in Molina and Correa (1992:113) as having told González during an inspection of felling operations:

Ustedes no son dueños, somos nosotros. ¿A quién le ha comprado esta tierra? ¿A los señores Bunster [previous holder of legal title to the Fundo Ralco]? ¿A los señores Bunster a quién le compraria? ¿A los indígenas? Los indígenas jamás han vendido. Así que no queremos que saque más madera y se vayan.⁴

The conflict was mediated by the Ministerio de Tierras y Colonización. There was a proposal to continue exploiting araucaria in exchange for the creation of a fund aimed specifically at improving the socioeconomic conditions of Ralco Lepoy. González

³ At the time González bought the Fundo Ralco its indigenous inhabitants had been living under one cacique and shared a common social and political organization. However, in 1954 the indigenous inhabitants of the Fundo Ralco split into two communities, Quepuca Ralco and Ralco Lepoy. This split was done with the mutual consent of community leaders, as the extent and size of the community had caused conflicts over summer grazing grounds. Although there were now two communities, each with its own cacique, the Araucanos basically continued to occupy and use the Fundo Ralco as they had since time immemorial.

⁴ This is translated by the author as "You are not owners of this land. We are the owners. Who have you bought this land from? From the Bunster family? Who might have the Bunster family bought the land from? From the indigenous people? The indigenous people have never sold this land. We want you to stop taking our wood and leave."

rejected this proposal as he thought it meant fully recognizing the rights claimed by the Araucanos. For the Araucanos, who also rejected the idea, it meant the continued depredation of an important resource and a violation of their territorial rights. However, González eventually skirted the Ministerio de Tierras y Colonización and countered with an offer directly to the cacique, Pedro Mariguan Pino. For five thousand pesos and two hundred quintals of flour the cacique, against the wishes of the community, gave Maderas Ralco S.A. authorization to continue cutting araucaria in La Mula.

Outraged that Pino had sold off community resources and acted against the wishes of its members, the inhabitants of Ralco Lepoy elected Manuel Neicuman to replace Pino as cacique. In three seasons Maderas Ralco S.A. managed to cut only 240 araucaria trees, as conflict and community resistance to felling interrupted plans for more intense extraction.⁵ By 1970 the community seemed to be back in control of its araucaria forests, although the threat of further exploitation was still a stark reality. To quell this threat, gestures were made by the provincial authorities to get the araucarias of the Fundo Ralco declared a national park. They were ultimately successful. On September 14, 1972, Law 17.699 stipulated that the araucarias of the Fundo Ralco were part of Ralco National Park and felling was strictly prohibited. What Law 17.699 did not do was define precise limits for the newly created park, which was primarily established as a legal mechanism to stop araucaria exploitation in the area once and for all.

In 1982 Maderas Ralco S.A. liquidated its assets. By this time Dionisio González had died, but his widow was involved in settling the company's affairs. She was influential in getting the Fundo Ralco donated to the Chilean government. However, two conditions were imposed: (1) the Chilean government had to deliver the occupied lands to the Fundo's inhabitants; and (2) a national park or national reserve had to be created to

⁵ Many of the felled trees could not be taken out of the area as a result of the conflict. Today they lie in place rotting on the forest floor.

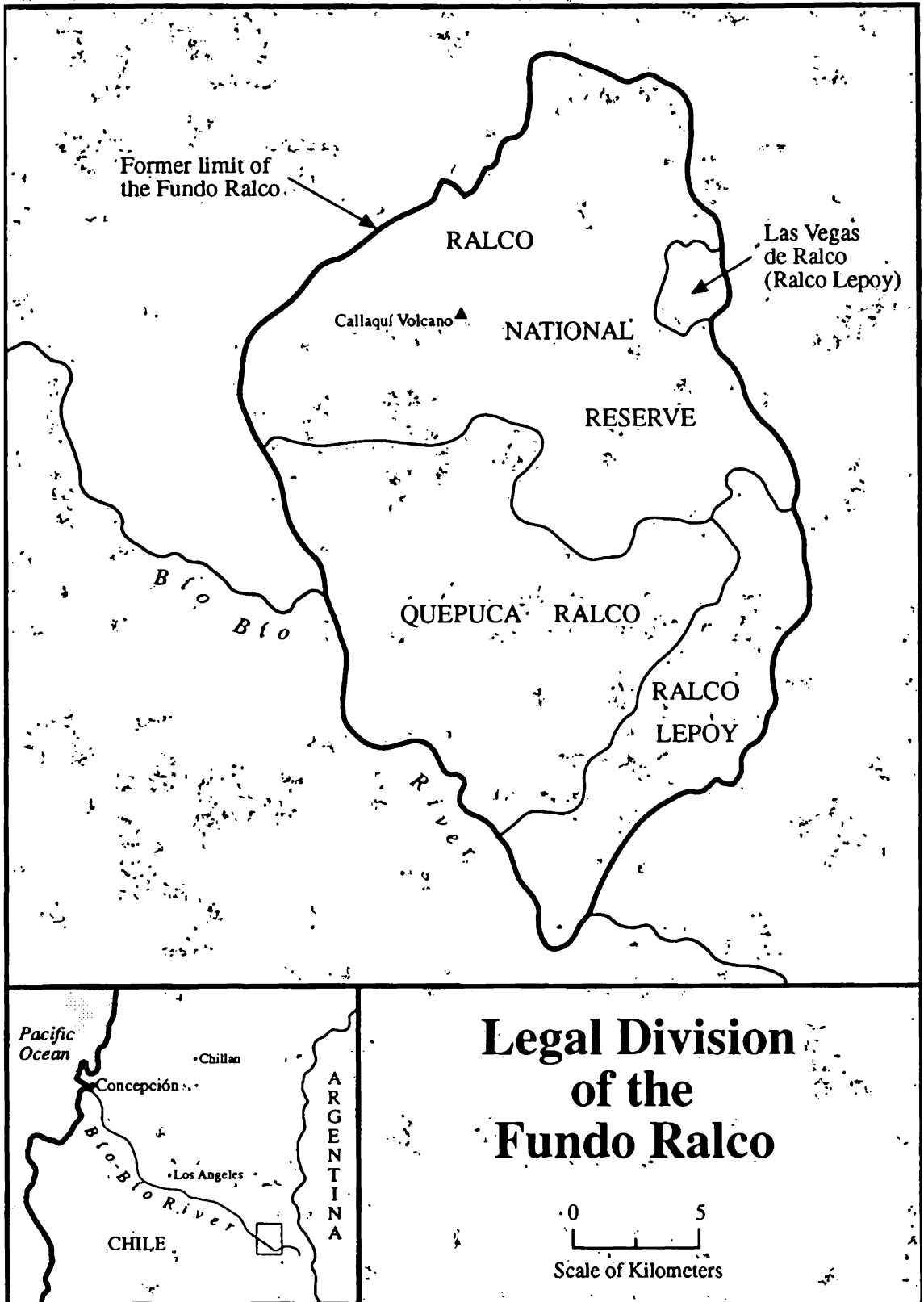
effectively protect the araucarias.⁶ These conditions had conflicting objectives. On one hand they stipulated that CONAF had an obligation to ensure the protection of the araucaria forests. On the other hand, the conditions stated that lands used by the Fundo's inhabitants be legally deeded to the respective users. The veranada lands used by the inhabitants of Ralco Lepoy contain araucaria. They saw no justice in CONAF administering their veranada, but CONAF was required to ensure the protection of araucaria, and CONAF claimed that the Araucanos had contributed to its degradation through their grazing and collection strategies. A number of proposals on the best way to reconcile this contradiction followed.

It was not until 1987 that the Dirección de Asuntos Indígenas (DASIN) of the Instituto Nacional de Desarrollo Agropecuario (INDAP) and the Ministerio de Bienes Nacionales divided the Fundo Ralco into two large tracts. One comprised 12,421 ha and became the Ralco National Reserve, and the other contained 23,998 ha which INDAP was required to subdivide among the inhabitants of the Fundo.⁷ This meant first defining the legal limits between the communities of Quepuca Ralco and Ralco Lepoy and then subdividing the land in each community among its inhabitants. All land in the veranada sector which contains araucaria was incorporated within the limits of the reserve. A small plot of land in the veranada, called Las Vegas de Ralco, was legally transferred to the community of Ralco Lepoy because it contains no araucaria trees. Land in the invernadas, even the small area with araucaria, was divided among the inhabitants of the respective communities. In essence, CONAF received all lands containing araucaria which are not used on a year-round basis by the Araucanos (Figure 7.2).

⁶ By this time araucaria was protected as a natural monument under Decree 29. Also, Ralco National Park already existed with the passage of Law 17,699 in 1972. However, as this law set no precise park boundaries, conditions of the donation specified that borders be defined and the ambiguous land-tenure situation normalized.

⁷ The larger tract was actually noncontiguous.

Figure 7.2



There are also veranada lands which belong neither to the community of Ralco Lepoy nor to CONAF. Adjacent to the reserve's eastern boundary is a large piece of private property, used primarily for grazing, called the Fundo Barco. Ten indigenous families from the community of Ralco Lepoy occupy a sector of the Fundo Barco called El Peleco for their veranada. Vargas (1993) reports that these families have been repeatedly threatened by the caretakers and the owners of the Fundo Barco with relocation (Figure 7.3).

In Ralco Lepoy INDAP eventually measured and subdivided 5,889 ha into 202 individual parcels and 26 collective parcels. This was a break from the traditional Araucano land-tenure practice of communal property rights. The new system meant having a mixed individual-collective system. Families were given individual plots, usually in the same area they had occupied for years. Collective titles were issued for plots shared by families as grazing land for their livestock.

The process of measuring and assigning lands was controversial, being finalized only in October 1991. The debate focused on whether to issue one collective title for the entire community, or to break the reservation into individual plots with a limited number of shared areas. Molina and Correa (1992) write that INDAP waged an extensive campaign to convince the inhabitants that the proposed mixed system would be to the community's advantage. INDAP argued that it would give the inhabitants the possibility to sell resources located on their property without the consent of the total community.⁸ Also, INDAP raised the issue of rural subsidies and bank credits. Individual property

⁸ In Quepuca Ralco fourteen families and the cacique are selling native forest (roble, raulí and coigüe) under management plans approved by CONAF. The wood is being bought at prices well below market value. To date no management plans have been filed in Ralco Lepoy.

ownership facilitates the distribution of state subsidies and is absolutely necessary to secure any kind of loan.

Figure 7.3

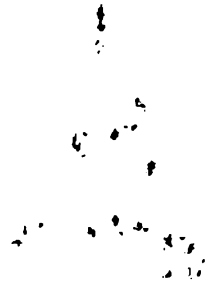
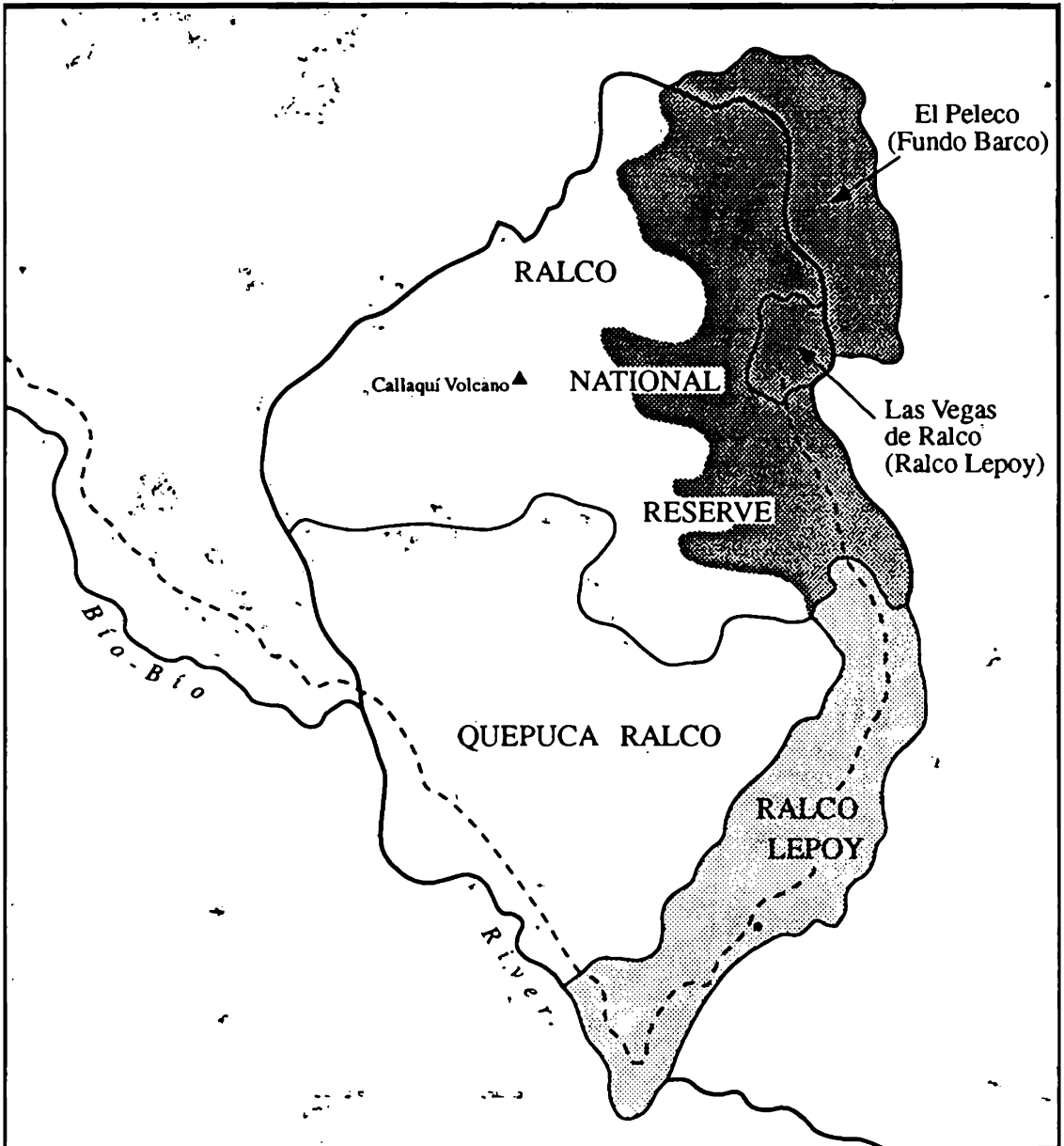


Figure 7.3



Seasonal Land Use in Ralco Lepoy

0 5
Scale of Kilometers

-  Veranada
-  Invernada
-  Road
-  School

Source: Vargas (1993)

Molina and Correa (1992) claim that the community of Ralco Lepoy was against the subdivision of its land into individual holdings, but saw no alternative way out of a difficult situation. As evidence they cite a community meeting which took place in October 1991, the same month in which the mixed titles were delivered. In this gathering seventy-eight of eighty-three heads of families signed a declaration expressing their desire for a community-wide collective title. During primary data collection, the author asked informants about their preference on the land title issue. Of twenty-five responses, fourteen preferred common, six individual, one mixed, three did not know, and one informant said the cacique knew best. In any event, community residents might have been relieved to receive any legal document eliminating the threat of relocation with which the residents had lived for over one hundred years.⁹

CONAF was charged with administering the 12,421-hectare Ralco National Reserve. The reserve contains much of the summer grazing land and almost all of the araucaria forests traditionally used by the inhabitants of Ralco Lepoy. Provisions were made to allow the inhabitants to use the reserve in accordance with the land management norms established by CONAF. For the Araucanos initial regulations meant the following: land could be used only according to a grazing capacity determined by CONAF; only dead wood could be used for fuelwood, house maintenance and fence repair; grazing lands could not be cleared or burned; piñones could be collected only according to

⁹ Many of Ralco Lepoy's inhabitants may still be displaced involuntarily by a massive hydroelectric project along the Bío-Bío. The first of seven proposed dams will be completed in 1997. Although this dam will not have a direct effect on the residents of Ralco Lepoy, if plans for the second dam are approved, lands traditionally used by as many as fifty families in Ralco Lepoy could be inundated. The fact that they now have legal title to the land may make little difference in their quest for self-determination and territorial rights.

regulations which ensured the natural regeneration of araucaria; and permitted use of the area was non-transferable.

