

## WAITING FOR THE FOREST LAW: Resource-Led Development and Environmental Politics in Chile\*

*Roger Alex Clapp*  
*University of Toronto*

Chile has gained a reputation as the Latin American economic success story of the 1990s. Domestic savings rates are high, foreign investment continues to expand, inflation remains single-digit, and economic growth has averaged 6 percent annually from 1984 to 1995. In the seven years of democratic government since 1989, the poor have begun to share some of the benefits of this growth. From 1989 to 1993, unemployment fell from 12.2 percent to 4.9 percent, and social expenditures increased by a third in real terms (Hojman 1995). But Chile's impressive recent record of sustained economic development coupled with improvements in social justice has incurred significant environmental costs that raise doubts about the ecological sustainability of the Chilean model (Meller, O'Ryan, and Solimano 1996).

The country's economic growth has been led by exports of natural resources. But its continued dependence on resource industries poses a special threat to endangered native ecosystems, especially the Valdivian rain forest. This article will explore the past and likely future impacts of resource-led development on four forest ecosystems in Los Lagos, the Chilean Lake Region. Each forest type presents a different species composition and a different management dilemma. One forest ecosystem offers sustainable economic opportunities. The other three have little economic potential but are irreplaceable biological and cultural resources. The danger is that these three forests will be judged solely on their contribution to resource exports and that narrow economic interests will obtain tacit approval for the destruction of what may be Chile's greatest intangible asset.

The relationship between resource exports and the period of rapid growth in Chile is striking. Total exports doubled in value between 1987

\* I am grateful to Carolyn Crook, Joe McBride, Jim Parsons, Dick Walker, and Michael Watts for their helpful comments. I also thank three anonymous *LARR* referees, whose careful reading and suggestions have substantially improved this study. Remaining errors of fact and interpretation are my responsibility. This article draws on dissertation research funded by the Inter-American Foundation and the Institute for the Study of World Politics, whose support is gratefully acknowledged.

and 1994, while forestry exports nearly tripled (INFOR 1994). In 1994 mining (especially copper mining) generated 44 percent of Chile's export earnings, but that figure represents a decline from 85 percent in 1970 (Meller, O'Ryan, and Solimano 1996). Copper is no longer the country's only export staple and may soon be one of four. Since the military government first adopted export-led development as a strategy in 1975, fruit, fish, and especially forest products have expanded at least tenfold. Former Treasury Secretary Alejandro Foxley, when complimented on Chile's economic success, credited the country's natural resources for its success.<sup>1</sup> But Foxley is too modest. Chile's most successful resource exports are crops, not wild stocks. Natural forests and fisheries have been declining for many years, and industry has replaced them with exotic species, introduced trees and fish that can exploit Chile's natural environmental advantages. Irrigated orchards and vineyards supply Chilean fruit exports, aquaculture provides Chilean salmon exports, and timber plantations have supplied a rapidly growing softwood lumber and pulp industry. An activist government played a large role in generating those industries. Decreto Ley 701, the Forest Law of 1974, provided public subsidies for three-quarters of the costs of planting and tending trees. It has been credited with generating an internationally competitive forest industry (Wisecarver and Tardones 1989; Clapp 1995a) but also criticized for its effects on the rural population and native forest ecosystems (Cruz and Rivera 1983; Cavieres et al. 1986; Lara and Veblen 1993; Clapp 1995b).

Foxley's reply nevertheless reflects current consensus among the Chilean business and political elites that the country's economic growth depends on continuing and expanding resource exports, not on diversifying away from them. Chile has captured some forward linkages in the processing of its resources, but its greatest success in world markets continues to be as a supplier of minimally processed resource commodities that have little value added (Gwynne 1993). Continued economic expansion is held to depend on the extension of extraction to every conceivable natural resource. The Chilean forestry debate is dominated by economism and developmentalism—the ideas that material incentives and economic values ultimately determine human action and that the country is too poor not to make each natural resource yield its fullest economic potential.<sup>2</sup> According to this perspective, conservation means not preservation but the intensification of resource exploitation because only a sustainably profitable

1. *Moneyline*, Cable News Network, 10 Jan. 1993.

2. The economism of resource managers is the legacy of the military's team of economic advisors. Most were neoliberal economists trained under Milton Friedman and Friedrich von Hayek at the University of Chicago. Nicknamed "the Chicago Boys" by supporters and opponents alike, they and their policies have been studied by many (e.g., Whitehead 1986). The Chicago Boys imposed monetarist measures in finance and stripped away the industrial policies accumulated over forty years of import substitution, proposing that the market

resource industry can guarantee maintenance of that resource. According to this perspective, without the incentive of profit from management, the resource will be degraded or replaced entirely by economic man (e.g., Hartwig 1991). If a forest ecosystem cannot be made to produce a profit, it will be replaced by a plantation that will.

Such is the shared ideology of a growth coalition of business leaders, government, professionals, and labor unions, all of whom support proposals for intensive use of Chilean native forests to produce hardwood chips for export. They have welcomed the chip market as a chance to make money from a resource that has been marginal since plantation-grown pine replaced native lumber in the 1950s. The first shipments of chips were exported in 1987, and since 1990, wood chips have become Chile's largest timber export by volume. During the twelve-month period ending in April 1995, the volume increased at an annual rate of 40 percent (*Chile Forestal* 1995d). The boom in hardwood chips has also accelerated dramatically the clearing of the Valdivian rain forest.

The visible effects of chip exports have generated growing environmentalist opposition that threatens to undermine the consensus in favor of resource-led development. Since 1990, a broad national debate has been taking place over the successor to the forest law of 1974—and ultimately the future of the native forest. Many proposals for a native forest law have been circulated, but none has yet emerged. Instead, the Proyecto de Ley de Bosque Nativo has become an omnibus bill. It is expected to establish policy on issues ranging from biological diversity and old-growth forests to public subsidies for forest management and substitution of exotic species. Originally expected in 1994, the new law has been frozen in the legislature through 1997. The government's search for consensus appears to have failed, and the lack of consensus has turned into paralysis.

Chileans' long wait for the next forest law illustrates the obstacles to developing ecologically appropriate forest policies in resource-dependent societies. The balance between environment and development in the Lake Region hinges on the application of concepts of sustainability to Chile's unique forest ecosystems. Environmentalists and timber interests have offered radically different proposals, both of them justified as forms of sustainable development. The mantle of sustainable development is popular because it promises to reconcile ecological and economic priorities (Adams 1995; Lelé 1991). But although it has been claimed by groups all along the political spectrum, no reconciliation has taken place. Sus-

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should determine which industries thrived and which died. But the resource sectors were not subjected to as stern a test. Adhering to traditional notions that Latin America's comparative advantage lay in resources (see Cardoso and Faletto 1979), the military expected that commodity exports would replace manufacturing as the engine of growth. Thus Chilean developmentalism also springs from resource-subsidy policies that preceded the Chicago Boys and were left in place (Clapp 1995a).

tainable development in Chile has been invoked to justify the conversion of old-growth forests to tree farms (Hartwig 1991) and to oppose any forest clearing at all.<sup>3</sup> The underlying disagreement is over what is to be sustained: timber production, corporate profits, employment levels, ecosystems, or rural communities? Each of the five priorities has its partisans in current Chilean debates, but none has yet prevailed. Chilean forest policy is stalemated, and in the absence of a definitive new law, the status quo drags on. Forest is being cleared rapidly in the Lake Region and may lead to widespread replacement of the native forest by exotic plantations.

This article will review the Valdivian rain forest and four of its main forest types, distinguishing among the four conservation issues they present: endangered species protection, value-added manufacturing, substitution by exotic plantations, and the fate of the remaining old-growth forests. I will conclude by considering the delay in passing a new forest law and its implications for Chile's temperate rain forests. As long as Chileans recognize only the economic values of their forests, development seems likely to be dominated by resource depletion, ecosystem degradation, and exotic replacement.

#### THE VALDIVIAN RAIN FOREST

This remnant of a tropical forest in a nontropical zone comprises many species whose physiognomies reflect their evolution under warmer conditions (Hueck 1978). As the South American continent became cooler and drier during the Quaternary period, the mild and rainy climate of the Lake Region served as a refuge for species from the more widespread tropical forests of the Tertiary (Ramírez 1987). The biological diversity of the forest reaches its peak in the Lake Region, a temperate marine climate ideal for tree growth. Rainfall is abundant in all seasons and heaviest in the winter. Temperatures are cool year-round, but frost is never severe.

Most species are evergreen hardwoods. Nine coniferous species are restricted to marginal environments or to the understory of the rain forest.<sup>4</sup> The understory is complex: ferns, mosses, and bamboos cover the forest floor, while lichens, epiphytes, and seventeen varieties of red-flowering vines cover the tree branches (Hoffmann 1991). The structural complexity of the Valdivian understory impressed Charles Darwin in the 1830s: "The wood is so intricate that a person who has never seen it will not be able to

3. Adriana Hoffman, "Astillas ¡No!" *El Mercurio*, 11 Oct. 1995.

4. The Chilean araucaria (*Araucaria araucana*) and incense cedar (*Austrocedrus chilensis*) colonize dry rocky spots. The Guaitecas cypress (*Pilgerodendron uvifera*), the rare dwarf cypress (*Dacrydium fonckii*), and the alerce (*Fitzroya cupressoides*) grow in superhumid environments, particularly the acidic bogs of the rain forest. The four Podocarpus species grow as isolated constituents of old-growth forests, where their seeds are consumed by birds. Scattered throughout mountain forests, they grow as shade-tolerant individuals in the understory.

imagine such a confused mass of dead and dying trunks. I am sure often-times for quarter of an hour our feet never touched the ground, being generally from 10 to 20 feet above it; at other times, like foxes, one after the other we crept on our hands and knees under the rotten trunks. [The trees] were matted together by Bamboos or Canes. Here our party were more like fish struggling in a net than any other animal" (Darwin 1888).

Mapping the different forests within the region is notoriously difficult. At least twenty-seven different evergreen tree species grow within the Valdivian rain forest. Individual species vary in their ability to adapt to disturbance,<sup>5</sup> particularly in the spectrum of shade-tolerance (see table 1). The rain forest has little natural resistance to fire, most species having thin bark and low drought-tolerance. Consequently, large areas have been scarred by fires of human origin (Pérez Rosales 1882; C. Donoso 1983). Indicator species show a gradual shift from the sclerophyll forests of central Chile to the full-fledged rain forest of the Lake Region to the south (Hueck 1978; Quintanilla 1983). The *evergreen rain forest* is a catchall term for a mix of associations, or combinations of dominant and secondary tree species. They have been categorized differently by various authors: Veblen and Schlegel (1982) identified sixteen associations, while Ramírez and Figueroa (1987) found twenty-three.<sup>6</sup> But the gradations between different types are so imperceptible that Claudio Donoso (1989) concluded that the different associations are more arbitrary than helpful and calls them simply "evergreen."

European colonization of this region of Chile began in the 1840s and spread quickly through the lowlands during the later nineteenth century. The central valley is now an entirely humanized landscape, with only small patches of native forest maintained as woodlots. Four major forest types remain in the Andes and the coastal range (see figure 1),<sup>7</sup> all of them substantially affected by human intervention. First, the alerce has disappeared from much of its original range, although the remaining old-growth alerces have been afforded legal protection. Second, the deciduous

5. Regeneration is often unpredictable in that many species produce abundant seed only infrequently. For the coigüe, canelo, melí, and olivillo, annual seed production can vary by a factor of ten (C. Donoso 1989).

6. For many years, Chilean authors distinguished the evergreen forests of Chiloé from the Valdivian rain forest of the mainland (e.g., Yudelevich et al. 1967) because of its distinctive variety of coigüe (*Nothofagus nitida*) and concentrations of canelo (*Drimys winteri*). But both species are also found in the Valdivian forest. Quintanilla (1983) distinguished belts of ulmo-olivillo, ulmo-tineo, coigüe-tineo-mañío, and tepa-tineo, differentiated by altitude and exposure to the prevailing westerly winds. Ramírez and Figueroa (1987) developed a statistical measure of floristic affinity delimiting forests of olivillo, coigüe-ulmo, arrayan, and tepa-tineo within the evergreen forest.

7. Many authors have mapped or zoned the forests (Oberdorfer 1960; Yudelevich et al. 1967; Veblen and Schlegel 1982; Quintanilla 1983; C. Donoso 1983; Ramírez and Figueroa 1987). A national forest survey based on aerial photos was undertaken in 1996. When published, it will be the authoritative source.



TABLE 1. Evergreen Trees of the Valdivian Rainforest

Family and Species	Common Name	Range in Latitude	Shade Tolerance	Main Use	Price <sup>a</sup>
<b>Nothofagaceae</b>					
<i>Nothofagus dombeyi</i>	coigüe	35–45°S	pioneer	hardwood	170
<i>Nothofagus nitida</i>	coigüe de Chiloé	39–48°S	medium	hardwood	
<i>Nothofagus betuloides</i>	coigüe de Magallanes	40–56°S	medium	hardwood	
<b>Proteaceae</b>					
<i>Embothrium coccineum</i>	notro, ciruelillo	35–56°S	pioneer	cabinetry <sup>b</sup>	
<i>Gevuina avellana</i>	avellano	33–45°S	medium	cabinetry <sup>b</sup>	
<i>Lomatia dentata</i>	piñol	34–44°S	shade-tolerant		
<i>Lomatia ferruginea</i>	fuique	35–54°S	understory		
<i>Lomatia hirsuta</i>	radal	30–44°S	pioneer	cabinetry <sup>b</sup>	
<b>Podocarpaceae</b>					
<i>Podocarpus nubigena</i>	mañío macho	39–48°S	understory	softwood	188
<i>Podocarpus saligna</i>	mañío de hojas largas	35–44°S	medium	softwood	188
<i>Prumnopitys andina</i>	lleuque	35–46°S	shade-tolerant	softwood	188
<i>Saxegothea conspicua</i>	mañío de hojas cortas	35–46°S	shade-tolerant	softwood	188
<b>Cupressaceae</b>					
<i>Fitzroya cupressoides</i>	alerce	39–43°S	shade-intolerant	protected	446
<i>Pilgerodendron uviferum</i>	ciprés de las guaitecas	40–56°S	shade-intolerant		
<b>Monimiaceae</b>					
<i>Laurelia philippiana</i>	tepa	37–47°S	shade-tolerant	hardwood	221
<i>Laurelia sempervirens</i>	laurel	35–42°S	medium	hardwood	271
<b>Cunoniaceae</b>					
<i>Weinmannia trichosperma</i>	tineo	35–47°S	pioneer	veneer	
<i>Caldcluvia paniculata</i>	tiaca	36–46°S	medium		
<b>Myrtaceae</b>					
<i>Amomyrtus luma</i>	luma	37–48°S	understory	fruit	
<i>Amomyrtus meli</i>	meli	39–44°S	understory	fruit	
<i>Blepharocalyx cruckshanksii</i>	temu	34–44°S	understory		
<i>Luma apiculata</i>	arrayan	34–44°S	understory	ornamental	
<i>Myrceugenia exsucca</i>	pitra	32–44°S	understory		
<b>Aextoxicaceae</b>					
<i>Aextoxicon punctatum</i>	olivillo	35–43°S	extremely tolerant	fuel	275