Molina and Correa (1992) write that the residents of Ralco Lepoy were adamantly opposed to CONAF regulations, which were seen as unnecessary restrictions on their livelihood. Markers delimiting the reserve have been unacceptable to the community. A sign placed by CONAF to mark the entrance to the reserve was quickly removed.¹⁰ The Araucanos of Ralco Lepoy suggest that the reserve should be entrusted to the community in recognition of its historical occupation and stewardship of the land, and of its defense and preservation of the araucaria forests.

AIGO

Characteristics and Productive Activities

Aigo, a Mapundungu word meaning "ten eagles,"¹¹ is an Araucano community in Argentina's Neuquén province. It is located along the southern banks of the Ruca Choroy River, and is accessible from the small town of Alumine by a well-maintained gravel road, although there is currently no public transport service. The community permanently occupies approximately 2,828 ha of land. About 150 ha are within the limits of Lanin National Park. Lands north of the Ruca Choroy River and Lanin National Park belong to the Corporación Interestadual Pulmari, a public entity managed by representatives from the provincial and national governments and the area's indigenous communities (Figure 7.4).

A 1983 Departamento de Asuntos Indígenas (DASIN) census counted 85 families and 640 persons in Aigo. One family in the community is non-indigenous. Osidala et al.

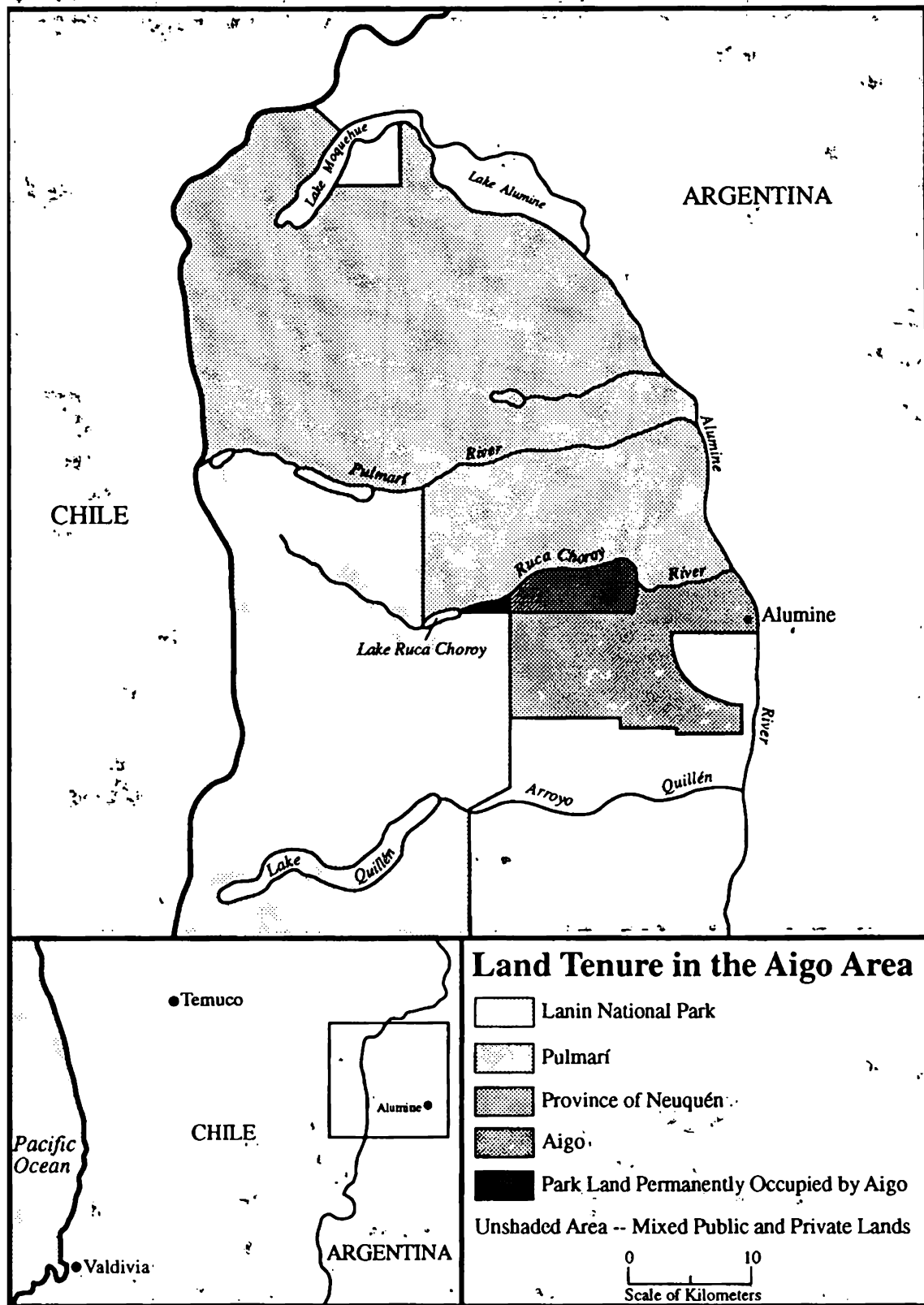
¹⁰ The community has accepted, however, the permanent presence of a forest ranger.

¹¹ This translation comes from Reynoso (1959). Aigo is also the surname of the current cacique, Amaranto Aigo. His father, Juan Aigo, founded the community. By tradition most Araucano communities in Argentina, and many in Chile, assume the last name of their founders.

(1992) surveyed the 150-hectare plot in Lanin National Park and concluded there were 225 persons living within the park limits, meaning that over one-third of Aigo's inhabitants occupy less than 1% of the land. Osidala (1990) reports that 44% of the adult population are illiterate. The community has two schools, a health clinic, two small stores, a Catholic church, a marketing cooperative for woven goods, and even a civil

Figure 7.4

Figure 7.4



register so the inhabitants can avoid traveling to Alumine to file or obtain official documents. Only the schools have electricity, which is provided by diesel-powered generators.

Most houses in Aigo were constructed in the 1980s through rural housing subsidies. They are generally small concrete structures, which contain common quarters and two bedrooms. The common quarters usually have a wood stove for cooking and heat. Some families prefer to cook with natural gas brought up in cylinders from Alumine. Formerly, the houses had walls of bamboo and adobe with roofs made of rye stalks. Several families in Aigo still maintain these dwellings. Victor Licán, a resident of Aigo, is cited in *Testimonios Mapuches en Neuquén* (Fundación Banco de la Provincia del Neuquén 1992) as saying that long ago people made their houses from horse hides.

Aigo has a more developed infrastructure than Ralco Lepoy, and goods and services are much more accessible, in part due to its proximity to Alumine. Also, in Ralco Lepoy there is relative parity in living conditions, production and income. Within the community of Aigo there are greater disparities. Families living in or close to Lanin National Park generally have few monetary and material assets, while those living closer to Alumine have bigger houses, barns, more animals and larger fields. Several individuals in this part of the community even own automobiles.

Osídala (1990) reports that the principal sources of income in Aigo, in order of importance, are: handicrafts, livestock, forage crops, day work, garden vegetables, fruits, and forestry. This description seems incomplete and inaccurate. Osídala fails to mention

piñon collection, which will be discussed in the following chapter. The handicraft market is currently saturated and products are difficult to sell. Forage crops, such as alfalfa and oats, are popular but generally not grown for sale. Gardens are small subsistence plots, and limited to a small harvest of beans, peas, lettuce, cabbage, carrots, beets and onion. There are no fruit or forestry projects within the community of Aigo, although some residents work in this sector as temporary laborers in nearby areas. Day work provides employment for a limited number of community residents. However, many have some kind of regular salaried work, either in one of the schools, on the road repair crew or with the park service.

Admittedly, it is difficult to make generalizations for the entire community. Families rely on a number of sources for income. However, livestock unquestionably remains an important economic resource for most families. Sheep and goats are the most common domesticated animals. Poultry, pigs, and horses are also seen, although there are very few cows in Aigo. Like the inhabitants of Ralco Lepoy, most families with animals practice transhumance. In some cases they take their animals from 1100 to 1800 m during the warmer summer months. Nevertheless, the veranada is generally close to the invernada, involving not more than several hours' journey for most people. It is common practice for the veranada to be maintained by a single family member, with the remainder of the family staying in the invernada, working outside the community, or gathering fuelwood for the winter. Several families have no animals.

Located on the leeward side of the Andes, Aigo is considerably more arid than Ralco Lepoy. The community straddles the Patagonian forest-steppe ecotone. In the invernada very few natural grasses are available for livestock grazing. This partly explains the popularity of cultivating forage grasses and the limited amount of cereal crops. Also, during the summer a great deal of time is devoted to collecting fuelwood for the long winters, and this restricts the time available for cereal cultivation. Fuelwood is

much less accessible in Aigo than Ralco Lepoy, especially for the community's eastern residents.

Land-Tenure History

The history of land tenure in the Aigo area has not been documented nearly as well as the situation in Ralco Lepoy. Much of the information below was obtained through interviewing Aigo residents and the park ranger in Ruca Choroy, Arturo Costa Álvarez.¹² Some documents were acquired in the Dirección General de Tierras y Colonización in Neuquén, but its file on Aigo is fragmented and incomplete. Many papers were apparently discarded or lost when federal authorities transferred their records to Neuquén when it became a province in 1957. Since few details are known about the actual formation of Aigo, the most effective way to outline its land-tenure history is to take a reverse approach, starting with what is known and working back through time.

As previously mentioned, the inhabitants of Aigo permanently occupy approximately 2,828 ha of land, with 150 ha of these inside Lanin National Park. The 2,678 ha outside the park are held under a collective community-wide title. Although this title was not officially registered as a legal deed until May 11, 1992, the land was formally surveyed in 1981 and Decree 737 in 1964 fully recognized the right of the community's inhabitants to live on these lands. Those living in Lanin National Park, however, have neither collective nor individual title to the land. They live under the jurisdiction of the federal park service authorities and are given permission to occupy the land.¹³

¹² Ruca Choroy, which Amaranto Aigo (pers. com. March 1993) translates from Mapundungu as "house of parrots," is often used to refer to the indigenous community of Aigo. Technically this is incorrect. Aigo is the name appearing in all legal documents. Ruca Choroy is a *paraje*, which translates from Spanish as a place, area or region. A *paraje* has no fixed boundaries nor is there any administrative authority at this level. The ranger station in the community of Aigo is referred to by park authorities as the Ruca Choroy post, even though it is physically located within the park but among the inhabitants of Aigo.

¹³ In the past this permission was granted through a Permiso Precario de Ocupación y Pastizaje (PPOP). A PPOP required the holder to declare annually his number of animals and area cultivated. Also, it was non-transferable and authorities could revoke permission upon death or at their convenience provided six months notice was given. PPOPs were initially devised as a mechanism to remove inhabitants from parks

Regulations strictly prohibit the use of natural resources in some parts of Lanin National Park. For example, piñon gathering, fuelwood collection and grazing are technically forbidden in certain areas. However, as the inhabitants of Aigo depend on these activities, informal arrangements are negotiated with Arturo Costa Álvarez. Permission to collect fuelwood must be solicited but is almost always granted. Álvarez states that this is a way for him to monitor wood extraction. His primary concern is that no wood be taken from the park for commercial purposes. On the other hand, Álvarez allows residents to collect and sell piñones within park boundaries without asking for permission. Also, he nearly always grants permission to use park lands for grazing, although he attempts to see that sound practices are followed (pers. com. March 1993).

Lanin National Park and other protected areas in Argentina have inhabitants. In 1984 the Departamento de Asentimientos Humanos was created in the Administración de Parques Nacionales to assist populations within protected areas, and to resolve disputes and clarify ambiguous land-tenure situations. Since democracy returned to Argentina in 1983, authorities have apparently been more disposed to address problems faced by these inhabitants, whether they be indigenous peoples, large property owners, or illegal occupants. However, in the past park authorities were not always so benevolent or open to negotiation.

The residents of Aigo suffered greatly at the hands of park authorities. Although there is little written documentation, the author was told about a substantial relocation in 1947. Desiderio Calfinahuel, an Aigo resident currently living in Lanin National Park, says that people living within the park at that time were induced to relocate by signing documents they did not understand and accepting attractive promises which were never fulfilled. Arrangements were made for the Araucanos to inhabit the lands north of the

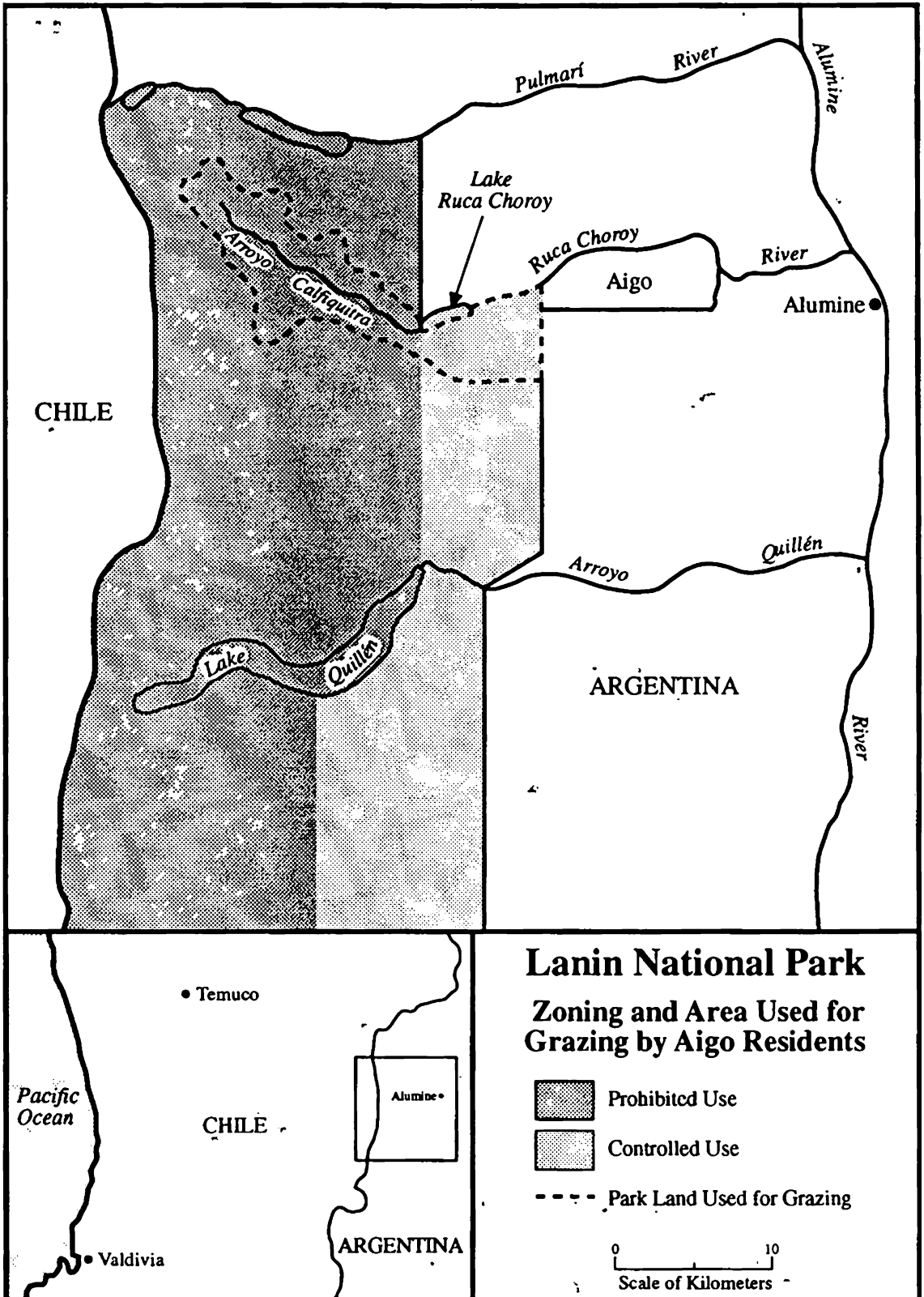
in Argentina, but because family members had no other place to go and often just refused to relocate after the death of the family head, the strategy was not successful (Osidala et al. 1992).