TABLE 1. *Evergreen Trees of the Valdivian Rainforest (continued)*

Family and Species	Common Name	Range in Latitude	Shade Tolerance	Main Use	Price <sup>a</sup>
Eucryphiaceae					
<i>Eucryphia cordifolia</i>	ulmo	37–44°S	medium	fuel	171
Lauraceae					
<i>Persea lingue</i>	lingue	33–41°S	shade-tolerant	cabinetry <sup>b</sup>	
Compositae					
<i>Dasyphyllum diacanthoides</i>	trevo	35–44°S	shade-tolerant		
Winteraceae					
<i>Drimys winteri</i>	canelo	30–56°S	medium	medicine	

Sources: Adriana Hoffman, *Flora silvestre de Chile: Zona Araucana* (Santiago: Fundación Claudio Gay, 1991); Claudio Donoso, "Antecedentes básicos para la silvicultura del tipo forestal siempreverde," *Bosque* 10, no. 1 (1989): 37–53; Juan Díaz-Vaz et al., *Maderas comerciales de Chile* (Valdivia: Marisa Cuneo, 1989); and INFOR, *Estadísticas Forestales 1993*, Boletín Estadístico no. 17 (Santiago: Instituto Forestal, 1993).

<sup>a</sup> Price data are listed for FOB (in U.S. dollars) per cubic meter of sawn lumber for 1992. If INFOR (1993) lists multiple quality grades, the price is for the highest grade. For purposes of comparison, raulí sold for \$554 per cubic meter in 1992; plantation-grown pine sold for \$133. The lumber markets do not distinguish between the various species of coigüe and mañío. The absence of a price suggests that the available volume of that species is so low that INFOR (1993) could not find enough data to establish a price.

<sup>b</sup> Denotes a species that provides high-quality wood but in volumes so low that industrial use is currently impossible.

southern beech forests have been heavily logged. While no old-growth stands remain, the southern beech forests offer the greatest potential for sustainable forest development. Second-growth stands will soon mature in quantities sufficient to support a growth industry based on value-added manufacturing. Third, the coastal evergreen rain forest has been stripped of its high-quality lumber. It is ecologically largely intact but economically degraded and is threatened with replacement by eucalyptus plantations. Finally, the Valdivian rain forest in the Andes and the fjords, which contains most of Chile's remaining ancient forests, is under intense pressure from the hardwood chip industry. Each forest type has its own distinctive ecology and history of human use and requires specially tailored policy prescriptions. But in Chile today, forest ecology is inseparably bound up with resource politics. Ecological lessons from one forest are applied indiscriminately to all forests and appropriated to justify unsustainable policies in political debate. Each forest type will be considered in turn.

#### *The Alerce Forests: Endangered Species and Ecosystem Preservation*

The alerce (*Fitzroya cupressoides*) once dominated large areas of southern Chile. It now survives under government protection in only a

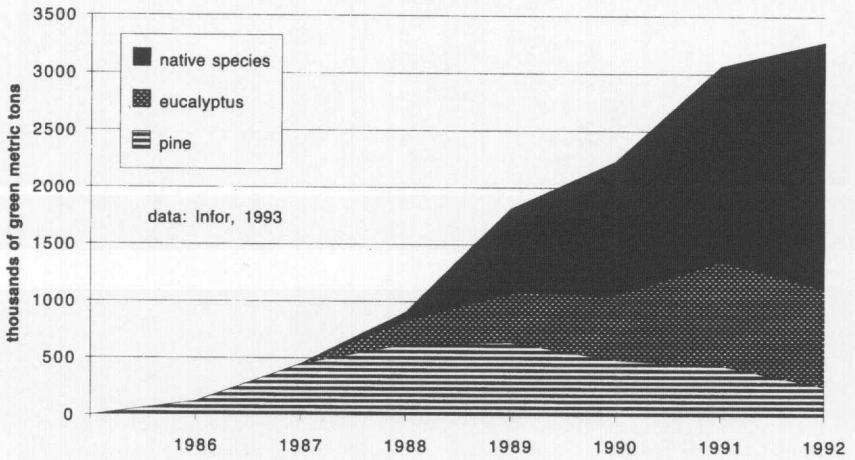


FIGURE 1 Chip Exports by Species, 1985–1992

few isolated highlands. Before human impact, longevity, not adaptability, was the alerce's natural advantage. Its reddish bark is thin and papery, making it vulnerable to fire, and its seedlings require abundant light and water to grow. The alerce's evolutionary strategy has been to outlast competitors, awaiting a disturbance that will create the bare mineral soil in which it can grow without competition (Veblen and Ashton 1982). The oldest documented alerce, in the Parque Nacional Alerce Andino, southeast of Puerto Montt, has survived for forty-two hundred years (*Chile Forestal* 1991a). Alerce forests are thus by definition old-growth forests. Young alerces are very rare. I have seen only two, both growing in rock and gravel exposed by a landslide.

Alerces once extended from Valdivia south to central Chiloé in the coastal range, and from Puyehue Volcano in the Andes south to Corcovado Volcano. Alerces were also found in the swamps of the central valley between Puerto Varas and Puerto Montt and in a few Andean rain forests in Argentina. Many alerce forests are dominated by standing snags bleached from long exposure to the elements. Dead alerces may outnumber living ones even in an undisturbed forest. Most disturbed forests remain only as stands of skeletons because logging and fires of human origin have killed the seed sources that could permit regeneration in much of the alerce's range.<sup>8</sup> This tree survives only in national parks and in isolated highlands above the fjords.

8. Fire and extraction of alerce timber quickly reduced the stocks of standing wood. The fires of 1863, set to clear the forest during a brief drought, left miles of dead alerce between Puerto Varas and Puerto Montt. The stumps have long since been converted to shingles, and no low-



The scarcity of the alerce stems in part from its slow regeneration. An alerce rarely grows more than three centimeters a year, although over centuries, some specimens have reached fifty meters in height and four in width.<sup>9</sup> Only in recent years have Chileans agreed that the alerce's slow regeneration makes it a nonrenewable resource, at least not in a human lifetime. The designation of national parks in Los Alerzales in the coastal range south of Valdivia and the Alerce Andino in the Andes southeast of Puerto Montt protected some of the remaining stands, but cutting continued throughout the 1960s, especially on the Contao Peninsula south of Reloncaví Fjord. Finally in 1976, the military government declared the species a national monument, prohibiting the cutting of standing alerces, dead or alive. Fallen logs, which do not rot, may be cut up for wood.

Debate continues over the effectiveness of such protection. The exception granted to cutting wood from fallen logs makes enforcement difficult because the market and its regulators cannot distinguish shingles cut from fallen logs and those cut from living trees. Only loggers caught in the act of felling a tree can be punished. Illegal cutting of alerce continues on a small scale in the fjords. Old trees are felled during the summer, and winter floods carry the trunks down the glacially steepened valley walls. The loggers return in the spring to collect the logs floating in the fjord waters. Thus in reality, the government ban prevents the large-scale destruction of the remaining stands but leaves the ecosystem of the alerce vulnerable.

An attempt to create a land reserve sufficient to guarantee protection of the ecosystem as well as the species has generated a political firestorm. Douglas Tompkins, a U.S. entrepreneur and a deep ecologist, purchased private holdings around Quintupeu and Cahuelmó Fjords, extending from the Pacific Ocean to the Argentine border. He gradually amassed 270,000 hectares in an attempt to set aside the rain forest containing the country's largest remaining unlogged stands of alerce.<sup>10</sup> Tomp-

land alerce stands remain. Loggers exhausted the accessible groves in the coastal range as early as the 1850s (C. Donoso 1983). Less accessible stands in the coastal range and the Andes were exploited from the 1930s through the 1960s, and fires spread to many unlogged forests. In the coastal range south of Valdivia, forest fires burned out of control during the summers of 1908, 1953, and 1956 (Salas 1991). The fire left the broad-leaved evergreen forests in the valleys mostly unscathed but burned many stands growing on the summit plateau, leaving behind a forest of skeletons. A 1983 survey of remaining alerce forests found that 53 percent had been burned (Schmidt and Lara 1985). Most of the burned stands show no signs of regeneration (Veblen and Ashton 1982).

9. Early chroniclers marveled at the alerce's great size. Diego Rosales reported in 1878 that one specimen required fifteen men to encircle it. His most enthusiastic comments, however, were reserved for its dusky red wood: light, fine-grained, and prized by woodcarvers. Growing in swampy conditions, this wood is almost impervious to rot. Alerce shingles were the only exports from Chiloé and Llanquihue during the early years of settlement and served as a medium of exchange in frontier Chile (Darwin 1988).

10. Jon Bowermaster, "Take This Park and Love It," *New York Times Magazine*, 3 Sept. 1995.

kins's proposed park has triggered long-standing Chilean fears that the narrow country will be cut in half by foreign interests.<sup>11</sup> A coalition of the military, the Catholic Church, and the forest industry has united in opposition to the proposed park.<sup>12</sup> Yet Tompkins's original goal of ecosystem protection is now closer to fulfillment. The Universidad Católica de Valparaíso owns 12,000 hectares in the center of Tompkins's holdings and has declined to sell the land to him or to the Chilean state, announcing that it would create an ecological park of its own.<sup>13</sup> The protected area is continuous and the ecosystem largely intact, although the jurisdiction will probably remain divided.

The relative success of the ban on cutting alerce has led to proposals to declare other species as national monuments. The government has agreed in several cases. The araucaria (*Araucaria araucana*) was the second species to receive protection, but for clearly specified reasons: it is the signature tree of Araucanía, an important tourist attraction, and the tree's nuts are essential to the subsistence of the indigenous Mapuche.<sup>14</sup> The government presented its declaration as a "gesture of consideration and respect for community" (*Chile Forestal* 1990b). In 1994 the Eduardo Frei administration gave national monument status to five rare species growing in central Chile. Capitalists in the forest sector anticipate further conservation proposals and decrees and seem prepared to fight them all the way. The Corporación de Madera (CORMA), the industry's *gremio* complains that the industry has lost confidence because its members do not know when another species will be declared a national monument.

The limits of national-monument designation as a political tactic have been established in the far south, where the government has refused

11. The military's concern was as much for symbolic reasons as for security concerns, given that the land is mountainous and inaccessible. The glaciated highlands are dissected by steep U-shaped valleys culminating in the fjords. Because the land is not suitable for an overland road, the southern highway currently bypasses the fjords with a ferry link.

12. The military perceives a physical obstacle to national unity. The Left and the Right are united in their suspicions: socialist deputy Jaime Naranjo declared it "extremely dangerous . . . to transfer enormous areas of land to foreigners" (Rivadeneira 1995). He warned darkly that Tompkins has set back the cause of conservation. But it is not just foreign ownership that has stirred opposition. Multinational forestry companies have been purchasing large areas of forest land for years. Tompkins's advocacy of zero population growth aroused opposition by the Catholic Church, which has been joined by the military and native forest industry in pressing the government to block the park.

13. "UCV creará parque ecológico en Huinay," *El Mercurio*, 26 Mar. 1996, p. 1.

14. The military government originally designated the araucaria and alerce as national monuments in 1976 but rescinded the protection of the araucaria after the Corte Suprema upheld a landowner's claim that protection constituted a taking of private property that required compensation. One of the earliest environmental policies of the democratic government was the 1990 restoration of the araucaria's protected status. See Iván Fredes, "Acción legal contra prohibición para tala de la araucaria," *El Mercurio*, 12 Nov. 1990. This decision was made possible by a combination of concerns for the ecosystem, the scenic land-

to protect the lenga (*Nothofagus pumilio*) from commercial logging. Lenga trees grow near the timberline in the frontier and lake regions. Near Cape Horn, they grow at sea level in dense single-species stands, a structure that simplifies timber extraction and forest regeneration. Harald Schmidt (1989) found that selection cutting increased wood yields tenfold in the lenga forests and that the rotation for sawmill-quality lumber could be reduced by a factor of three to a rotation of 120 years. RENACE (Red Nacional de Acción Ecológica), a coalition of environment groups, has lobbied for the lenga to be designated a national monument, but that appeal has been rejected. Loggers point out that the lenga is neither vulnerable nor endangered: the species is abundant, reasonably valuable, and regenerates well. It is in no danger of extinction, provides no special foods or secondary products, and has no unique value in indigenous or national culture.<sup>15</sup> Industrial logging of lenga began in January 1992.<sup>16</sup> In the process, candidates for national-monument status have been restricted implicitly to species that are rare and slow-growing and have special scenic or cultural value.

#### *Value Forestry and the Southern Beeches*

Chilean environmentalists have not yet succeeded in attaching such values to species as common and resilient as the southern beeches. Of the nine species in Chile, several are abundant and fast-growing. *Raulí* (*Nothofagus alpina*) offers excellent prospects for sustainable timber production without further ecological degradation. The deciduous raulí grows in single-species stands in the Andean foothills north of Puyehue Volcano (see figure 2). Smaller patches of second-growth stands appear on the leeward slopes of the coastal range.

Raulí forests provided most of the raw material for the Chilean lumber industry from the 1880s to the 1940s. Loggers selected the best old-growth raulí specimens for cutting, leaving the rest in a process that Chileans call *floreo* (high-grading). By the 1950s, the hardwood industry was in decline because high-quality wood had been exhausted. Economi-

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scape, and the resurgence of campaigns for indigenous rights. The decree cited the araucaria's designation as a "vulnerable species" and its importance as a tourist attraction in the frontier region but "fundamentally, the cultural and anthropological importance that it represents for the Araucanian people" (*Chile Forestal* 1990b).

15. As designed, the lenga projects will sustain neither employment nor wood volumes beyond thirty years. The old-growth lenga designated as production forest will be depleted within thirty years, while second-growth trees will not reach harvestable size for a century. Harvest levels have been front-loaded to guarantee initial profitability, according to Luis Otero (interviewed in Jan. 1991). The inevitable shortfall after thirty years will lead to pressure from lumber mills and unemployed loggers to open up forests currently protected for habitat.

16. *El Mercurio*, 3 Dec. 1991.