Ruca Choroy River (Figure 7.5). For many years Pulmari had belonged to a wealthy English family named Miles.¹⁴ Indigenous use of the property was strictly controlled. In fact, the land was fenced off and vigilantes were hired to ensure that the Araucanos kept their animals off the Miles' land. However, during the first government of General Juan

Figure 7.5

¹⁴ Before 1988, when the Corporación Interestadual Pulmari was formed, the Pulmari property measured 67,900 ha. The province of Neuquén ceded 45,000 ha to the Corporación Interestadual Pulmari upon its formation. These lands currently comprise the western portion of the 112,900-hectare property.

Figure 7.5



Domingo Perón, Pulmari was transferred to the federal authorities, some say for compensation and others say by expropriation.¹⁵ The land was then occupied by the Argentine Army, which used it to raise mules and train troops. Under these circumstances arrangements could be made to move families residing inside Lanin National Park to Pulmari.

Aigo residents cleared out of Lanin National Park and took all their possessions to Pulmari. After several years, however, the army began charging exorbitant grazing fees. The Araucanos could not manage to pay the required amount and were forced to leave in May 1954. Having nowhere else to go, the Araucanos returned to the park. Although they were allowed to stay, the displaced people were required to live to the east of Lake Ruca Choroy. Before they were relocated to Pulmari, some had permanent homes along the southern shore of the lake and even in the Calfiquitra Valley to the west of the lake. This meant occupying an area much smaller than they had some seven years before, and would ultimately put much more pressure on the land and resources. To further complicate their plight, a severe winter in 1954 caught the Araucanos unprepared. They survived in makeshift dwellings and by eating mushrooms picked off the bark of nearby trees. All of their animals died.

Arturo Costa Álvarez suggests that the relocation in the late 1940s was an attempt by park authorities to respect zoning regulations. The area to the east and south of Lake Ruca Choroy is technically a national reserve and allows for the controlled use of

¹⁵ Arias, A. 1993. Terminan 40 años sin haber sembrado algo. *Río Negro*. March 6.

resources. However, the Calfiquitra Valley to the west of the lake is zoned to prohibit resource use. Álvarez believes that only those living in the Calfiquitra Valley, as opposed to those living in the controlled-use zone, were relocated to Pulmari to comply with the obligations required by national park legislation. There are currently no permanent residents in the prohibited-use zone, although arrangements made with Álvarez allow the inhabitants of Aigo to graze their animals and engage in certain other activities in this area.

The author tried to verify Calfinahuel's story. A similar version was found in *Testimonios Mapuches en Neuquén* (Fundación Banco de la Provincia del Neuquén 1992). Told by Sara Gil and Emilio Reyes, the account differs only slightly. It indicates that Pulmari was administered by the Administración de Parques Nacionales after the Miles family left and before the army arrived, and that the severe winter took place in 1953 rather than 1954. In the Dirección General de Tierras y Colonización in Neuquén no specific references to this relocation were found. An attempt to acquire documentation in Buenos Aires at the Administración de Parques Nacionales was unsuccessful. Access to its archives was denied because records, which are not catalogued or processed, are strictly for in-house use.

In the search for documentation, several other interesting items were uncovered. In Neuquén's Dirección General de Tierras y Colonización, a file is kept on Aigo. Documents indicate that over the years the community has made formal requests for more land, has filed for the abolition of all provincial and national park grazing fees, and expressed its concern over an alleged change of the park limits and relocation in 1967.¹⁶ In a follow-up search regarding the latter item, a 1968 Dirección General de Parques

¹⁶ This information was obtained in a letter from Juan Aigo to the Señor Interventor de la Dirección de Protección al Aborigen (dated November 12, 1949), in a letter from Juan Aigo to the Señor Interventor de la Dirección de Protección al Aborigen (dated March 26, 1951), and in a letter signed on the behalf of Roberto Pellao by an unnamed individual to Vicente S. Escala, director of the Dirección General de Tierras y Colonización (dated April 14, 1967).

Nacionales¹⁷ internal document was found in its library in Buenos Aires. This document did indeed make recommendations for adjusting the limits of Lanin National Park. However, it suggested that the park authorities let the Aigo community remain in place and redraw the park limit around its use of land and resources. Action on the issue was never taken. The original limits of Lanin National Park have never been modified (R. Romero, Administración de Parques Nacionales, pers. com. April 1993).

The Araucanos of Aigo had been living in the area long before Lanin National Park was created in 1937. In its community protocol, Aigo considers itself to have existed since the beginning of this century. Many of the original inhabitants had returned from Chile, to which they had fled during the bloody Desert Campaign (Jara de Herrera 1992). There are only a few references to conditions in the community during its early days. Rothkugel, writing in 1916, reports of land use restrictions, saying the Araucanos in Aigo had no *invernada* because lowlands were private property. He mentions that Pulmari had been fenced off since the Miles family arrived in the early 1900s. The Araucanos themselves speak of these times in *Testimonios Mapuches en Neuquén* (Fundación Banco de la Provincia del Neuquén 1992). Roberto Pellao, the grandson of the founding cacique Juan Aigo, mentions that before the Miles family came it was all *campo libre* (free land). In the same collection of stories Mariano Antilef remarks "antes la gente estaba bien porque eran dueños de los campos y eran dueños de la tierra."¹⁸

Even a lengthy archival and historical investigation may not be sufficient to piece together the official and unofficial land tenure-history of the area. What is important to understand here is that the Araucanos were excluded from the territorial organization after the Desert Campaign, and that since their territory was lost they have had a series of problems with private property owners and provincial and national governments. In the

¹⁷ This is the former name for the Administración de Parques Nacionales.

¹⁸ This is translated by the author as "before the people did better because they were owners of the fields and owners of the land."

case of Aigo there have been restrictions on the community's use of resources in Lanin National Park and Pulmari.¹⁹ There was at least one systematic relocation of park inhabitants in the late 1940s. Perhaps there have been more, as informants mention the past burning and destruction of their homes by park authorities.

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¹⁹ Pulmari, which was transferred by law from the Argentine Army to the Corporación Interstadual Pulmari in 1988, is currently managed by an eight-member board of directors. Three members represent the provincial government of Neuquén, one represents the area's indigenous inhabitants, and there are four representatives from the national government. Although no comprehensive management strategies for Pulmari have been implemented, use of the area by the Araucanos is now permitted. Limited grazing, fuelwood collection, piñon gathering, and some cultivation are allowed. It is hoped that this will take the pressure off national park land and land belonging to Aigo. The principal objective of the Corporación Interstadual Pulmari is to improve the socioeconomic conditions of Aigo and other indigenous communities in the area (Arias, A. 1993. Terminan 40 años sin haber sembrado algo. *Río Negro*. March 6)

PRIMARY DATA ANALYSIS

One of the most problematic parts of a case study is analyzing primary data in a systematic fashion. Yin (1989) stresses that techniques are simply not well defined. He outlines several strategies, however, including one to which he refers to as the "explanation-building" approach. Yin points out that this can be of value in exploratory case studies. As data are analyzed and variables are identified, explanations for the case are built. The goal may not necessarily be to conclude a particular study, but rather to develop ideas for further inquiry, which is an objective of this thesis. Also, Yin's "explanation-building" approach is useful for exploring concepts and hypotheses stemming from other studies, which is another explicit objective of this case study. Indigenous territorial rights, protected areas and conservation, which have been the focus of geographical research in Central America, are considered in the distinct localities and socioeconomic contexts of two Araucano communities in southern South America.

Crabtree and Miller (1992) write that descriptive quantitative analysis is based on statistics, and refers to the distribution, frequency, prevalence, incidence, and size of one or more phenomena. Qualitative methods, which do not rely on statistical procedures or other means of quantification, explore the meanings, variations and perceptual experiences of phenomena. Strauss and Corbin (1990) write that quantitative and qualitative methods can be used effectively in the same research project. A combination of both methods is used to analyze the primary data collected for this thesis.

The data from Ralco Lepoy and Aigo were collected through open-ended interview questions and field observations. These techniques are normally associated with qualitative research, although much information collected in this fashion is subject to

quantification. The initial steps of data analysis for this thesis involved a systematic assessment of the response-recording forms. Answers to specific questions from the survey instruments (Appendices A-D) were reviewed and organized. Data were classified and tabulated when possible. This strategy allowed the author to examine frequencies and ranges, and analyze important features and relationships.

To state that the data analysis begins and ends with the presentation of tables is shortsighted, at least for a study of this nature. Much information was obtained through the interviews which was not offered as specific responses to the questions asked. Also, the author kept extensive field notes. Much of this information is used to complement the tabulated data. In this chapter quantitative results from the interviews are presented, but they are interspersed with additional information obtained during the interviews, field notes, and the author's own observations and interpretations of phenomena. By using a combination of tables and text as done here, it is hoped that qualitative data illustrate or clarify the quantitatively derived findings.¹

This chapter is organized into four sections: (1) the use of araucaria; (2) change in araucaria use; (3) the reasons for and reactions to change; and (4) the protection of araucaria. In each section responses to applicable questions from the survey instruments are discussed, and this information is supplemented by interpretations and explanations of the phenomena which might account for some of the observed differences between Ralco Lepoy and Aigo. A cross-case analysis is presented. The intention is not to do intra-community analyses.

THE USE OF ARAUCARIA

¹ A historical-documentary approach was also important in analyzing data collected for this thesis. It was especially critical in understanding the land-tenure history in Ralco Lepoy and Aigo.

The first fifteen questions in each survey instrument address the actual use of araucaria. The first one simply asks the informant to comment on his or her use of the araucaria tree. The question was helpful in introducing the topic and initiating conversation. The responses were not necessarily provided when the question was first asked. Some uses of the araucaria were brought up later in the interview. The author recorded all uses that were mentioned throughout the interview and incorporated them into Table 8.1.

Table 8.1

Informants' Use of the Araucaria Tree

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
food	25	23
sale	25	14
construction wood	1	18
fuelwood	2	23
fodder	0	10
other	0	3

Note: The columns do not add up to 25 and 23 respectively because most informants mentioned more than one use.

The most obvious feature of Table 8.1 is that araucaria, or more specifically the piñones, are a food resource for every informant in Ralco Lepoy and Aigo. It is also evident that in Ralco Lepoy the piñones are more important in generating income, but in Aigo the use of araucaria wood (both for fuel and construction) is more prevalent. Aigo residents also mentioned using the piñones to feed livestock. Three responses in Aigo are classified as other. One of these informants said that the polygonal plaques of araucaria bark can be used as a plate (eating utensil). The second informant pointed out that the

tips of araucaria branches can serve as a comb. The third mentioned that the araucaria trees provide protection for those having to sleep outside at night.²

Comments regarding the use of araucaria and explanations for differences in use between Ralco Lepoy and Aigo will be offered throughout this chapter as more tables are presented. However, a few words are in order here. As mentioned in Chapter 7, Aigo straddles the Patagonian forest-steppe ecotone and is more arid than Ralco Lepoy. Woody vegetation and natural forage grasses are less abundant, and pressure on forest and grazing resources is generally greater. Perhaps the greater use of araucaria wood and the reliance on piñones as a food supplement for livestock in Aigo stem in part from environmental conditions. Population density (both human and animal) may be another factor. Observations led the author to believe that these are greater in Aigo. The regular income that many residents of Aigo have from working for the park service, the schools, the road repair crew, and the postal service may help explain the decision of many not to sell piñones.

Provided there are sufficient piñones, there are normally two *piñoneos* (gathering seasons) per year. The first one begins in late summer (austral) and lasts until the first snow falls in April or May. A shorter piñoneo may commence in October after the snow melts, when the piñones remaining from the fall are exposed. Sixty percent of the informants in Ralco Lepoy and 70% in Aigo gather piñones one time per year. (Table 8.2) Those going only once do so exclusively in the summer and fall season.

² Many families in Aigo live at a considerable distance from an araucaria forest and have no veranada. This precludes the possibility of gathering piñones during the day and returning to either a summer or winter residence to sleep at night. These families often take to the araucaria forests for several days at a time, and spend nights beneath the araucaria trees. The literature mentions the existence of rustic dwellings, or *rucas*, built specifically to accommodate families during the collection season. These were not observed in either Ralco Lepoy or Aigo.

Table 8.2

Number of Times During Year Piñones Are Collected

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
once	15	16
twice	10	7

Note: The responses do not refer to the number of days informants gather piñones, but rather their seasonal pattern of collection.

Many informants who responded "twice" qualified their answers. They collect in the spring only if there are piñones remaining. This requires an exceptionally good year of piñon production. One informant pointed out that early snowfall prevents animals from eating all the piñones which fall to the ground and ensures that some will remain in the spring. Even if there are piñones on the ground after the snow melts, another informant mentioned that animals often beat the Araucanos to them. One informant from Aigo stated that he previously collected during both piñoneos. However, now there are so many animals in the community that their consumption of piñones permits him to go only once a year. The responses indicate that there is definitely some competition for piñones between the Araucanos and animals, both wild and domesticated.

Informants were also asked when they collect piñones. Many replied from February until the first snowfall. Others provided specific dates for the beginning and end of the season, such as a man in Ralco Lepoy who said he collects from January 25 until April 22. Another informant in Ralco Lepoy pointed out that at lower elevations piñones begin falling a few weeks earlier than at higher elevations. This same informant

stated that at lower elevations he starts collecting on February 10 and at higher elevations he begins on February 20.

The first locational question from the survey instruments asks where informants collect piñones. Many of the responses make no reference to specific locations. For example, typical answers include *arriba* (up above), *a la cordillera* (in the mountains), or *a la veranada* (in the summer grazing grounds). As many informants in Aigo live in an araucaria forest or very close to one, they often replied *aquí* (here) or *al lado* (best understood in this context to mean close by).

Eleven of twenty-five informants in Ralco Lepoy and eleven of twenty-three in Aigo answered the "where" question with some degree of specificity, meaning that a place name was mentioned. However, even when reference to a place name was made, e.g., the Fundo Barco, it was difficult to get the informants to say exactly where. The Fundo Barco is a large piece of property. The author feels that working with the informants to locate places on a map was not a feasible alternative. The informants do not know how to read or interpret topographic maps. All locational questions from the survey instruments posed the same complications. This ultimately precluded making any maps based on the primary data presented in this chapter. Nevertheless, some useful and interesting information did result from the locational questions.

In Ralco Lepoy all piñon collection takes place in the Ralco National Reserve, on the very small portion of the invernada land titled to community residents which contains araucaria, and on lands belonging to the Fundo Barco. The map in Figure 7.3 illustrates that some residents in Aigo use the El Peleco sector of the Fundo for their summer grazing grounds. Two informants mentioned that they collect piñones in this sector, but are required to pay a fee or provide the Fundo's caretaker with a portion of the piñones. However, three other informants said that in the El Peleco sector they collect piñones free of charge, but for other parts of the Fundo Barco permission for piñon gathering must be

obtained and fees are collected. Whatever the actual situation is, apprehension and insecurity about using the El Peleco sector are understandable. The community and its residents have no legal title to this land.

Informants were asked how much time it takes to travel from their permanent (invernada) residence to the araucaria forests where piñones are collected. In Aigo this ranges from a matter of minutes to 4 hours. In Ralco Lepoy a range of 1 hour to 1.5 days was recorded. Four informants take an entire day to arrive at the araucaria forests and only one requires more than a full day. For those informants who gave an answer in hours (n=20), an average time of 3.2 hours is needed. Many informants indicated that the travel time depends on where they decide to collect.

Informants were also asked about their method of travel to the araucaria forest (Table 8.3). The prevalence of horseback in Ralco Lepoy may be related to the greater distances that must be covered. Horses facilitate the transport of piñones, without which very heavy sacks must be transported over one's shoulder.³

Table 8.3

Method of Travel to the Araucaria Forest for the Piñoneo

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
horseback	18	6
foot	7	12
foot or horseback	0	5

The next question relates to the methods used to collect piñones (Table 8.4). Collecting piñones off the ground and placing them in large potato sacks is the most

³ Some araucaria forests may be accessed by ox-drawn carts, which also may be used to transport piñones.

common way in both Ralco Lepoy and Aigo. Using a lasso to pull down cones or shake piñones to the ground seems more prevalent in Aigo. However, as this activity was observed repeatedly in both communities, the author suspects that more informants actually use a lasso. Perhaps there was some reluctance to talk about this technique in Ralco Lepoy because it is technically in violation of norms established by CONAF. It was pointed out in Chapter 5 that using a lasso may disrupt the araucaria's natural flowering process.