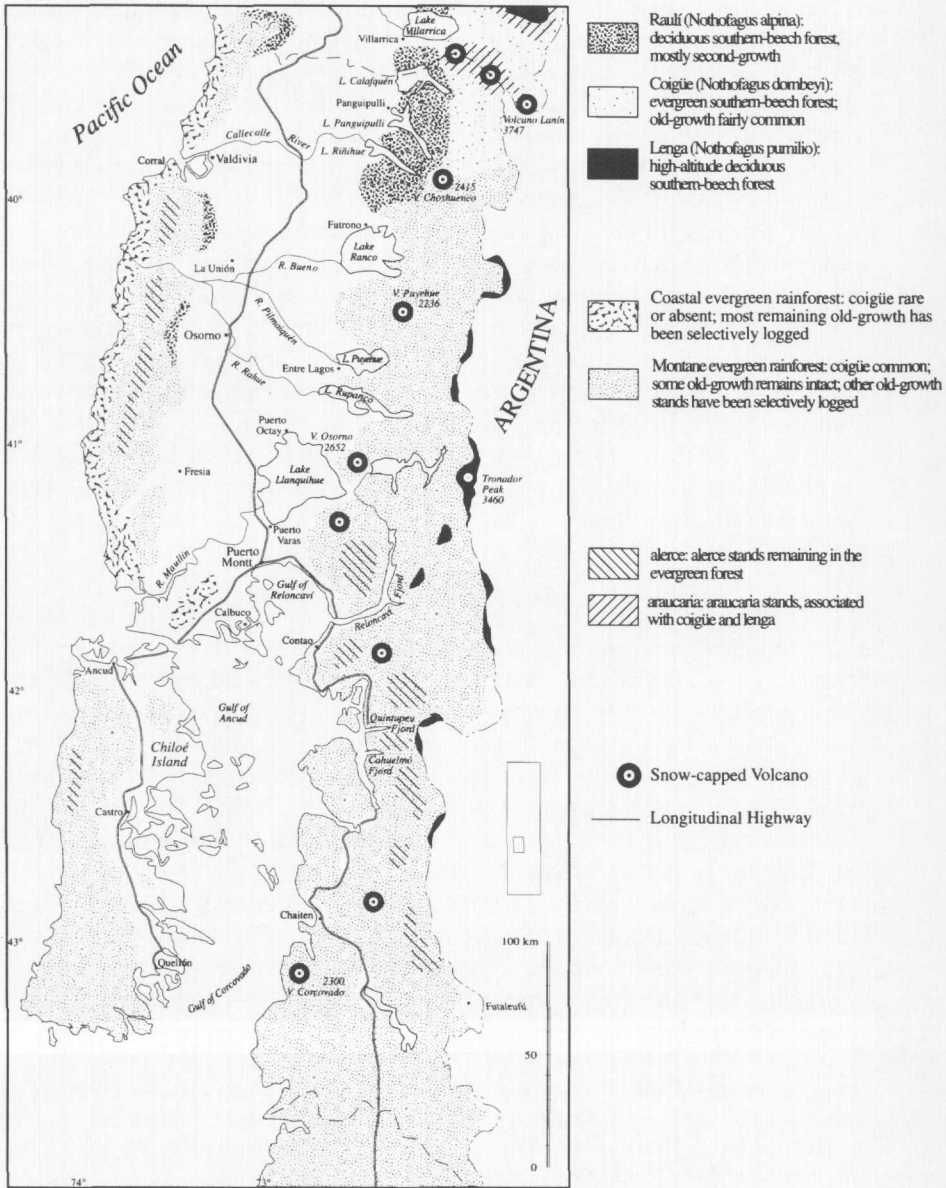


FIGURE 2 Current Forest Cover of the Chilean Lake Region

cally degraded by a century of high-grading, the native forest of the 1980s seemed an unlikely target for new investment. But the native timber industry has shown signs of rejuvenation. Corporate as well as individual landowners have begun to thin the regenerating stands in anticipation of rising prices for decorative and cabinet hardwoods (Grosse 1989).

This scenario is the appealing vision of “value forestry,” beloved of hardwood foresters everywhere. Value forestry has been presented as an industry that combines rising prices, environmentally benign harvesting, extensive forward linkages and multiplier effects, precision manufacturing, and quality control in a worldwide network linked by a system of just-in-time distribution (Leslie 1987b). Raulí fits the value-forestry scenario in both economic and ecological terms. It regenerates well in an open, partially shaded understory, making it an ideal species for continuous selective cutting, a technique that preserves much of the original environment as habitat and natural landscape. The saplings of a young raulí forest respond well to thinning, which reduces competition within dense stands. Average annual growth in the second-growth forest is between fourteen and twenty-two cubic meters per hectare, with rotations between thirty and forty years. Plantations of raulí are somewhat less productive (P. Donoso et al. 1993; Grosse 1993). Hans Grosse (1989) reported annual volume increments in managed stands near Panguipulli of thirty-one cubic meters per hectare, rivaling the yields for exotic pines and eucalyptus.

The red-orange raulí heartwood compares in form and beauty to prized furniture woods. European furniture producers, faced with declining supplies of domestic and African hardwoods (Panayotou and Ashton 1992), have become increasingly interested in Chilean hardwood. Raulí sold for 554 dollars (U.S.) per cubic meter in 1992 and increased to 646 dollars in 1993, more than twice the price of any other Chilean wood (except for the protected alerce) and more than three times that for pine lumber (INFOR 1993). At those prices, the returns on investment in managing second-growth raulí are highly attractive, and raulí forests in the northern part of the Lake Region have come under intensive forest management.<sup>17</sup>

Raulí is therefore an excellent candidate for the value-forestry scenario. Value forestry is also a plausible gamble for a few other Chilean species. For most, however, it is no more than wishful thinking. Some native species may find acceptance among carpenters and cabinetmakers, but few hardwoods are as attractive in color and grain or as easily worked as raulí. Valuable species—especially *notro*, *avellano*, *tineo*, and *lingue*—have been depleted. Other species that are still abundant have flaws that

17. The French consortium Pexma invested 18 million dollars in a modern sawmill in Entre Lagos in 1991 for its lumber operations in Panguipulli, near the southern limits of the raulí forests (Cabello 1991). Pexma bought the Panguipulli forest, a state-owned complex designed to manage the extensive forests of coigüe and raulí around Panguipulli and the nearby lakes (Stolzenbach 1979).



limit their uses. Coigüe (*Nothofagus dombeyi*), the dominant tree in most Andean forests,<sup>18</sup> is the most abundant species in the rain forest. It responds to thinning and management with high yields, up to twenty-two cubic meters per hectare annually (P. Donoso et al. 1993), a figure rivaling pine plantations. But as a cabinet wood, coigüe's pale hardwood has high moisture levels that make it prone to warping and collapse during drying. Those faults are reflected in its low price (see table 1). In the coastal range and Chiloé, *tepa*, *ulmo*, and *canelo* each account for 10 to 17 percent of the forest (Altamirano 1995). But the amount of each species available is small, and the quality unpredictable. The uses of these native woods are well known (see Díaz-Vaz et al. 1989), but only the deciduous raulí and lenga have secure niches in international specialty wood markets.

### *The Montane Rain Forest and the Hardwood Chip Market*

The evergreen rain-forest species cannot compete with exotic plantation species in lumber markets where consistent quality is a prime selling point. They are sold instead as wood chips to the Japanese paper industry. The chip industry is the most rapidly growing subsector of the Chilean forest industry and the one that adds the least value to the wood.

Since 1987 the Valdivian rain forest has been subjected to the most intensive logging in its history. A few inaccessible areas of the native forest have been preserved intact in the mountains of the Lake Region, but most have already been logged. The currently low quality of most native woods can be traced to the widespread practice of high-grading (floreo). Loggers in the Valdivian forests have long cut selectively, without planning for forest regeneration. Woodcutters felled the largest and straightest trees, leaving behind those with crooked trunks, insect damage, or heart rot. High-grading thus has left the forests with large volumes of biomass, but little of the remaining wood is suitable for sawmilling.<sup>19</sup>

The extraction of the most valuable specimens has reduced the genetic quality of the harvested tree species from the point of view of wood production but left many forests otherwise ecologically intact. Chilean forestry companies label the native forest "degraded," but it is anything

18. Coigüe dominates the Andean forests, growing in groves of equal age that date from a single episode of forest destruction and recolonization (von Buch 1990). Earthquakes and volcanic eruptions, heavy precipitation on glacially oversteepened slopes, and the slide-susceptible soils developed on volcanic ash combine to topple the Andean forests frequently. In the quake of 1960, 5 percent of the Andean forests were destroyed by landslides (Veblen 1982a).