Table 8.4

Method of Piñon Collection

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
off ground	24	23
with lasso	1	8
by climbing	1	2

Note: The columns do not add up to 25 and 23 respectively because some informants mentioned more than one method.

Informants were then asked how much time is typically dedicated to gathering piñones during the piñoneo. Most replied that it depends on the amount of other work that has to be done. Informants tend to gather piñones as much as possible, but collecting fuelwood, the cereal harvest, garden cultivation, cutting forage grasses, and caring for livestock are time-consuming activities during the summer and fall months.

The next question concerns the amount of piñones that informants collect in a season. Before the results are discussed, a few words are necessary about the question itself. As there are usually two seasons in a year, the question could have been phrased more effectively. The question was intended to refer to the summer-fall piñoneo, and the

author believes that this is how the informants interpreted it. Not a single informant reacted to the question by asking, "Which season?" The first piñoneo is the more important one and involves by far the greater collection of piñones. The spring piñoneo yields small amounts, if any. Although a season was not specified when the question was asked, the author feels there probably is still value in the responses.

Informants were given the option of answering the "amount" question in terms of sacks or kg. Most of them answered with numbers of sacks. Reliable sources informed the author that a sack of piñones weighs about 80 kg. Conversions were made from the number of sacks to kg. Many informants answered the question with a range, e.g., from 10 to 15 sacks. In such cases an average was taken, so for the hypothetical example above 12.5 sacks would have been converted to 1000 kg.

In Ralco Lepoy, where twenty-three of twenty-five informants answered the question, the range of piñones collected is from 200 to 2800 kg. The mean is 1132 kg and the median is 1000 kg. In Aigo, where all twenty-three informants provided an answer, the range is from 40 to 2400 kg. The mean is 783 kg and the median is 800 kg. The findings indicate that the Araucanos of Ralco Lepoy tend to collect more piñones than those of Aigo. Environmental conditions could mean that there are more piñones available in Ralco Lepoy, but there are several other factors likely to be important. There may be more grazing pressure on piñones in Aigo, thus restricting their availability. Also, Aigo is relatively close to Alumine (25 km) and much less remote than Ralco Lepoy. Alternative foodstuffs are much more accessible, and can often be purchased with the alternative sources of income not as widely available in Ralco Lepoy. Perhaps the piñon accounts for a greater portion of the diet in Ralco Lepoy.

Informants were then asked who collects the piñones. The intention was to detect any gender or age distinctions in this activity. In both Ralco Lepoy and Aigo all informants mentioned that the entire family participates. Whoever has time collects

piñones, regardless of age or sex. This confirms Hilger's (1957) conclusion. In Ralco Lepoy, however, several informants mentioned that after mid-March children do not participate in the piñoneo. This is when classes begin in the community school, which is located in the invernada, far from the araucaria forests. There are boarding facilities in the school, and during the school year (weekends excepted) children live away from their families. This means that by mid-March all children leave the veranada and are no longer able to gather piñones.

The next question relates to how piñones are used. All informants mentioned that they are an important source of food. Many went on to describe how piñones are prepared in traditional fashion, i.e., by making bread from piñon flour, by drying and grinding piñones to be used as a condiment in soups and stews (*chichoca*), and by making a fermented beverage called *chavid*. Although the importance of the piñon as a food resource cannot be denied, the author feels that the more traditional ways of preparing piñones are not as widespread as informants indicated. A key informant in Aigo mentioned that only the *antiguos* (old-timers) still make bread and *chichoca*. Also, the author never saw or tasted bread made from piñon flour in either community, and only one family was seen drying piñones to make *chichoca*.⁴ Perhaps the informants were speaking about how one could use the piñones rather than how they are actually used. This relates to one of the complications in the interview process mentioned in Chapter 2.

Informants were then asked if they sell piñones. In Ralco Lepoy all twenty-five informants responded yes, although one informant prefaced this by saying that he sells only if he has enough piñones to last through the winter months. In Aigo only fourteen of twenty-three informants sell piñones. One informant mentioned that he does not sell because the price is too low. He prefers to eat the piñones and feed them to his animals.

⁴ Piñones are typically eaten boiled, roasted or raw.

Another informant does not sell piñones because she lives too far from the road. One informant pointed out that he buys piñones as supplemental feed for his livestock.

The fact that all of the informants in Ralco Lepoy sell piñones compared to 61% in Aigo suggests that in the former community piñones are a more important source of income. As pointed out earlier, this may be related to more inhabitants of Aigo having regular income. Cultural assimilation and piñon availability may also be factors. Furthermore, in Aigo there are some legal and pricing complications (outlined below) which may result in fewer inhabitants selling piñones.

In both communities piñones are sold exclusively to traveling merchants, known as *comerciantes ambulantes* in Ralco Lepoy and *mercachifles* in Aigo. The merchants travel to the communities at various times during the summer-fall collection season and load their trucks with piñones gathered by the Araucanos. Prices are usually negotiated where the transaction takes place on a one-to-one basis. Barter arrangements for sugar, wheat flour, yerba mate, or other provisions are often made.

In Ralco Lepoy the Araucanos are paid between 40 and 300 pesos/kg.⁵ Sixteen informants said they sell piñones for 100 pesos/kg. In Concepción the author observed piñones being sold in the municipal market for 500 pesos/kg. In Aigo piñones are sold from 50 centavos to 1 peso/kg.⁶ One kg of piñones is commonly traded for 1 kg of wheat flour. This puts the price of piñones at 43 centavos/kg. In Neuquén the author saw piñones priced at 3 pesos/kg. The mark-up is considerable.

In Aigo selling piñones can be a complicated affair. During the author's stay in the community, some informants expressed concern because by mid-March very few mercachifles had arrived. There were rumors that they were angry because the community was discussing the possibility of fixing a price for piñones. As the

⁵ Approximately 400 Chilean pesos equal 1 U.S. dollar.

⁶ One Argentine peso equals 1 U.S. dollar.

mercachifles negotiate with the Araucanos on an individual basis, they usually acquire piñones at a relatively low price. The Araucanos are at a disadvantage because they have few alternatives regarding where and to whom they can sell. Setting and adhering to a community-wide price might give them some bargaining power. On the other hand, the mercachifles have the option to buy piñones from other communities.

There is an additional complication for all piñon transactions in Aigo: By law mercachifles need permission from the Neuquén provincial government to buy piñones. A permit must be obtained and taxes paid on the amount of piñones purchased. Although tolerated by the park ranger, it is technically prohibited to collect or sell piñones within Lanin National Park under any circumstances. This creates some reluctance on the part of the mercachifles to buy piñones in Aigo. They fear that the provincial authorities who issue the permits will discover that the piñones were collected and bought within the limits of Lanin National Park. This situation may keep some mercachifles away from Aigo. For those who do buy piñones in Aigo, the risk involved provides leverage in negotiating a lower purchase price. The park ranger in Ruca Choroy, Arturo Costa Álvarez, is currently making efforts to legalize the sale of piñones collected in Lanin National Park. Specifically, he is lobbying for the Administración de Parques Nacionales to issue permits to the mercachifles and have any applicable taxes paid directly to the Araucanos. This could increase the value of the piñones for the Araucanos by as much as 30 centavos/kg. However, Álvarez informed the author that the institutional and bureaucratic obstacles to pushing his plan through are tremendous (pers. com. March 1993).

The discussion now turns to the first substantial difference in the survey instruments.⁷ The Araucanos of Ralco Lepoy were not asked about *their* use of araucaria

⁷ There are numerous minor variations throughout the survey instruments. For example, in Ralco Lepoy settlers are commonly referred to as *colonos*. In Aigo *huinca* (from Mapundungu and meaning non-indigenous) is generally used for settlers and outsiders. The survey instruments were both constructed

wood. Initial observations and informal conversations in the community led the author to believe that there was no use of this wood.⁸ It was concluded that direct and detailed questions about wood use would not be appropriate and might be offensive. The literature (Bengoa 1992; Quarto 1990) obtained before entering Ralco Lepoy indicates that the Araucanos do nothing to damage the forest. The author thought that pressing questions about the use of araucaria wood might have been interpreted by the informants as accusatory. During the interview only general reference to wood use was made. In Aigo, however, one of the first observations made by the author was the use of araucaria wood for fuelwood, and it was determined that detailed questions regarding its use were more appropriate in this community.⁹

Referring back to Table 8.1, all informants in Aigo use araucaria as fuelwood and over 75% use araucaria wood for some other purpose.¹⁰ Fuelwood is generally obtained from a dead tree, either standing or fallen. Lassos, to pull branches off a standing tree, and axes are the principal tools used. The author observed persons pulling branches from live trees. Southern beech species such as lenga are also collected. All fuelwood is obtained from Lanin National Park and Pulmari land. In both cases permission is required. Several informants mentioned that a small fee was charged to extract fuelwood from Pulmari. No fuelwood taken from Lanin National Park may be sold to anyone outside the community, although sometimes arrangements are made to do so among

considering the local contexts and histories of each community, and this explains many minor (and major) variations in terminology and format.

⁸ During his stay in Ralco Lepoy the author went on to discover that two informants do use the wood.

⁹ The questions from the survey instrument for Aigo break down wood use into "fuelwood" and "wood." The latter implies any use other than for fuel. This almost exclusively entails use for construction and fences.

¹⁰ Of the two informants in Ralco Lepoy mentioning araucaria wood use at some point during the interview, one said that he uses dead wood for fuel and the other stated that he uses dead wood for both fuel and construction. Again, the differences in wood use between the communities may in part be explained by the limited availability of any wood in Aigo. There residents are more apt to use whatever they can.

community members. Fuelwood is typically transported to the winter or summer residence by ox-drawn cart.¹¹

Araucaria wood used for construction typically provides structural support to a house or barn.¹² One informant was building an addition onto his house and pointed out that the beams were araucaria. Several informants reported that boards are made with a sledge hammer and wedge, although the author was never able to observe this. One informant mentioned using a chain saw. Wood used for construction is taken from dead trees, either standing or fallen. It is taken from Lanin National Park or Pulmari and permission is needed. No informants sell araucaria wood, although one mentioned buying it from a mill in Alumine.

Informants in Aigo were also asked about their use of green araucaria wood. All twenty-three informants responded that they do not use green wood. Several made reference to using green wood in the past, but said that cutting a live araucaria tree is now prohibited. One informant was emphatic about this, saying that cutting a live araucaria is *delicadísimo* (extremely delicate). Others responded to the question by asking why anyone would want to cut a live araucaria. One informant wondered aloud, ¿Por qué uno va a cortar un árbol que da frutos?"¹³ Another informant mentioned that green araucaria wood is not useful for construction because it is subject to considerable twisting and warping upon drying.

Informants in both Ralco Lepoy and Aigo were asked about their use of araucaria resin. Not a single informant in either community collects or uses the resin. However, many pointed to its utility, and some suggested possible uses. Aigo inhabitants mentioned that the resin is quite combustible, and the more resin wood contains the better

¹¹ Many residents in Aigo do not have oxen or carts. They make arrangements to rent from those who do, with payment usually being made in a negotiated quantity of fuelwood.

¹² On occasion araucaria wood is also used for fence repair.

¹³ This is translated by the author as "why would one cut a tree that bears fruit?"

its use as fuelwood. Many likened the resin to kerosene. An informant in Ralco Lepoy mentioned the resin as a potential adhesive. Two informants even mentioned that it can be used as a substitute for cooking oil. No one mentioned using the resin for medicinal purposes, as reported in the literature by Angli (1918), Gusinde (1936), Record and Hess (1943), and Hoffman (1982).

An effort was made during the interviews to assess the spiritual significance of araucaria. There were complications in asking the relevant question, regardless of word choice or question structure. For example, when it was asked if the tree has spiritual significance, many informants looked as if they did not understand the question. Upon trying the term religious significance, one informant mentioned that God determined the amount of piñones every year. Others stated that God created the tree for the Araucanos. Asking about the ceremonial importance of araucaria seemed to be somewhat more effective. A number of informants pointed out that an araucaria (two in the case of Aigo) is located in the center of the site reserved for the *Ngillatun*, the Araucano ritual outlined in Chapter 4. In any event, there were problems in gauging the tree's spiritual significance.¹⁴

CHANGE IN ARAUCARIA USE

The next section of each survey instrument (questions 16-22 for Ralco Lepoy and 16-28 for Aigo) is concerned with changes and perceived future changes in the use of araucaria. Quarto (1990), González (1980) and Elizalde Mac-clure (1970) all report that

¹⁴ The author feels that very few Araucanos in either Ralco Lepoy or Aigo are aware of or identify with the araucaria deities discussed in Chapter 4. Traditional Araucano spiritual beliefs seem to have largely disappeared, even though the *Ngillatun* is still practiced in both communities. In this ceremony Araucanos pray to Chachao, also referred to as the god of the Araucanos. Several informants were asked what the difference is between Chachao and the huinca god. On all occasions the author was told that there is no difference. Most marriages in Ralco Lepoy are conducted by a Catholic priest, and many of the houses in Aigo contain a poster or picture of Jesus Christ.

araucaria use has changed in most Araucano communities. The data analyzed here attempt to assess the degree and nature of these changes.

Informants were initially asked about the manner in which their parents and ancestors used the araucaria tree (Table 8.5). In Ralco Lepoy 68% of the informants reported no change, and in Aigo 57% of the informants did so. Of those who reported a difference, five informants in Ralco Lepoy indicated that their parents and ancestors sold fewer piñones. Several mentioned that the road into Ralco Lepoy has existed only since the mid-1970s. Prior to this the Araucanos had to make a full day's journey by horseback to the town of Ralco to sell piñones. The cacique, Manuel Neicuman, remembers when piñones had to be taken by horseback to Mulchen, an arduous two-day ride from Ralco Lepoy. In Aigo five informants indicated that their parents and ancestors prepared more traditional foods. This supports the author's belief that the preparation of certain foods has declined. Also in Aigo, parents and ancestors of informants used more wood in some cases. Several informants made specific reference to the former use of green wood.

Table 8.5

Difference in Use of Piñones by Informants' Parents

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
no difference	17	13
sold less	5	0
prepared different foods	1	5
prayed before harvest	1	0
used more wood	0	5
used green wood	0	3
made an alcoholic beverage	0	1
preserved more	0	1
did not know	1	0

Note: The column for Aigo does not add up to 23 because some informants gave more than one response.

Informants were then asked where their parents and ancestors collected piñones. The problematic nature of locational questions was discussed above. Most informants provided no specific details. They usually responded by saying "in same place," "all over," or "up above." The author found no reason to believe that the parents and ancestors of informants gathered piñones in different araucaria forests.

The next question relates to the quantity of piñones collected by the informants' parents and ancestors (Table 8.6). There was some ambiguity with this question, as there was for other questions comparing quantities. In this case, although the author made specific reference to the quantity of piñones collected when asking the question, most informants seemed to interpret it as if they were being asked about the amount of time their parents and ancestors spent collecting piñones. However, the author feels that this can be translated into the quantity collected. There is no reason to believe that the Araucanos today are any more or less efficient in collecting piñones than their parents and ancestors were. The findings indicate that in both communities parents and ancestors of informants collected more piñones.

Table 8.6

Comparative Amount of Piñones Collected by Informants' Parents

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
collected more	20	17
collected the same amount	4	6
collected less	1	0

Some noteworthy supplemental information resulted from this question. Many informants commented on the actual number of piñones available for use in the past, saying they were once much more plentiful. The Araucanos typically maintain that the araucaria trees bear much less fruit today. One individual stated that he has only a quarter of the nuts available to him that his parents had available to them. The reasons given for this decline in piñon production vary. One informant in Ralco Lepoy mentioned that God is angry with the Araucanos for speaking Spanish and is taking their piñones away. An informant in Aigo stated that the climate has changed.

In the survey instrument for Aigo there are several questions about how araucaria wood was used by the informants' parents and ancestors. Regarding the quantity of araucaria fuelwood, eighteen of twenty-three informants reported that their parents and ancestors used the same amount as the informant uses today, and five informants stated that more was used in the past. With respect to araucaria wood used for other purposes, fourteen informants said that their parents and ancestors used the same amount as the informant uses today, and nine informants indicated that they used more. The questions regarding where parents and ancestors collected wood suffered from the same pitfalls as previous locational questions. However, one informant mentioned that there were no restrictions when his parents collected fuelwood. They did not need permission from the park ranger because Lanin National Park did not exist.

The interview questions now shift to focus on changes in araucaria use during the life of the informant. Following the format used for the parent and ancestor questions, specific reference was initially made to the manner of change (Table 8.7). In Ralco Lepoy not a single informant reported change, and in Aigo only four informants did. Of these four informants, two mentioned that formerly they made chichoca and prepared piñones in more traditional ways. Two other informants mentioned that they no longer use araucaria wood (for construction).

Table 8.7**Informants Indicating a Change in Araucaria Use During Lifetime**

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
no change	25	19
change	0	4

Informants were then asked about changes in the quantity of piñones collected during their lifetime (Table 8.8). In Ralco Lepoy 68% and in Aigo 70% of the informants indicated that they collect fewer piñones today than in the past. With the exception of two informants who said that the quantity depends on the year, the informants report that they collect the same amount of piñones today as they always have. No informants mentioned that they currently collect more piñones. Generally speaking, informants who reported that their parents and ancestors collected more piñones also reported that they themselves collect fewer piñones today than in the past.

Table 8.8**Informants Indicating a Change in the Quantity of Piñones Collected During Lifetime**

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
collect less now	17	16
collect the same amount	6	7
collect more now	0	0
depends on the year	2	0

Informants who mentioned a change in the quantity of piñones collected during their lifetime were also asked when that change occurred (Table 8.9). The only noticeable pattern is that over half of the informants did not specify. The remaining responses vary considerably. Some informants offered plausible explanations as to why the particular change occurred when it did. For example, in Aigo two residents moved out of the araucaria forest, one twenty years ago and the other fifteen years ago, and as a result they began collecting fewer piñones. However, other responses made little sense. The man who mentioned that his quantity of piñon use changed at the start of this century was not born until 1920. Just as locational questions posed problems during the interviews, temporal inquiries were also complicated.

Table 8.9

When Any Change in the Quantity of Piñones Collected During Lifetime Occurred

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=17)</u>	<i>Aigo</i> <u>(n=16)</u>
did not specify	10	8
10 or 15 years ago	0	2
15 years ago	1	1
20 years ago	1	1
25 years ago	2	0
30 years ago	1	1
36 years ago	1	0
40 years ago	0	1
50 years ago	1	0
1935	0	1
start of this century	0	1

Note: N=16 and n=17 because only those who mentioned collecting fewer piñones today than at a previous point in their lifetime (Table 8.8) were asked this question.

Informants in Aigo were then asked if they have experienced any changes in the amount of araucaria fuelwood and araucaria wood (used for other purposes) collected

during their lifetime (Table 8.10). Eighteen of twenty-three informants collect the same amount of fuelwood as they always have. However, many of these informants made repeated references to the difficulty in finding fuelwood and the greater distances which must be traveled to acquire it. There has been great pressure exerted on all fuelwood resources of Aigo. Several informants attribute this to population increase in the community. There has also been a noticeable decline in the use of araucaria wood collected for purposes other than cooking and heating. This is most likely related to the introduction of alternative materials in the community. Most houses are now concrete, and much more wire fencing is used today than in the past. Informants experiencing a change in the use of fuelwood and wood were also asked when and where these changes occurred. Little valuable information resulted from these questions.

Table 8.10

Change in the Quantity of Araucaria Wood Collected During Informants' Lifetime

<u>response</u>	<i>Aigo</i>	
	<u>(n=23)</u>	<u>(n=23)</u>
	Fuelwood	Wood
collect the same amount	18	11
collect less now	5	12

To conclude the discussion of change in the use of araucaria, informants were asked to comment on the possibility of future change during their own lifetimes and whether or not they thought their children and grandchildren would continue using araucaria as they do today (Table 8.11). Even though many informants reported that they have already experienced changes in araucaria use, it is clear that they do not envision future change. Some informants mentioned that their parents taught them to use araucaria

and that they are teaching their own children so they will continue to use it as adults. Others said that God put the araucaria trees where he did for the Araucanos to use and they would always use them. Several informants wondered why one would not use a tree which provides food, and looked as if they did not understand how or why the author could ask such a question.

Table 8.11
Perceptions of Future Change in Araucaria Use

<u>response</u>	<i>Ralco Lepoy</i> (n=25)		<i>Aigo</i> (n=23)	
	<u>Own Lifetime</u>	<u>Distant Future</u>	<u>Own Lifetime</u>	<u>Distant Future</u>
will not change	20	16	23	22
will change	0	5	0	1
did not know	5	4	0	0

Note: The distant future implies during the lifetime of children and grandchildren.

Of the five informants in Ralco Lepoy who feel that araucaria use will change in the distant future, four believe that it will increase. They specifically mentioned that because *los interesados* (interested persons [in the araucaria tree]) are being kept out of the area, there is healthy araucaria regeneration. This means that future generations will have more araucaria trees to use. One informant in Aigo and one in Ralco Lepoy predicted that in the distant future people will use the tree less, but did not provide explanations. Finally, one informant stated that he feels his use of araucaria will not

change, but mentioned that he still worries about the future. He expressed concern that CONAF will someday charge fees for collecting piñones.

THE REASONS FOR AND REACTIONS TO CHANGE

The next seven questions from each survey instrument (questions 23-29 for Ralco Lepoy and 29-35 for Aigo) concern reasons for change in araucaria use and the Araucano reactions to change. The open-ended nature of the questions led to great variation in the responses, and oftentimes the subsequent discussion was not overtly related to the topic. The interview process became progressively complicated and extra caution was required to keep the conversation focused.

Informants were initially asked to discuss the reasons for change in araucaria use (Table 8.12). The question was asked in reference to any kind of change the informant (or parents and ancestors) may have experienced, such as the manner in which the tree is used, the quantity of piñones collected, the quantity of piñones or wood available for collection, or the way in which wood is used. In Ralco Lepoy twenty-one informants responded to this question. In Aigo twenty-two informants provided an answer. Some of the reasons for change had been volunteered earlier in the interview. In this case the author made a mental note of these reasons and referred back to them while asking this question, soliciting more details and other reasons.

Table 8.12

Reasons for the Change in Araucaria Use

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=21)</u>	<i>Aigo</i> <u>(n=22)</u>
more cultivation today	5	0
grazing or animal damage	4	0
fire	3	0

divine intervention (God knows or God is responsible)	3	1
logging	2	0
park or reserve authorities	1	3
product substitution (e.g., use concrete instead of wood)	0	5
demographic pressure	0	5
huinca influence (cultural assimilation)	0	5
alternative provisions more accessible	0	4
change of residence	0	2
less poverty today	0	2
did not know	6	2

Note: N=21 and n=22 respectively because these are the numbers of informants providing at least one reason for change (including "did not know"). Only the informants who provided an answer to this question were asked the remaining questions discussed in this section. Subsequent tables are also based on n=21 and n=22. The columns in the table above do not add up to 21 and 22 because some informants provided more than one answer.

The perceived reasons for change differ in the two communities. For example, of eight reasons given in Aigo, only two were mentioned in Ralco Lepoy, and of six reasons offered in Ralco Lepoy, only two were repeated in Aigo. This is testimony to their dissimilar situations and experiences.

In Ralco Lepoy an increase in cultivation (primarily wheat) is the most common reason listed. Manuel Neicuman, the cacique and a key informant in Ralco Lepoy, contends that this is the main reason why piñon collection and use have declined in the community. He stated that in the past it was difficult to cultivate wheat because of land conflicts. The Araucanos would sow wheat on their invernada land and shortly afterwards take their animals and families to the veranada. Upon returning from the veranada, an Araucano was likely to find that his land and harvest had been taken over by a settler. The larger the wheat field, the greater the likelihood that one's land would be occupied. The typical reaction was to forego planting wheat and concentrate on collecting piñones. Neicuman says that around 1920 the cacique (the grandfather of Neicuman's secretary) encouraged people to resist by planting wheat, making better fences, and defending land and crops with force if necessary. Eventually settlers stopped

occupying Araucano houses and fields, and wheat cultivation became more popular and widespread.

Four informants in Ralco Lepoy mentioned grazing or animal feeding as being responsible for a decline in piñon consumption. One pointed out that goats and pigs eat piñones. He also stated they eat the leaves off araucaria seedlings and that the seedlings are sometimes crushed by the animals. Another informant indicated that the feral European hare deprives the Araucanos of piñones. Two others made reference to an increase in the number of livestock in the community and greater overall grazing pressure.

Three informants in Ralco Lepoy mentioned that fire has been an agent of change. Two specifically pointed out that some large fires in the past were the result of Araucano carelessness. They often got out of control as piñones were being toasted under the araucaria trees. Another informant said the fires resulted from children's playing with matches.

Several informants mentioned that God is behind the change in araucaria use. One, as previously mentioned, claims that because the Araucanos are losing their language, God is chastising them by limiting piñon production. Another informant believes that God is angry because today the Araucanos sell more piñones than they eat. The third informant stated that only God knows why change has occurred.

Two informants made reference to logging activity as being responsible for change. One believes that when Maderas Ralco S.A. exploited the araucaria forests of Ralco Lepoy, the trees became angry and started producing fewer piñones. Another informant mentioned that *los interesados* cut araucaria trees in the past so that there are fewer piñones today.

Only one informant in Ralco Lepoy blamed CONAF for change in araucaria use. He said that CONAF has restricted access to the araucaria forests.

In Aigo five informants responded to the question about why change occurred by commenting on the decline in wood use. They mentioned the availability of alternative construction materials.

Five informants said there are fewer piñones to go around today. They attributed this to population increase in the community.¹⁵

Five informants pointed out that integration into Argentine society has brought about change. One of these mentioned that people leave the community to look for work to earn money to buy provisions. Another said that the Araucanos are *civilizados* (civilized) and no longer need piñones.

Four informants mentioned that change has occurred because alternative foods are more accessible today than in the past. It is not necessary to eat as many piñones because trips to Alumine are easier and are made more frequently. Thirty years ago the road to town did not exist.

Three informants indicated that the Administración de Parques Nacionales is responsible for the change in araucaria use. They reported that wood use has declined since the park service authorities arrived in the community.

Two informants indicated that they have income which allows them to diversify their diet. In the past they ate piñones because they had few other choices.

As mentioned in a previous section, two informants have moved to a part of the community relatively far from the araucaria forest. This has resulted in a decline in their use of piñones.

¹⁵ Osidala (1990) reports that demographic pressure in Aigo did not increase significantly during the 1980s. However, in Neuquén's Dirección General de Tierras y Colonización, the author uncovered a letter from Juan Aigo to the Señor Interventor en la Dirección de Protección al Aborigen (dated November 12, 1949) which makes reference to 54 families and 350 persons in the community. Today there are approximately 85 families and 640 persons in the community.

Only one informant in Aigo mentioned that God is responsible for the change. God is reacting to the community's loss of Araucano identity and traditions by providing fewer piñones.

Once the reasons for change had been discussed, informants were asked in what ways the reason(s) given has/have affected their use of araucaria. Although this question seems redundant, the author intended it as a cross-check. In several cases it was effective. For example, one informant said that today he collects fewer piñones than he did in the past. He attributes the change to increased demographic pressure. When asked how increased demographic pressure has affected his use of araucaria, this informant responded by saying that fewer piñones are available and he cannot collect as many. In other instances, however, informants looked puzzled when this question was asked. Most did not offer a response. As a result the question is not analyzed here.

Informants were then asked how the reason(s) given for change has/have affected them in other ways. The intention was to bring out any issues which had yet to surface. Although many informants did not provide an answer, some provided interesting responses. In Ralco Lepoy one informant mentioned that increased wheat cultivation not only has led him to use fewer piñones; it has also given him a greater sense of security. No longer does he strictly rely on the piñon harvest. Another informant said he is not bothered that his livestock deprive him of piñones. Heavier animals fetch a higher price, and he needs money to buy clothing for his children. In Aigo, one informant mentioned that increased demographic pressure not only means more competition for piñones among community residents but also more intense competition for pasture.

Informants were then asked about adaptations they have made in response to changes in araucaria use (Table 8.13). Although many informants in Ralco Lepoy and Aigo have adapted to change by consuming different foods, the remainder of the responses show considerable variation and apply exclusively to one community or the

other. The adaptations mentioned are based on the particular change discussed by the informant. For example, those saying that they have adapted to change by cultivating more cereals are referring to a decline in the number of piñones collected or available. An informant in Ralco Lepoy who attributes change to the restrictions imposed by the authorities of Ralco National Reserve claimed that he has adapted by violating regulations. Another informant has adapted to change by embracing it. His livestock deprive him of piñones but generate more income. Therefore, he has built up his number of animals, which in effect further restricts his access to piñones. One informant in Aigo has adapted to using less fuelwood by purchasing a gas stove.

Table 8.13

Adaptations to Change in Araucaria Use

<u>response</u>	<i>Ralco Lepoy</i> (n=21)	<i>Aigo</i> (n=22)
eat other foods (bread, meat, sugar, yerba mate)	13	13
grow more cereal crops	3	0
violate park or reserve regulations	1	0
increase animal stock	1	0
sell more piñones today than in the past	1	0
spend more time collecting fuelwood	0	2
purchase fuelwood	0	1
use gas stove	0	1
find employment	0	1
learned to protect araucaria	0	1
have not adapted	0	2
have not needed to adapt	0	2
did not know	2	1

Note: The column for Aigo does not add up to 22 because some informants provided more than one answer.

Informants were then asked about the advantages of change. However, there were complications in asking this question. Some informants answered the question in

reference to the benefits of change itself, while others commented on the benefits of the reason(s) responsible for the change. For example, one informant mentioned that an advantage of consuming fewer piñones is being able to enjoy a relatively wider variety of food. In this case an advantage provided by the actual change was reported. Another informant, the one who mentioned that the CONAF authorities are responsible for his change in araucaria use, pointed out that CONAF is useful for monitoring and controlling forest fires. In this case an advantage of the agent behind the change was offered. Perhaps presenting this question differently would have removed the ambiguity. It would not have prevented, however, informants from talking about whatever they wanted to talk about whenever they felt like doing so.

In Ralco Lepoy only seven of twenty-one informants mentioned an advantage to either change or the factor(s) responsible. Four of these pointed out that they have benefited from having greater security through animals and crops. In Aigo fourteen of twenty-two informants reported some kind of advantage. Several pointed out that since food and other items had become more widely available in Alumine, life was much easier. It was no longer necessary to make the five-day trip by ox-drawn cart to Zapala to sell wool and piñones and to secure provisions. Another informant mentioned that a benefit of integration into Argentine society is that the children are being educated and it will no longer be possible for others to take advantage of Araucanos.

Informants were also asked about the disadvantages of change. The same complications and ambiguity surfaced in this question. Nevertheless, some interesting comments were recorded.

In Ralco Lepoy nine of twenty-one informants mentioned a disadvantage to either change or the factor(s) responsible. One mentioned that most food available today is not as nutritious as piñones, and another indicated that growing crops requires more work than collecting piñones. Many informants in Ralco Lepoy used this question as an

opportunity to denounce CONAF.¹⁶ One informant claimed that CONAF wants to own the araucaria forests. He expressed concern that CONAF will charge an entrance fee to the Ralco National Reserve at some point in the future. This perspective reflects the insecurity the Araucanos feel because they do not have legal title or rights to this land. A number of informants spoke about restrictions imposed by CONAF. Some pointed to the difficulties involved in collecting fuelwood and using wood for house and fence repair, and others called attention to the grazing restrictions and limitations on the gathering of piñones.¹⁷ One informant complained of cultivation restrictions in the veranada. It became clear that many Araucanos want CONAF to leave the community.¹⁸

In Aigo fourteen of twenty-two informants mentioned a disadvantage to either change or the factor(s) responsible. One complained that he no longer has surplus piñones to feed his animals. Another informant reiterated the drawbacks of increased demographic pressure in the community, saying that piñones, fuelwood, and grazing land have become less available. One informant stated that increased integration means the Araucanos are losing their language and traditions. Another mentioned that new foods in the community are often rotten and disease-ridden. He pointed out that the Araucanos are not as healthy today and it is not possible to reach an age of 120 years as his ancestors did. Only one informant took this opportunity to complain about the Administración de Parques Nacionales. She said that now it is necessary to ask for permission to gather wood, and that community residents can no longer do as they please.