19. The future of the evergreen forest as a source of lumber remains in doubt. Forestal San José, in addition to its mechanized loading dock and chip plant near Puerto Montt, established a sawmill, but it was shut down when the company could not get enough quality wood to operate at a profit (Bañados 1991b).

but degraded as wildlife habitat. Dead snags and dying trees are more densely inhabited than the healthiest of trees. Ecologists are only now discovering the complexity of life in the treetops. In old-growth forest ecosystems, crooked and half-dead trees provide habitat for birds, insects, and mammals that nest in wood cavities (FEMAT 1993; Lindenmayer and Norton 1994). The forest openings left by taking large trees create sunny glades that support lush growths of smaller plant and animal life. Thus the selectively logged evergreen forest, part juvenile and part dying, is one of the most biologically and structurally diverse landscapes in Chile.

Until 1986 the submarginal economic value of these forests gave them a measure of protection, despite repeated proposals to intensify management of the native forest. The Haig Commission (Haig and Teesdale 1946) predicted a shortage of raw material for wood manufacturers. Reports by the United Nations Food and Agriculture Organization (FAO) repeatedly urged the extraction of the older trees of low value in an attempt to promote healthier young trees.<sup>20</sup> Such a project would require extensive labor with uncertain future returns, however, and was never funded. The Corporación de Madera (CORMA), the primary association of Chilean forestry companies, declared the Chilean native forest exhausted, recommending as early as 1965 a full conversion to plantations of exotic species. CORMA's enthusiasm for exotic species reflected the judgment that the native forest had no value beyond its standing wood. Lacking careful studies and influenced by the forest's slow recovery from fire, many foresters generalized the slow growth of the alerce to all Chilean species. As a result, the native forest was viewed as an extractive resource, practically nonrenewable and therefore not worth managing. Protection of the alerce and the araucaria have further reduced the potential commodity value of the native forest by setting aside the remnants of two of the highest-priced woods from the market.

Before industrial markets, the primary use for the native woods was for fuel. With the quadrupling of oil prices during the 1970s and the impoverishment of large segments of the population following the 1973 coup, households in the Lake Region reverted to using firewood for heat.<sup>21</sup> Like selective logging, however, the gathering of firewood implies

20. The FAO issued reports on Chilean forest resources after World War II, in 1956 and in 1962. The FAO assisted the Ministerio de Agricultura in evaluating Chile's forest resources between 1966 and 1968, but the recommendations for managing the native forest were discarded with the change of administration in 1970. The latest report from the FAO mission to Chile (1991) recommends converting old native forests to young stands, if necessary by replacing native species with exotics.

21. In 1982 fuelwood supplied an estimated 23 percent of Chile's energy consumption (Lara 1985), rising from 11 percent in 1974 (INFOR 1986). Close to 10 million cubic meters of wood are burned as fuel each year, or 3.4 million tons. Virtually all is for residential use, and 62 percent of that in rural areas (FAO 1991). Urban dwellers consume only 38 percent of the

thinning rather than clearing forests, thus improving the conditions of growth for the trees that remain. The same cannot be said for the hardwood chip industry, which accepts wood in almost any condition. Japanese demand for hardwood chips has created a new resource boom and led to a rapid increase in clear-cutting.

Because the evergreen forest is no longer economically marginal, any conservation effect in Chile has been lost, in part due to increased demands for conservation elsewhere around the Pacific Rim. The Japanese paper industry encountered supply problems during the 1980s, as its demand for short-fiber pulp confronted restrictions on hardwood supply (Marchak 1995). Formerly forest-rich areas like peninsular Malaysia have imposed restrictions on exporting unprocessed wood to promote a domestic processing industry (Vincent and Binkley 1992). Restrictions have also been set on log export in Indonesia and most of Latin America (Laarman and Sedjo 1992). Environmentalist pressure has slowed the cutting of hardwood forests in Australia and New Zealand (Roche 1990; Norton and Mitchell 1994), and large areas of the temperate rain forests of Tasmania and New Zealand's South Island have been withdrawn from chip production. Both countries have decided that their dwindling temperate rain forests are worth more standing than cut.

Chile is the exception: hardwood chip exports are legal, cheap, and booming. Chip production has grown from nothing in 1987 to 5,715 cubic meters in 1993 (INFOR 1993). The chip industry consumes almost a fifth of the total industrial wood supply, and chips are Chile's largest forest export by volume. The Compañía Chilena de Astillas (CCA), a joint venture of Chilean, Japanese, and New Zealand capital, made the first shipment of hardwood chips to Japan in January of 1988 (CORMA 1991). The success of the Japanese paper industry and the high costs of Japanese lumber make Japan the only significant market for Chilean chips (INFOR 1993).

The chip merchants earn high returns on minimal investment, in part because so little domestic processing is necessary. Transportation and loading are the major expenses. Three ports have been established at Corral, Calbuco, and Puerto Montt to load the chips onto oceangoing freighters. Each company maintains a great pile of wood chips at its port, where trucks drop off their loads and ships wait for the chips to be deposited in their holds by pipeline conveyor.

The ports obtain their raw materials through an expanding network of log depositories that chip exporters have established at many road junctions in the Lake Region. They accept wood from any supplier, paying the posted price for each *metro ruma* (a unit of two cubic meters). Some accept only hardwood, others only pine, but most advertise their willing-

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total, but enough to threaten forests near the urban fringes. Puerto Montt and Valdivia suffer chronic firewood shortages.

ness to buy any species and to beat a competitor's price. The market network includes independent contractors with chain saws and logging trucks who solicit landowners for the right to cut trees. The depositories and logging contractors provide a competitive market for low-quality hardwood, and many landowners seek the largest possible immediate gain in the hardwood-chip market by clear-cutting their forests.

The dispersed network makes enforcement difficult. Under Chilean law, no forest can be cut without an authorized management plan, but enforcement is underfunded. The Corporación Nacional Forestal (CONAF), the government regulatory body, generally authorizes only selective cutting in native forests, with a view toward creating young and fast-growing stands of trees for later harvest. CONAF has a broad mandate but a limited staff, and inspections of private forest are a low priority. The government publicly asserts that unsustainable practices are a thing of the past. But a 1993 study found that only 30 percent of the registered management plans were being followed and that a plan serves merely as "permission to cut" (*Chile Forestal* 1995c, 37). In 1994 forester Harald Schmidt estimated that no more than one-fifth of the management plans in the Lake Region were being carried out in good faith (*Chile Forestal* 1994a).

Rural inhabitants in the Andean foothills confirm that the regulations are not flouted, but neither are they obeyed. Forests bordering roads are maintained according to the requirements, but in woodlands beyond public view, clear-cutting appears to be the norm. Four residents seeking rides reported that they had been hired to cut trees and clear brush on land belonging to other farmers and described their task as *tala rasa* (clear-cutting). Several substantial fines were levied against high-profile corporations for illegal cuts (*Chile Forestal* 1994c). But many other cases remain bogged down because local police and judges often refuse to enforce prohibitions against forest clearing.<sup>22</sup>

The rush to cut reflects the fear that the market for Chilean hardwood is temporary. Eucalyptus plantations are expected to be a formidable competitor in the chip market someday. Eucalyptus can be grown in rotations as short as eight years and is the preferred hardwood for short-fiber cellulose (Stier 1990). In 1994 almost 35 percent of the new plantations established in Chile were eucalyptus, up from less than 4 percent in 1981. In the Lake Region, more than half the new plantations were eucalyptus (INFOR 1994). Forest owners may fear that eucalyptus will soon capture the market for hardwood chips. When it does, they expect the native forest to become economically marginal again. The window of

22. Obstruction of national forest policy by local authorities appears to be an ongoing problem (*Chile Forestal* 1994b). One judge in Curacautín declined to impose fines on landowners, despite CONAF's proofs of clear-cutting. The judge's actions reflect the lack of social consensus on forest protection in a society where the clearing of forest traditionally established ownership to land, according to Andrés Duarte of CONAF, interviewed in Jan. 1992.

opportunity—or window of vulnerability, from the environmentalists' point of view—is expected to close soon. Yet current evidence suggests that worries about eucalyptus capturing the chip market are premature. Large volumes of eucalyptus began to mature in 1996, but most will be consumed locally. Two new pulp mills built to process eucalyptus are now operating in Osorno and Valdivia. Native species dominate chip exports by a large margin (figure 1). They will likely continue to do so because the Japanese market for hardwood chips appears capable of absorbing as much wood as Chileans are willing to ship (Penna 1992; Marchak 1995).

### *The Coastal Rain Forest and Exotic Substitution*

The competitive advantages of eucalyptus plantations have generated the most contentious debate in Chilean forest conservation over exotic substitution of the coastal Valdivian rain forest. The coastal rain forest presents a special challenge to commercial foresters. Species diversity is higher than in the Andes, and wood values and commercial volumes remain low and irregular. Disturbances have been less frequent and pioneer forests fewer than in the Andes. Late-successional shade-tolerant species are common in the selectively logged forests. Southern beeches are rarer than in the Andes, producing a complex forest with uncertain patterns of succession. Moreover, large-scale clear-cuts are often colonized by bamboo, which delays forest regeneration for decades because it is difficult and expensive to eradicate. The management of such a forest depends on classifying it into subtypes, each one of which may respond to a different technique. Clear-cuts in strips or small patches favor the reproduction of the faster-growing pioneer species (C. Donoso 1989), but they have not proved to maintain ecosystem function in practice.

Although native rain-forest trees grow slowly on the coast, several species of eucalyptus grow spectacularly well there. Frost is rare and never severe. Average rainfall exceeds two meters a year, with six hundred millimeters even during February, the driest month (Montaldo and Medel 1986). *Eucalyptus nitens* is astonishingly productive in the region, with annual yields as high as 70 cubic meters per hectare (Hunter 1987).

The actual area of eucalyptus now growing in the Lake Region is uncertain. INFOR (1994) reported 35,000 hectares, but that figure included only subsidized plantations. Eucalyptus planted on agricultural land is ineligible for the government's afforestation subsidies and is not included in the datum. The plantations were established by Chilean landowners and by multinational corporations. Japanese corporations have been particularly active in acquiring land through Chilean subsidiaries.<sup>23</sup>

23. Japanese capital pervades the hardwood industry. Forestal Anchile, an affiliate of Daio



The multinationals are trying to establish a raw material base, and to do so, they are willing to pay premium prices. Land prices have soared in southern Chile because of the region's suitability for eucalyptus plantations. In their efforts to attain "full value," owners treat the native forest as an obstacle rather than a resource and lobby to replace it.

The issue of substitution attracted wide public attention during the Terranova controversy. In 1987 Forestal Terranova, a Swiss-Japanese joint venture, began to study the potential for exporting hardwood chips from the port of Corral. Construction began on an industrial complex to be supplied by the coastal forests, including port, sawmill, and chipping operations, with a short-fiber cellulose plant to follow. Raw materials were to come from large tracts of forest in the coastal hills. Terranova had already acquired the Chilean coast from Corral southward to the Río Bueno, and eastward to the crest of the coastal range. Terranova proposed to clear-cut the native forest and replace it with eucalyptus trees, which were to be harvested in rotations of eight years.<sup>24</sup>

Terranova obtained the permission of the military regime to begin the work and in March 1990 sought final approval from the incoming administration of Patricio Aylwin. Environmentalists led by the Comité de Defenso de la Flora y Fauna (CODEFF) protested such extensive substitution of native species as well as the clear-cutting, insisting that the existing forest be managed for sustained yield of native species (CODEFF 1990). This group marshaled wide international support, making the case a watershed event for the Chilean environmental movement and a major test of what sustainable development will mean in Chilean forestry.

Law and precedent are on CODEFF's side: clear-cutting and substitution had not been permitted for existing native forest, and a similar chipping operation for Chiloé was rejected in 1987 (Contreras 1989). The Terranova project became a test case to determine whether a democratic government would enforce a sixteen-year-old forest policy established by the military when it protected the native forest in an area of high unemployment.<sup>25</sup> Maximiliano Cox, Undersecretary of Agriculture, recognized as much by declaring that the government's decision on Terranova's application would establish future policy on substitution (*Chile Forestal* 1990a).

Paper and the C. Itoh Trading Company, has spent 60 million dollars (U.S.) for 660 square kilometers of land near Osorno in the Lake Region, with a further 30 million reserved for future acquisitions (Bañados 1991a). Mitsubishi supplied 70 percent of the capital for a new sawmill south of Concepción, and Mitsubishi affiliates have begun buying up land to secure 100 square kilometers of coastal land suitable for eucalyptus.

24. Out of a total of 60,700 hectares, Terranova classified 23,000 as degraded by selective logging. These areas plus another 2,700 hectares already deforested were to be converted to eucalyptus on slopes as steep as 45 percent (Terranova 1990).

25. Shirley Christian, "Spare Those Trees? Woodmen Fret," *The New York Times*, 3 Oct. 1990.

In 1991 a cabinet committee ruled out large-scale clear-cutting and substitution, but neither side believed this decision to be the final word. At the same time, the government formed a national forest commission dominated by representatives from the Ministerio de Agricultura, CONAF, CORMA, the large forestry companies, the forest workers' union, and the foresters' professional association. CODEFF did not join, perceiving a body stacked in favor of industry. Other environmental organizations were not invited. Meanwhile, a letter from forty-one ecologists and foresters appeared in the press, requesting that the government clarify its forest policy and recommending that substitution be rejected.<sup>26</sup> Amidst the controversy, Terranova halted the project, declaring that without a free hand in deciding where to clear-cut and where to substitute eucalyptus, the project would no longer be commercially viable. Despite the project's suspension, the question of substitution continues to be a central focus of the conflict over environment and development in the Lake Region. It remained unresolved through 1997.

#### USE IT OR LOSE IT? THE NATIONAL DEBATE

A coalition of capitalists, professional foresters, labor unions, and state officials are insisting that Chile must use its native forest or lose it. Foresters, investors, and Japanese buyers claim that profits from the hardwood chip industry will help pay for thinning that would convert the native forest into a commercially viable source of hardwood lumber. They assert that the only alternative to removing old-growth is replacing the forest with other land uses, invoking the specter of deforestation by peasants in search of agricultural land. Yet their own figures show that agricultural clearing has ceased in Chile and that the chip industry has been the primary agent of forest clearing in the past five years (e.g., Hartwig 1991, 171). Pointing to the success of government subsidies in promoting the growth of the plantation-based industry, members of this coalition are calling for the state to subsidize the conversion of Chile's remaining old-growth forests to young second-growth stands—essentially tree farms (CORMA 1991). They say that industrial use of the native forest is necessary, regardless of whether it is profitable or sustainable. If not yet profitable, they call for state subsidies to make it so. The idea that a forest could remain uncut to serve as wilderness, wildlife habitat, and a source of secondary forest products is scorned. Preservation is labeled a luxury, and its advocates are characterized as a wealthy and selfish band of ecological fanatics.<sup>27</sup>

26. Carlos Aldunate, "El bosque nativo sigue quemando," *Segundo Cuerpo* 11 Aug. 1991.

27. The interviewer stated, "There are experts who fear that commercial pressure on the native forests will carry all before it." CONAF Director Juan Franco de la Jara replied: "Ah, those experts! How easy it is to speak from a desk in a rich suburb with a monthly check of \$5,000 in one's wallet! They want the forests untouched so that people like themselves can

The array of forces supporting increased logging in the native forest is formidable. Foremost among them is CORMA, the organization of forest-sector firms.<sup>28</sup> It conducts an ongoing publicity campaign promoting commercial forestry and an expansive interpretation of the rights of private property (e.g., CORMA 1991). These groups are aware of mounting opposition among Chileans to current forestry practices and have made efforts to preempt it. Professional foresters also support industrialization, partly because of the timber-first forestry curriculum under which they were trained. Many also support industrial subsidies because of the prospect of increased demand for their expertise. The Asociación de Ingenieros Forestales represents the growing numbers of those trained during the past thirty years of curriculum development in commercial forestry. The leader of the association, Pablo Tironi, asserts that rigorous enforcement of forest management plans will reconcile development and conservation if the plans are designed by association members (*Chile Forestal* 1990d). The Confederación de Trabajadores Forestales represented only 8 percent of the industry's workers in the late 1980s (Morales 1989). CORMA's members have blocked its expansion where possible but in this debate have given the union ample opportunity to object to environmental concerns and to support state funding for the industry.