¹⁶ Some informants actually started criticizing CONAF earlier in the interview, but returned to it at this point.

¹⁷ As a management plan for the Ralco National Reserve has yet to be drawn up, there are technically no specific restrictions at this point. However, some general ones related to fire and tree cutting are applied. The concern of the Araucanos arises from previous attempts to impose restrictions and uncertainty about their future use of the area's resources.

¹⁸ There is some divergence of opinion on this issue, both among the Araucanos themselves and between the Araucanos and some of the settler families living in Ralco Lepoy. The author conducted two informal interviews with settler families. Both indicated that CONAF's presence was necessary, saying that it does an effective job and does not bother community residents. One stated that the Araucanos lack the technical knowledge necessary to manage the area's resources.

Informants were then asked if change or the factor(s) responsible has/have been resisted, accepted, or left one indifferent (Table 8.14). Roughly half of the informants in each community say they have accepted change or the factor(s) responsible.

Table 8.14

Acceptance, Resistance and Indifference to Change in Araucaria Use

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=21)</u>	<i>Aigo</i> <u>(n=22)</u>
accept	10	13
resist	6	5
indifferent	4	2
mixed feelings (accepts and resists)	0	1
did not answer	1	1

Informants were also asked why change or the factor(s) responsible has/have been resisted, accepted, or left one indifferent. In Ralco Lepoy one informant mentioned that he has resisted because the araucaria trees belong to the Araucanos. Another who has accepted change mentioned that more cultivation and more livestock translate into a higher standard of living. Many informants said they have accepted change because they have had little other choice. In Aigo one informant has resisted change because God put him on this planet as an Araucano and he must continue to live like one. An informant in Aigo who has accepted change mentioned that nothing can be done about the number of people in the community. The one informant indicating that he has mixed feelings stated

that he has accepted change because he eats better, but has resisted in part because it means losing an Araucano tradition.

Informants who indicated that they have resisted change were also asked how they have done so. Very few informants seemed to understand this question, so no discussion is included here.

THE PROTECTION OF ARAUCARIA

The questions analyzed in this section (30-35 for Ralco Lepoy and 36-40 for Aigo) are principally concerned with indigenous interest and participation in the protection of araucaria. Informants were asked to comment on their feelings about effective stewardship of the tree. The answers are considered in light of the conceptual issues regarding indigenous territorial rights, protected areas, and environmental conservation discussed in the introductory chapter of this thesis. Specifically, an effort to explore any connection between indigenous territorial rights and interest in conservation is made.

Informants were first asked about the use of araucaria by huincas (Table 8.15). In Aigo there is a stronger perception of the huinca as a buyer of piñones, despite the fact that earlier in the interview more informants in Ralco Lepoy reported that they sell piñones. Also, more informants in Aigo report wood use by huincas. Several made reference to araucaria felling on lands outside the community and Lanin National Park. In Ralco Lepoy more informants concluded that there is no difference between Araucano and huinca use. Many of the responses to this question were offered with supplementary information. For example, some informants stated that huincas use araucaria but not on indigenous lands. One mentioned that huincas may collect piñones but only with permission. An informant in Ralco Lepoy pointed out that only the huincas living in the community are allowed to collect piñones. Another informant in Ralco Lepoy said that

huincas intentionally take their animals to the araucaria forests to let them feed on piñones. One informant in Aigo said that huincas do not use araucaria because they are not allowed to.

Table 8.15

Huinca Use of the Araucaria According to Informants

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
buy piñones	7	16
collect piñones	7	4
same as the Araucanos	8	0
same but do not sell	1	0
fodder	1	0
wood	1	5
do not use	1	1

Note: The columns do not add up to 25 and 23 respectively because some informants gave more than one answer.

Informants were then asked how they are affected by the huinca use of araucaria (Table 8.16). Nearly three-quarters of all informants reported that there is no effect. Most of the other informants mentioned that the huinca purchase of piñones allows them to acquire supplemental income.

Table 8.16

How Huinca Use of the Araucaria Affects Informants

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=24)</u>	<i>Aigo</i> <u>(n=22)</u>
no effect	18	16
provides a market	5	6
did not say	1	0

Note: N=24 and n=22 because one informant in each community reported that huincas do not use the araucaria.

Informants were then asked if they think araucaria trees are being cut (Table 8.17).¹⁹ In Ralco Lepoy twenty-two of twenty-five informants answered no. Seventeen of these informants mentioned that cutting is strictly prohibited, not only in the Ralco National Reserve, but throughout Chile. Several pointed out that although araucaria is not being exploited now, it was cut heavily in the past. One informant stated that much of this felling was clandestine. Only one informant in Ralco Lepoy mentioned that araucaria is being cut, but no details were provided. In Aigo five informants stated that araucaria is being cut. Two informants indicated that it is cut secretly. Two others said that araucaria is cut but only with the permission of the park ranger. The fifth informant who indicated that araucaria is being cut provided no details. Another informant in Aigo pointed out that in the past araucaria was cut but now the Araucanos are more *educados* (educated) and no longer cut the tree.

Table 8.17

Number of Informants Believing That Araucaria Is Currently Being Cut

¹⁹ Question 31 from the Ralco Lepoy survey instrument asks specifically if there are non-Araucanos (Pehuenche) who cut araucaria. This relates the author's concern, discussed in the previous section, about insulting the informants by suggesting that they might cut the tree.

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
no	22	11
yes	1	5
not in the community but in other places	0	1
not in the community but did not know about other places	1	1
did not know	1	5

An effort was then made to assay the Araucano perception of araucaria abundance (Table 8.18). In Ralco Lepoy 52% and in Aigo 83% of the informants believe that araucaria is plentiful.²⁰ Perhaps this difference in perception stems from no commercial logging ever having taken place in Aigo. In Ralco Lepoy Maderas Ralco S.A. cut araucaria during the late 1960s.

Table 8.18

Informant Perception of Araucaria Plenitude

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
many trees	13	19
few trees	8	3
same as always	2	0
depends where	2	1

Informants were then asked if they think araucaria should be protected from cutting (Table 8.19). In Ralco Lepoy there is unanimous opinion among the informants. In Aigo nineteen of twenty-three informants gave an unqualified yes in answer to this question. Two informants indicated that they have mixed feelings. Both mentioned that on one hand araucaria needs to be protected to prevent people from cutting the tree, but

²⁰ Informants were actually asked if there were many araucaria trees or only a few. This is one of many examples in which word choice was necessarily straightforward and simple.

sometimes people in the community desperately need wood and are stymied by the prohibition against the felling. Another informant indicated that people should be permitted to cut only dead araucarias. Only one informant in Aigo believed that the tree should not be protected. She mentioned that life in the past was much better when there were no restrictions, and wondered how the Araucanos were supposed to get wood if the tree is protected. Although there are strong feelings in both communities that araucaria should be protected, one might tentatively conclude from the numbers in Table 8.19 that there is a slightly stronger commitment to protection in Ralco Lepoy than Aigo.

Table 8.19

Number of Informants Feeling That Araucaria Should Be Protected from Cutting

<u>response</u>	<i>Ralco Lepoy</i> <u>(n=25)</u>	<i>Aigo</i> <u>(n=23)</u>
yes	25	19
yes except dead trees	0	1
mixed feelings	0	2
no	0	1

Questions were then asked to ascertain the Araucano perception of who protects araucaria, by whom or how it should be protected, and why it should be protected like this. Slight differences in the questionnaire were necessary. These differences are elucidated below.

Ralco Lepoy

33) Do you think that the cutting of araucaria should be prohibited?

33A) If it should be protected, who do think should protect it?

33B) If it should not be protected, why?

Aigo

39) Do you think that the cutting of araucaria should be prohibited?

39A) Who is in charge of protecting it?

39B) Do you think it is good or bad to have a ranger?

39C) Does the community itself look after the araucaria?

39C1) Then why have a ranger?

39D) If araucaria should not be protected, why?

In Ralco Lepoy it was sufficient to ask a single question (33A). Although it specifically asks who the informants think should protect araucaria, responses were nearly always accompanied by explanations. Much relevant information surfaced in response to this question. In Aigo, during preliminary conversations and the pilot interview, individuals were asked who they think should protect araucaria. The author was informed that the park ranger protects it. The "should" part of the question was either ignored or not understood. An alternative approach was necessary, and this explains the differences in the questions above. As they are not identical, the data for Ralco Lepoy and Aigo are presented in tables separately.

Sixty percent of the informants in Ralco Lepoy mentioned that the community should be responsible for protecting araucaria, while 24% mentioned CONAF, 8% pointed to the cacique, and another 8% said the community and CONAF should share the responsibility (Table 8.20). Informants also provided explanations for their answers.

Table 8.20

Informants in Ralco Lepoy: Who Should Protect the Araucaria?

response

(n=25)

the community	15
CONAF	6
the community and CONAF	2
the cacique	2

Several informants in Ralco Lepoy mentioned that they depend on araucaria trees for food, so the Araucanos would ensure its protection. One informant said that the cacique gave a direct order not to cut araucaria and the community respects his word. Another informant told the author, "Jamás ha botado un pino un indígena."²¹ Other informants mentioned that they use the forest for many things and maintain its good health by taking only what is necessary. One informant mentioned that the Araucanos take good care of the forest because they own it.²²

Many informants in Ralco Lepoy used this question as another opportunity to denounce CONAF. On repeated occasions it was mentioned that CONAF does nothing to protect araucaria and there is no need for its presence in the community. One informant said that CONAF even destroys the natural environment. Another pointed to his suspicion that CONAF intends to exploit the forest for profit. Others mentioned that CONAF came to the community to control the people rather than protect the forests. Informants echoed complaints heard earlier about grazing, cultivation, wood and piñon restrictions. Many maintain that the Araucanos are perfectly capable of looking after the araucaria forests and feel that the presence of CONAF is unnecessary. Antonio Ancanao, the secretary to the cacique and a key informant in Ralco Lepoy, pointed out that community residents came to the defense of these forests when Maderas Ralco S.A. started felling trees some twenty-five years ago. However, some informants in Ralco Lepoy made favorable comments about CONAF. Several said that CONAF was needed

²¹ This is translated by the author as "never has an indigenous cut down a pine [araucaria]."

²² In providing the explanations here many informants spoke about the forest in general rather than focusing on araucaria.

to prevent huincas from cutting araucaria. Others pointed out that CONAF is necessary to monitor and control fires.

As all the informants in Ralco Lepoy indicated that araucaria should be protected, there was no need to ask why it should not be protected. However, an attempt was made to broaden the discussion and uncover related issues by asking informants if they are concerned about other trees and resources. Nothing new and significant was revealed. Most informants said they worry about everything.

In Aigo informants were asked who protects araucaria (Table 8.21). Most informants mentioned that the park ranger has a role in protecting the tree. Over half of the informants said the ranger does so exclusively, five mentioned that the community also helps, two pointed out that the park ranger receives help from his assistants,²³ and one informant mentioned that the responsibility belongs to the Comisión Directiva, which comprises the cacique, a vice cacique, a secretary, and a treasurer. Another informant brought up the provincial authorities.

Table 8.21

Informants in Aigo: Who Protects the Araucaria?

<u>response</u>	<u>(n=22)</u>
the park ranger	13
the park ranger and the community	5
the park ranger and his assistants	2
community leaders	1
Neuquén Forest Department	1

Note: N=22 because one informant reported that araucaria should not be protected and was not asked this or subsequent questions about araucaria protection in Aigo.

²³ The park ranger in Ruca Choroy is provided with six *guardaparque ayudantes* (assistant rangers). All are from the community and are primarily involved in fire monitoring and control.

Informants in Aigo were then asked whether the presence of a park ranger in the community is desirable. All twenty-two informants responded yes, and no fundamental objections to the ranger's presence were reported.

To assess the perception of the community's interest and role in the protection of araucaria in Aigo, informants were asked if the community itself looks after the araucaria (Table 8.22). Only 36% gave an unqualified yes for an answer. Very few informants came right out and said that the community has the knowledge and commitment to protect the tree. In Ralco Lepoy, however, 60% of the informants stated that the community itself should be responsible for protecting araucaria, and there many informants made reference to the community's interest in araucaria protection at various points during the interview.

Table 8.22

Informants in Aigo: Does the Community Itself Protect Araucaria?

<u>response</u>	<u>(n=22)</u>
depends on the person	9
yes	8
most people	3
no	1
did not know	1

Of the informants in Aigo who stated that the community protects araucaria, several mentioned that the tree is respected because it provides food. One informant said, "Vivimos en el parque y ya sabemos que tenemos que cuidarlo."²⁴ Three informants stated that most people in the community are sensitive to protecting araucaria. Only one

²⁴ This is translated by the author as "we live in the park and we know that we must take care of it [the tree]."

informant flatly denied that the community protects araucaria. He stated that the community does not realize the tree should not be cut, and that without the park ranger Aigo would not have araucaria trees. The most common answer listed in Table 8.22 is that protection depends on the individual. One informant mentioned that "algunos no tienen vergüenza."²⁵

Informants in Aigo were also asked why the park ranger is necessary (Table 8.23). In the category, "to ensure that araucaria is not cut," many of the fifteen informants made specific reference to the necessity of having a ranger to prevent araucaria from being cut by Araucanos within the community.²⁶ One informant said, in reference to the degradation of the community's forest resources, "La gente ya ha sacado todos los árboles."²⁷ Another informant mentioned that rules and regulations are necessary, pointing out that if one individual cuts an araucaria, then perhaps a neighbor will, and so on and so forth. Five informants specifically pointed out that the park ranger is necessary to protect araucaria from huinca depredation. Five other informants stated that it is necessary to have the park ranger for fire control. Finally, one informant mentioned that the park ranger is needed to help the Araucanos. Reference was made to a project undertaken in the community in 1989 which aimed at improving subsistence garden plots and increasing the cultivation of forage species.²⁸

Table 8.23

Reasons for Needing a Ranger in Aigo

²⁵ This is translated by the author as "some have no shame."

²⁶ Referring back to question 13C in Aigo, all twenty-three informants mentioned that they do not use green wood and many wondered why one would cut araucaria. The figures in Table 8.22 and Table 8.23 indicate that protection is not as widespread as informants initially indicated. Never did a single informant admit to cutting an araucaria, but many said that others have done so.

²⁷ This is translated by the author as "the people have already taken all the trees."

²⁸ This program was actually funded by a Swiss non-governmental organization called CREAR, but was administered by the staff of Lanin National Park.

<u>response</u>	<u>(n=22)</u>
to ensure that araucaria is not cut	15
to prohibit huincas from using araucaria	5
fire control	5
to help the community	1
did not say	1

Note: The column does not add up to 22 because some informants provided more than one response.

Although nearly all residents in Aigo feel that araucaria should be protected, several of the comments above indicate that the community's commitment to protection is weaker than the commitment expressed in Ralco Lepoy. Again, the question to Aigo residents regarding the community's protection of araucaria clearly reflects the difference in commitment. The most common response, that protection depends on the individual, was often supplemented by reference to araucaria felling by community residents. In Ralco Lepoy no such stories surfaced, and informants revealed nothing to indicate that araucaria felling by community residents was even a remote possibility. A slight difference in commitment to protection is also reflected in Table 8.19, and is supported by the author's general field observations.

Molina and Correa (1992) and Santos (1991) state that Ralco Lepoy residents are actively demanding legal title to all of their veranada lands, which comprise a large part of the Ralco National Reserve and part of the Fundo Barco. The author's experience in the field corroborates that within the community there is general consensus on this issue. On the other hand, in Aigo no active claim is being made for legal title to lands administered by the Administración de Parques Nacionales or the Corporación Interestadual Pulmari. Although there have been conflicts in the past, there is generally a passive acceptance of huinca presence, policies and regulations.

Nietschmann (1992, 1991) and Chapin (1992a, 1992b) associate sound resource management with self-determination in the tropical forests of Central America. One of the principal objectives of this thesis is to explore this connection in diverse localities and contexts. Although the data presented in this chapter are by no means statistically representative, there is an indication that territorial struggles can be accompanied by a greater interest in conservation. In Ralco Lepoy, where the community is challenging institutional and private administration of lands and resources that it has used since time immemorial, the Araucanos see themselves as the legitimate and effective custodians of araucaria and show a stronger interest in protecting the tree. In Aigo, where the presence of the Administración de Parques Nacionales is passively accepted and there seems to be little active assertion to secure legal title to Lanin National Park or Pulmari land, some informants question the ability of the Araucanos to protect the araucaria forests.

An interesting possibility for further research is investigating other Araucano communities' assertions to land and resource rights and their interest in and commitment to araucaria protection. This effort could be made in conjunction with detailed land-tenure histories for each community and an analysis of current territorial claims. A working hypothesis for such an undertaking could be: in Araucano communities (which contain and use araucaria) stronger assertions to land and resources rights are accompanied by a greater interest in and commitment to araucaria protection.

There are other important factors which might help explain the higher priority of araucaria protection in Ralco Lepoy than in Aigo. Some have been discussed elsewhere in this thesis but will be reiterated here. First, fuelwood and wood are much less plentiful in Aigo. Perhaps Aigo residents are more inclined to pull down branches from a live araucaria or cut a standing tree to satisfy their demand for wood. Second, residents of Ralco Lepoy collect more piñones, and they seem to spend more time doing so. Piñones are apparently a more important food resource in Ralco Lepoy, and they probably

generate more supplementary income. Perhaps this factor has strengthened the community's commitment to protection. Third, there having been commercial exploitation of araucaria forests in Ralco Lepoy might account for the community's heightened interest in protection. In Aigo there have been no large-scale commercial threats to the araucaria forests. Fourth, in Ralco Lepoy resistance to CONAF dates back to 1972, when Ralco National Park was established. There have been repeated attempts and threats to restrict the livelihood of the Araucanos. Only within the past several years has there been any indication that CONAF authorities are willing to work with the community.²⁹ In Aigo, however, the Administración de Parques Nacionales has been much more disposed to work with the Araucanos, at least for the past ten years. Amend and Amend (1992) mention Lanin National Park as a successful example of park authorities trying to integrate indigenous peoples and their needs into management plans. Fifth, there is generally a higher degree of economic integration and cultural assimilation in Aigo, and this may influence the community's commitment to araucaria protection. Finally, it should be pointed out that some of the factors mentioned here, either on their own or in combination, might also account for the difference in the territorial claims and assertions being made in Ralco Lepoy and Aigo.

This case study uses araucaria as an environmental indicator. This species is used to assess the Araucano interest in conservation because, even though its use and importance have changed markedly over the years, it is still an important resource for many Araucanos. However, the Araucanos use other forest products and natural resources as well, and some of these resources have been severely degraded. Vargas (1993) and Mourgués (1983) point to serious erosional problems in Ralco Lepoy resulting from overgrazing. Vargas (1993) also reports that in some areas there is concern about

²⁹ In a letter dated July 26, 1989, from the executive director of CONAF, Ivan Castro Poblete, to the cacique of Ralco Lepoy, Manuel Neicumán, support of the community is solicited in drawing up a management plan for the Ralco National Reserve.

the quantity of fuelwood extracted. Osidala et al. (1992) describe severe erosional problems in Aigo which have also stemmed from overgrazing and wood collection. There is concern in both communities about the degree to which grazing practices interfere with araucaria regeneration.³⁰

Environmental deterioration is evident in both Ralco Lepoy and Aigo. It is important here to understand the conditions which have led to this deterioration. The historical reduction of indigenous territory has drastically restricted the resource base of the Araucanos. After the Araucanian War in Chile and the Desert Campaign in Argentina, indigenous peoples who once had access to large expanses of territory were squeezed onto relatively small areas. Over the years demographic and livestock pressure has increased in these reduced areas, and the Araucanos have faced a growing necessity to overexploit lands to satisfy basic demands. As they become incorporated into market economies, the Araucanos are often required to intensify production practices in order to pay for goods and services. For the Araucanos this process has typically meant the acquisition of more animals and increased cultivation, and a subsequent rise in environmental deterioration.

³⁰ All principal grazing animals are exotic.

CONCLUSION

This thesis has examined the natural and social geography of araucaria. The intention has been to synthesize fragmented data and consider the factors which might explain the differences between Chile and Argentina in managing the tree. The particular experiences of two Araucano communities have also been examined. The objective here has been to consider indigenous territorial rights, protected areas, and conservation in relation to findings from current geographical research in Central America. This chapter summarizes the results and reviews the major substantive points of this thesis. It also considers policy implications and discusses possibilities for further research.

SUMMARY

Araucaria has been depleted over much of its natural range. The principal agents have been fire and commercial logging activity. There has also been concern about the effect of piñon collection, grazing, and tourism on the health of the species. Degradation appears to have been more intense in Chile. Large areas were commonly burned in southern Chile to clear land for grazing and farming. Also, the timber industry is much more developed in southern Chile than it is in the Argentine Andes. In Argentina forestry activity is popular in the northeastern part of the country, where Paraná pine (the subtropical relative of araucaria) grows. Perhaps access to this faster growing tree, which also has good wood properties, spared much of the araucaria population in Argentina.

It is also important to reiterate that in Chile there are some 315,000 ha of araucaria, while in Argentina there are only 80,000 ha. When Lanin National Park was created in 1937, much of the araucaria remaining in Argentina was afforded legal

protection. Also, because of persistent winds and lower precipitation on the leeward side of the Andean Divide, araucaria trees in Argentina are generally smaller than those in Chile, and hence less attractive to timber companies (L. Araya, pers. com. April 1993). Furthermore, araucaria stands in Argentina are located far from markets and consumer centers.

Efforts to protect araucaria from timber exploitation and to ensure the survival of the species have been made over the years. Some have been based on employing sound silvicultural practices, while other measures have involved legislation to regulate felling and the creation of protected areas. Although the effectiveness of such efforts has often been limited and sporadic, the large-scale commercial exploitation of araucaria has ceased. A limited amount of dead wood is currently being processed at several mills in Argentina's Neuquén province. Workers report that this wood was cut years ago and is being taken from the forest floor. Although on occasion the exploitation of live araucaria may occur, informants, academics, forestry professionals, and environmentalists indicated that it is not widespread. Araucaria is no longer significant as a timber species. However, the possibility of its reverting to commercial importance cannot be overlooked. The status that it enjoys as a natural monument in Chile and the strict regulations imposed by Law 1890 on its felling in Neuquén are subject to modification.

The primary data presented in this case study suggest that change in the use of araucaria has occurred in Ralco Lepoy and Aigo. The nature and degree of this change, as well as the reasons for it, vary considerably. The findings indicate that in Ralco Lepoy, where claims to land and resource rights are being pressed actively, there is a greater interest in and commitment to the protection of araucaria. In Aigo this interest and commitment exist, but seem weaker, as do the community's claims to legal territorial rights. Other factors which might help explain the difference in commitment to araucaria protection include the limited supply of any wood and a higher degree of economic

integration and cultural assimilation in Aigo, on the one hand, and the lower availability of alternative foodstuffs and greater emphasis on the piñon as a food resource in Ralco Lepoy along with the community's past experience of commercial araucaria extraction, on the other hand. The inclination of the Administración de Parques Nacionales to work with the people of Aigo is also an important consideration. The factors above, either on their own or in combination, might also be useful in explaining the different degree of each community's quest for self-determination.

POLICY IMPLICATIONS

Data Integration

Argentina and Chile share an international border over 4000 km long. Araucaria is not the only vulnerable or endangered species which straddles this border. Along its northern reaches there are threatened populations of flamingos and vicuña. To the south are the last great stands of alerce trees. There are also problems with transboundary land degradation, such as erosional and sedimentation problems in the Futaleufu drainage basin. One of the policy implications of this thesis is the desirability of the integration of Chilean and Argentine data.

Transboundary resources have often been managed unilaterally. Admittedly, Chile and Argentina have had numerous border conflicts in the past, and some of these are still unresolved. However, in 1985 the two countries signed a treaty of peace and friendship. Now is an opportune time for cooperation on environmental matters. Efforts to coordinate resource management must be preceded by consolidating and disseminating information among all the individuals involved. The data collected and reported in this case study might make some Chilean professionals aware of the experience with araucaria in Argentina, and likewise be helpful for Argentines seeking to understand the situation of araucaria in Chile. The author is committed to summarizing the results in

Spanish and sending them to the institutions and individuals who assisted with this research.

Indigenous Self-Determination and Environmental Conservation

Another policy implication of this case study is the utility of approaching indigenous land rights and environmental conservation in a complementary fashion. Specifically, can the communities of Ralco Lepoy and Aigo reestablish and reinforce control over their traditional territory and ensure sound environmental management? Can their ambiguous land tenure situations be reconciled with the interests of conservation? If there is a convergence of interest, how might the situation be addressed?

The detrimental effects that productive and extractive activities in Ralco Lepoy and Aigo have on the natural environment were discussed in the previous chapter. The reduction of the Araucano resource base, increased demographic and livestock pressure, and the intensification of certain activities have been contributing factors. In both communities there have been proposals and programs to ameliorate the environmental degradation.

To achieve sustainable resource use in Ralco Lepoy and the adjacent Ralco National Reserve, Mourgués (1983) suggests that limited piñon collection be part of any strategy.¹ Cunazza (1989) recommends monitoring and improving pasture land through a grazing contract system. He suggests complementing this with environmental education and technology transfer. Verdugo (1991) writes that plans for sustainable resource use should consider soil conservation, watershed management, recuperation of degraded areas, and the preservation of the genetic diversity in the area.¹ As part of a plan to implement sustainable resource use in Ralco Lepoy, CONAF financed the recent study by

¹ Verdugo mentions that the genotype for araucaria in the Ralco National Reserve, which is in the northern part of the tree's range, is distinct from the genotype in the southern part of its range.

Vargas (1993). It plans to consider the results as the management plan for the Ralco National Reserve is written. All proposals to date have involved little, if any, local input. Osidala et al. (1992) report that the Departamento de Asentimientos Humanos for Lanin National Park has a series of plans aimed at assisting the community of Aigo. The objective is to support programs which raise living standards but do not threaten the social and cultural characteristics of the community. To address the problem of overgrazing, a project aimed at increasing the cultivation of forage species was implemented in 1989. This was complemented by efforts to increase production in family gardens. It was thought that these strategies would facilitate araucaria regeneration by reducing the grazing and collection pressure on piñones. This approach is hardly consistent with maintaining the social and cultural characteristics of the community.

In an edited volume about national parks in South America, Amend and Amend (1992) offer a solution for improving living conditions in communities located within protected areas. They recommend integrating the community into the protected area, educating its members about the area's objectives, and searching for an alternative livelihood which reduces pressure on local resources. This perspective, based on the assumption that people want alternative production activities, resembles the current approach of CONAF and the Administración de Parques Nacionales. It is also reminiscent of the principles incorporated in the integrated conservation-development plans (ICDPs) reviewed in the introductory chapter. Such strategies, as much as they have tried to encourage local participation, have failed partly because of their administrative complexity and the difficulty in getting local communities to recognize that sustainable development requires sound resource management. Nietschmann (1991) reports that self-determination may be the missing link.

The Ralco National Reserve and Lanin National Park were created without consulting the Araucano communities who live in and use the resources of these protected areas. Over the years there have been land-tenure conflicts. Resolution of these conflicts and efforts to address the problems facing these communities currently focus on incorporating the Araucanos into plans for the protected areas. None has considered the possibility of incorporating the protected areas into the plans of the communities. In Ralco Lepoy this would involve legal recognition of territorial rights and making arrangements for community residents to assume the local functions and duties of CONAF. Likewise, in Aigo this would involve legal recognition of territorial rights and making provisions for the community to incur the responsibilities of the Administración de Parques Nacionales for part of Lanin National Park. This would strengthen self-determination.

Environmental education would likely help community residents to recognize that conservation is an integral part of sustainable development. Strengthening self-determination might also facilitate this goal. Legal recognition of territorial rights might not only provide sufficient space and security to allow the Araucanos to use resources in a way which is not as degrading to the environment, but it might also foment or renew a commitment to environmental stewardship. One of the findings in this case study suggests that an active quest for self-determination in Ralco Lepoy may be related to the community's interest in protecting araucaria in particular and the environment in general. Strengthening self-determination in Ralco Lepoy may reinforce this interest. In Aigo strengthening self-determination may help to arouse and later solidify this interest.

The concept outlined above involves strengthening self-determination and then working with the Araucanos to define the goals and objectives of the protected area. Once legal rights to resources are obtained and assuming that the benefits of conservation are recognized and reinforced in this process, community residents would ideally be

trained as protected area staff and administrators. This might fortify local organizations and institutions, and ultimately give the communities more leverage in conflict negotiation. This approach may truly strengthen locally based participation and offers interesting possibilities of decentralizing conservation efforts to the community level. It is also consistent with rupturing the core-periphery relationships which have fostered and maintained conflicts over access to resources.

In Ralco Lepoy strengthening self-determination would require the transfer of the Ralco National Reserve to the community. It is assumed that such a proposal would be met with considerable reluctance by the Chilean authorities. However, public lands adjacent to the Cañi Forest Reserve were ceded for incorporation into this private protected area. This may serve as a precedent for ceding the Ralco National Reserve to the residents of Ralco Lepoy, who have asserted their rights to this territory for over a century. Additional action could involve the purchase of the El Peleco sector (from the Fundo Barco) by the Chilean government or international organizations and subsequent transfer to Ralco Lepoy.

Precedent to resolve the ambiguous land-tenure situation and strengthen self-determination in Aigo already exists. In the southern part of Lanin National Park, territory was recently ceded to the Araucano community of Curruhuinca (Osídala et al. 1992). Also, the transfer of Pulmari in 1988 from the Argentine Army to the Corporación Interestadual Pulmari would seemingly facilitate ceding some of this land to the residents of Aigo.

The creation and objectives of the Miskito Coast Protected Area (MCPA) were reviewed in the introductory chapter. The MCPA represents an authentic grassroots effort which has reconciled indigenous territorial rights and environmental conservation. The findings from this case study suggest that there are possibilities for similar projects in Ralco Lepoy and Aigo, especially in the former community, where there is significant

interest in promoting conservation. Protected areas which incorporate indigenous self-determination as an underlying principle, and define resource ownership and use rights at the outset, might encourage the concept of sound environmental stewardship and provide the Araucanos with power in negotiating management plans and conservation strategies.

Resolving ambiguous land-tenure situations by strengthening self-determination, working with the Araucanos as equals in the conservation planning process, and ensuring their participation in the day-to-day affairs of the protected areas do not represent a foolproof way of ensuring sound ecosystems. Perhaps the Araucanos would prefer to sell off their resources. This has happened in the community of El Naranjo near Quinquén in Chile, and residents of Quepuca Ralco are commercially exploiting the native forest in their *invernada*. By no means do the Araucanos live up to the strictly European conceit of the "noble savage" as perfect stewards of the environment. However, given the indication that an active claim for self-determination may be related to a heightened environmental consciousness, creating protected areas based on the foundations of self-determination is an alternative worth trying.

AN AGENDA FOR FURTHER RESEARCH

The survey instruments used in this case study cover a broad range of questions. This strategy was intentional because relatively little information was available before going into the field. Many different issues were identified through the interviews and field observations, making the possibilities for further inquiry numerous. Subsequent research would likely focus on narrower topics.

The most direct and related research which might result from this thesis was suggested in the previous chapter. It would involve assessing the territorial claims of other Araucano communities in the area and assessing their interest in protecting *araucaria* and promoting environmental conservation.

The possibilities for biogeographical research are considerable. One involves investigating the ecological impact of grazing in Ralco Lepoy and Aigo. Another possibility relates to the pressure on fuelwood resources. Both topics appear regularly in the literature on the two communities, but have yet to be investigated in a systematic fashion. The relationship between piñon collection and the regeneration of araucaria is another biogeographical topic worthy of investigation.

There are a host of other research possibilities that may eventually trace their origin to work done for this thesis. These include: the economic value of non-timber forest products in the southern Andes; the effectiveness of national park legislation in Chile and Argentina; community forestry projects; and market possibilities for piñones. Finally, the extent and condition of araucaria forests on indigenous lands needs to be mapped and compared with the situation for private and public lands.

SURVEY INSTRUMENT FOR RALCO LEPOY

- 1) ¿Cómo se usa el pino araucaria?
- 2) ¿Cuándo se recolectan los piñones?
- 3) ¿Cuántas veces por año se recolectan los piñones?
- 4) ¿Dónde se recolectan los piñones?
- 5) Desde su domicilio, ¿cuánto tiempo se demora para llegar allí?
- 6) ¿Cómo se llega allí?
- 7) ¿Cómo se recolectan los piñones?
- 8) ¿Cuánto tiempo se demora para recolectar los piñones?
- 9) ¿Cuántos sacos o kilos se recolectan en una temporada?
- 10) ¿Quién recolecta los piñones?
- 11) ¿Qué hace usted con los piñones?
- 12) ¿Usted vende los piñones?
 - 12A) ¿A quién se los vende?
 - 12B) ¿Dónde se los vende?
 - 12C) ¿Qué precio tienen?
- 13) ¿Se puede usar la madera del pino en alguna forma?
 - 13A) ¿Para qué?
- 14) ¿Usted recolecta la resina del pino?
 - 14A) ¿Para qué la usa?
 - 14B) ¿Usted la recolecta al mismo tiempo que los piñones?
- 15) ¿Es el pino importante en su vida religiosa?
 - 15A) ¿Cómo?
- 16) ¿Cómo usaban sus padres y ancestros el pino araucaria?

- 17) ¿Dónde recolectaban los piñones?
- 18) ¿Ellos usaban la misma cantidad que usted, o usaban más, o menos que usted?
- 19) ¿Han habido cambios en la manera de usar el pino araucaria durante su vida?
- 20) ¿Han habido cambios en la cantidad de frutos que ha recolectado durante su vida?
 - 20A) ¿Cuándo?
 - 20B) ¿Dónde?
- 21) ¿Usted piensa que el uso que usted le da al pino cambiará en el futuro?
 - 21A) ¿De qué manera?
- 22) Pensando en el futuro lejano, ¿usted piensa que sus hijos y nietos usarán el pino como usted lo usa hoy en día?
- 23) Razones por el cambio -- ¿hay otras también?
- 24) ¿Cómo [] ha cambiado su manera de usar el pino?
- 25) ¿De qué otras maneras le ha afectado []?
- 26) ¿Cómo se ha adaptado a estos cambios en el uso del pino?
- 27) ¿Hay algunas ventajas?
- 28) ¿Hay algunas desventajas?
- 29) En general, ¿usted ha aceptado o resistido estos cambios, o le dan igual?
 - 29A) ¿por qué?
 - 29B) Si ha resistido, ¿de qué manera ha resistido a estos cambios?
- 30) ¿Cómo usan el pino los colonos?
 - 30A) ¿Cómo le afecta a usted la manera de usar el pino que tienen los colonos?
- 31) ¿Usted cree que personas que no sean Pehuénches cortan el pino araucaria?
- 32) En su opinión, ¿los pinos son abundantes?
- 33) ¿Le parece que el pino debe ser protegido para que no lo corten?
 - 33A) Si debiera ser protegido, ¿quién lo tendría que proteger?
 - 33B) Si no debiera ser protegido, ¿por qué?

- 34) ¿Usted se preocupa por otros árboles y recursos naturales?
- 34A) ¿Cuáles?
- 34B) ¿Mucho, poco o igual?
- 35) ¿Usted consume los piñones todo el año?
- 36) ¿Qué tipo de ganado tiene?
- 36A) ¿Tiene vacas paridas?
- 37) edad
- 38) ¿Hasta qué curso alcanzó?
- 39) sexo
- 40) número de personas presentes
- 41) relación de personas presentes
- 42) dónde se realizó la entrevista
- 43) localidad/sector
- 44) nombre
- 45) número y tamaño del predio
- 45A) predio individual o común
- 45B) ¿Usted prefiere un título de dominio individual o común?
- 46) fecha de entrevista
- 47) duración de entrevista
- 48) número de entrevista
- 49) otra información

SURVEY INSTRUMENT FOR RALCO LEPOY - ENGLISH TRANSLATION

- 1) How do you use the araucaria tree?
- 2) When do you collect piñones?
- 3) How many times a year do you collect piñones?
- 4) Where do you collect piñones?
- 5) From your house how much time does it take to get there?
- 6) How do you get there?
- 7) How do you collect the piñones?
- 8) How much time does it take to collect piñones?
- 9) How many sacks or kilograms do you collect in a season?
- 10) Who collects the piñones?
- 11) What do you do with the piñones?
- 12) Do you sell piñones?
 - 12A) To whom do you sell them?
 - 12B) Where do you sell them?
 - 12C) How much do you sell them for?
- 13) Can one use the wood in any way?
 - 13A) What for?
- 14) Do you collect the resin?
 - 14A) What do you use it for?
 - 14B) Do you collect the resin at the same time you collect piñones?
- 15) Is the araucaria tree important in your religious life?
 - 15A) How?
- 16) How did your parents and ancestors use the araucaria tree?

- 17) Where did they collect piñones?
- 18) Did they use the same quantity as you do, or did they use more or less?
- 19) Have there been changes in the way in which you use araucaria during your lifetime?
- 20) Have there been changes in the quantity of piñones collected during your life?

20A) When?

20B) Where?

- 21) Do you think your use of araucaria will change in the future?

21A) In what way?

- 22) Thinking about the distant future, do you think your children and grandchildren will use the araucaria tree as you use it today?

- 23) Reasons for the changes. Are there others as well?

- 24) How has [] changed the manner in which you use the araucaria?

- 25) In what other ways has [] affected you?

- 26) How have you adapted to these changes in the use of araucaria?

- 27) Are there advantages?

- 28) Are there disadvantages?

- 29) Have you generally accepted or resisted these changes, or do they leave you indifferent?

29A) Why?

29B) If you have resisted these changes, in what ways have you done so?

- 30) How do the settlers use the araucaria tree?

30A) How does their use affect your use?

- 31) Do you think there are persons who are not Pehuenche who cut the araucaria?

- 32) In your opinion, are the araucarias abundant?

- 33) Do you think that cutting of araucaria should be prohibited?

33A) If it should be protected, who do think should protect it?

33B) If it should not be protected, why?

34) Are you concerned about other trees and natural resources?

34A) Which ones?

34B) Are you more concerned, less concerned, or equally concerned?

35) Do you consume piñones all year round?

36) What type of livestock do you have?

36A) Do you have pregnant cows?

37) age

38) What grade did you reach at school?

39) sex

40) number of persons present

41) relation of persons present

42) where the interview took place

43) location/sector

44) name

45) number and size of parcel

45A) individual or shared title

45B) Do you prefer an individual or collective land title?

46) date

47) length of interview

48) interview number

49) other information

SURVEY INSTRUMENT FOR AIGO

- 1) ¿Cómo se usa el pino araucaria?
- 2) ¿Cuándo se recolectan los piñones?
- 3) ¿Cuántas veces por año se recolectan los piñones?
- 4) ¿Dónde se recolectan los piñones?
- 5) Desde su domicilio, ¿cuánto tiempo se demora para llegar allí?
- 6) ¿Cómo se llega allí?
- 7) ¿Cómo se recolectan los piñones?
- 8) ¿Cuánto tiempo pasa en una temporada recolectando los piñones?
- 9) ¿Cuántos sacos o kilos se recolectan en una temporada?
- 10) ¿Quién se dedica a recolectar los piñones?
- 11) ¿Qué hace usted con los piñones?
- 12) ¿Usted vende los piñones?
 - 12A) ¿A quién se los vende?
 - 12B) ¿Dónde se los vende?
 - 12C) ¿Qué precio tienen?
- 13) ¿Usted usa la madera del pino en alguna forma?
 - 13A) ¿La usa como leña?
 - 13A1) ¿Cómo usted saca la leña?
 - 13A2) ¿De dónde usted saca la leña?
 - 13A3) ¿Usted vende la leña o es por uso personal?
 - 13B) ¿De qué otra forma usa usted la madera?
 - 13B1) ¿Cómo la saca?
 - 13B2) ¿De dónde la saca?

13B3) ¿Usted vende esta madera?

13C) ¿Usted usa la madera verde en alguna forma?

13C1) ¿Para qué la usa?

13C2) ¿Cómo la saca?

13C3) ¿De dónde la saca?

13C4) ¿Usted vende esta madera?

14) ¿Usted recolecta la resina del pino?

14A) ¿Para qué la usa?

14B) ¿Usted la recolecta al mismo tiempo que los piñones?

15) ¿Es el pino importante en su vida religiosa?

15A) ¿Cómo?

16) ¿Cómo usaban sus padres y ancestros el pino araucaria?

17) ¿Dónde recolectaban los piñones?

18) ¿Ellos usaban la misma cantidad de piñones que usted, o usaban más, o menos que usted?

19) ¿Dónde buscaban leña?

20) ¿Ellos usaban la misma cantidad de leña que usted, o usaban más, o menos que usted?

21) ¿Dónde buscaban madera?

22) ¿Ellos usaban la misma cantidad de madera que usted, o usaban más, o menos que usted?

23) ¿Han habido cambios en la manera de usar el pino araucaria durante su vida?

24) ¿Han habido cambios en la cantidad de frutos que ha recolectado durante su vida?

24A) ¿Cuándo?

24B) ¿Dónde?

25) ¿Han habido cambios en la cantidad de leña que se ha recolectado durante su vida?

25A) ¿Cuándo?

25B) ¿Dónde?

26) ¿Han habido cambios en la cantidad de madera que se ha recolectado durante su vida?

26A) ¿Cuándo?

26B) ¿Dónde?

27) ¿Usted piensa que el uso que usted le da al pino cambiará en el futuro?

27A) ¿De qué manera?

28) Pensando en el futuro lejano, ¿usted piensa que sus hijos y nietos usarán el pino como usted lo usa hoy en día?

29) Razones por el cambio -- ¿hay otras también?

30) ¿Cómo [] ha cambiado su manera de usar el pino?

31) ¿De qué otras maneras le ha afectado []?

32) ¿Cómo se ha adaptado a estos cambios en el uso del pino?

33) ¿Hay algunas ventajas?

34) ¿Hay algunas desventajas?

35) En general, ¿usted ha aceptado o resistido estos cambios, o le dan igual?

35A) ¿por qué?

35B) Si ha resistido, ¿de qué manera ha resistido a estos cambios?

36) ¿Cómo usan el pino los huincas?

36A) ¿Cómo le afecta a usted la manera de usar el pino que tienen los huincas?

37) ¿Usted cree que hay personas que cortan los pinos vivos?

37A) ¿Dónde?

38) En su opinión, ¿los pinos son abundantes?

39) ¿Le parece que el pino debe ser protegido para que no lo corten?

39A) ¿Quién se hace cargo de proteger el pino?

39B) ¿Le parece bien o mal que sea un guardaparque?

39C) ¿La comunidad misma cuida o no cuida bien el pino?

39C1) Entonces, ¿por qué tener un guardaparque?

- 39D) Si no debiera ser protegido, ¿por qué?
- 40) ¿Usted se preocupa por otros árboles y recursos naturales?
- 40A) ¿Cuáles?
- 40B) ¿Mucho, poco o igual?
- 41) ¿Cuánto ganado tiene?
- 42) ¿Usted cobra un sueldo fijo por algún trabajo que hace?
- 43) edad
- 44) ¿Usted fue a la escuela? ¿Hasta qué grado?
- 45) ¿Su invernada queda adentro o afuera del parque?
- 46) Si tiene veranada, ¿queda adentro o afuera del parque?
- 47) sexo
- 48) número de personas presentes
- 49) relación de personas presentes
- 50) dónde se realizó la entrevista
- 51) nombre
- 52) fecha de entrevista
- 53) duración de entrevista
- 54) número de entrevista
- 55) otra información

SURVEY INSTRUMENT FOR AIGO -- ENGLISH TRANSLATION

- 1) How do you use the araucaria tree?
- 2) When do you collect piñones?
- 3) How many times a year do you collect piñones?
- 4) Where do you collect piñones?
- 5) From your house how much time does it take to get there?
- 6) How do you get there?
- 7) How do you collect the piñones?
- 8) How much time do you spend in a season collecting piñones?
- 9) How many sacks or kilograms do you collect in a season?
- 10) Who collects the piñones?
- 11) What do you do with the piñones?
- 12) Do you sell the piñones?
 - 12A) To whom do you sell them?
 - 12B) Where do you sell them?
 - 12C) How much do you sell them for?
- 13) Do you use the wood in any way?
 - 13A) Do you use it as firewood?
 - 13A1) How do you get the firewood?
 - 13A2) Where do you get it from?
 - 13A3) Do you sell it, or is the firewood for personal use only?
 - 13B) In what other ways do you use araucaria wood?
 - 13B1) How do you get this wood?
 - 13B2) Where do you get it from?

13B3) Do you sell this wood?

13C) Do you use green wood in any way?

13C1) What do you use it for?

13C2) How do you get this wood?

13C3) Where do you get it from?

13C4) Do you sell this wood?

14) Do you collect the resin?

14A) What do you use it for?

14B) Do you collect the resin at the same time you collect piñones?

15) Is the araucaria tree important in your religious life?

15A) How?

16) How did your parents and ancestors use the araucaria tree?

17) Where did they collect piñones?

18) Did they use the same quantity of piñones as you do, or did they use more or less?

19) Where did they collect firewood?

20) Did they use the same quantity of firewood as you do, or did they use more or less?

21) Where did they collect wood?

22) Did they use the same quantity of wood as you do, or did they use more or less?

23) Have there been changes in the way in which you use araucaria during your lifetime?

24) Have there been changes in the quantity of piñones collected during your life?

24A) When?

24B) Where?

25) Have there been changes in the quantity of firewood collected during your life?

25A) When?

25B) Where?

26) Have there been changes in the quantity of wood collected during your life?

26A) When?

26B) Where?

27) Do you think your use of araucaria will change in the future?

27A) In what way?

28) Thinking about the distant future, do you think your children and grandchildren will use the araucaria tree as you use it today?

29) Reasons for the changes -- Are there others as well?

30) How has [] changed the manner in which you use the araucaria?

31) In what other ways has [] affected you?

32) How have you adapted to these changes in the use of araucaria?

33) Are there advantages?

34) Are there disadvantages?

35) Have you generally accepted or resisted these changes, or do they leave you indifferent?

35A) Why?

35B) If you have resisted these changes, in what ways have you do so?

36) How do the settlers use the araucaria tree?

36A) How does their use affect your use?

37) Do you think there are persons who cut live araucarias?

37A) Where?

38) In your opinion, are the araucarias abundant?

39) Do you think that the cutting of araucaria should be prohibited?

39A) Who is in charge of protecting it?

39B) Do you think it is good or bad to have a ranger?

39C) Does the community itself look after the araucaria?

39C1) Then why have a ranger?

39D) If araucaria should not be protected, why?

40) Are you concerned about other trees and natural resources?

40A) Which ones?

40B) Are you more concerned, less concerned, or equally concerned?

41) How many livestock do you have?

42) Do you have salaried and regular employment?

43) age

44) Did you go to school? Until what grade?

45) Is your winter house inside or outside the park?

46) If you have a summer house, is it inside or outside the park?

47) sex

48) number of persons present

49) relation of persons present

50) where the interview took place

51) name

52) date

53) length of interview

54) interview number

55) other information

PHOTOGRAPH OF JUVENILE (YOUNG ADULT) ARAUCARIA



PHOTOGRAPH OF MATURE (ADULT) ARAUCARIAS



PHOTOGRAPH OF FEMININE ARAUCARIA CONE



PHOTOGRAPH OF ARAUCARIA SEEDS



PHOTOGRAPH DEPICTING A LIMITATION OF SINGLE-SPECIES PROTECTION



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