Industry representatives assert that the solution to deforestation lies in freer markets and more of them, not in regulating land use. They propose that expanding markets for native woods will lead landowners to manage their forests for wood production. In the absence of markets, forests will be cleared to gain access to the productive potential of the underlying land. Accordingly, the conversion of the native forest to tree farms is posed as the only way to save it. Gonzalo Estévez, CORMA's general manager in the Lake Region and a spokesman for the chip industry, casts the dilemma in terms of limited state capacity: the native forest must be converted into a commercial forest because otherwise the state will lack the resources to protect it (*Chile Forestal* 1991b).

The argument that market development will lead to intensive management and thereby to forest preservation has many flaws. Logging can result in forest destruction whether it is for intentional extraction of timber or incidental to land clearing (Marchak 1995). This is particularly true with the industrial clear-cutting methods widely used in the Lake Region. In addition, uncertainty about interest rates over a rotation of many decades and arbitrary choice of an appropriate discount rate make precise

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enjoy their vacations, but such extreme environmentalism assumes very high incomes, and the country has economic needs." See *Diario Financiero*, 1 Aug. 1991.

28. CORMA is part of the deeply rooted Chilean tradition of *gremios*, or industrial interest groups. Although the military regime may have fragmented the working classes by destroying their unions, the elites remain as tightly linked and coordinated as ever. It is hard to overestimate the degree of organization among Chilean capitalists (see Zeitlin 1984).

calculations of the return on investment un dependable (Leslie 1987a). Discounting future returns makes it economically rational to exhaust the resource, converting natural capital to economic capital for reinvestment in industries with more immediate returns (see Johnson and Libecap 1980). The profitability of long-term investment in forestry is clearer in hindsight than in advance, and most landowners would probably prefer to invest in a eucalyptus plantation rather than manage the regeneration of native forest on a clear-cut. If market forces are to guide forest management in Chile, the evergreen rain forest is ultimately an impediment whose removal will generate a profit.

The argument that the chip industry provides a market for culled logs and thereby creates an incentive for selective thinning is attractive in theory but questionable in practice. CONAF's demonstration projects in the national forest reserves show the silvicultural value of thinning in second-growth stands but also the difficulty of using the chip market to finance thinning. Some of the logs can be sold for chips, but most are so far from the roadside that the labor required to transport them costs more than the price they fetch (Clapp 1993, 163). Although the chip market has failed to produce the predicted intensification of management, the industry's rosy scenario is still repeated often by politicians and the press.

The arguments for intensive exploitation of the native forest have taken on the appearance of political realism in a country where excessive idealism is blamed for the destruction of democracy in 1973. Resource-based development is widely considered the inescapable verdict of the free market. President Eduardo Frei, elected in 1993, has declared that no environmental cause will stand in the way of development.<sup>29</sup> Even some environmentalists believe that their only option is to promote the management of the native forest in the hope of preventing its replacement with exotic species. The Chilean environmental group of the longest standing and greatest legitimacy is CODEFF. Founded in 1967, it survived the years under military rule by combining scientific expertise with political conciliation, a blend that continues. CODEFF favors managing the native forest but limiting the export of unprocessed chips to slow the growth of the chip trade (*Chile Forestal* 1990c). Industry advocates tolerate CODEFF grudgingly, but less conciliatory environmental groups are labeled emotional, immature, and unscientific "fanatics who impede the use of resources" (*Chile Forestal* 1990e).<sup>30</sup>

29. Bowermaster, "Take This Park and Love It," *New York Times Magazine*, 3 Nov. 1995.

30. The Sociedad Amigos del Arbol and the Sociedad de Vida Silvestre date back to the 1970s, but the most radical environmental groups have developed under democratic government. Bosque Antiguo is a young organization championing the preservation of old-growth forests. The group that has especially aroused the ire of the native forest industry is the Red Nacional de Acción Ecológica (RENACE), an umbrella organization for local ecological activist groups. The Agrupación de Defensores del Bosque Nativo enjoys the highest profile. A group formed in 1994 by ecologist and taxonomist Adriana Hoffmann, its founding mem-

If precommercial thinning were restricted to second-growth stands, the subsidies for management could achieve an appropriate balance between development and conservation, promoting a relatively benign intervention in forest ecosystems already altered by human activities. But pressure is mounting to extend the process to old-growth forests. They have been labeled as "*sobremaduro*" (overmature or senescent), consisting of "worthless old trees" (Hartwig 1990). Fernando Hartwig, manager of the Compañía Chilena de Astillas, has proposed salvage cutting and the ringing of ancient trees in order to "rejuvenate" the forest. Roberto Isquierda, former president of CORMA, has called for the native forest to be used in "absolutely rational form," meaning it should be converted to a tree farm geared toward maximizing timber production. Both Grosse (1993) and Hartwig (1991) object to the "disorder" of the native forest. They prefer the nineteenth-century German model of homogeneous young second-growth forests, which result from a determined effort to simplify and homogenize an environment. Ironically, they are promoting ideas now widely rejected in Germany, where selective extraction of individual trees from second-growth forests is considered the only way to protect the full range of values that forests can offer.

Chilean foresters and industrialists urge in particular the removal of the current canopy layer, declaring it in a state of decadence. They generally regard old-growth forests, with their multiple canopies and stages of growth ranging from saplings to old giants to rotting logs, as deplorable. Hartwig rightly maintains that "it is not possible to reconstruct primeval ecosystems that developed over a long history" (1991, 123). But for one who recognizes the difficulty of ecosystem restoration, he is unjustifiably sanguine about the wholesale alteration of environments still close to the original. An entrepreneur who benefits from cheap hardwood, he envisions nature so overloaded with hardwood that public subsidies are needed to dispose of it.

Meanwhile, criticisms of the industry have mounted along with the piles of wood chips. Environmentalists have dubbed them "*montañas de infamia*," symbols of the destruction of the Chilean environment for short-term gain. They blame the chip exporters squarely for the rapid increase in clear-cutting.<sup>31</sup> To defuse such criticisms after the first two years of chip exports, a consortium of chip exporters pledged to contribute one dollar to CONAF's enforcement programs for every ton of chips exported during 1991. Most participants in the chip business acknowledge that the donation is a political maneuver, an effort too small to have much effect on enforcement. Hartwig labeled it "a tranquilizer for public opinion" (*Chile Forestal* 1990c).

bers include Bishop Bernardino Piñera, Minister of Public Works Ricardo Lagos, University Rector and presidential candidate Manfred Max-Neef, and several famous poets and singers.

31. Adriana Hoffmann, "Astillas ¡No!" *El Mercurio*, 11 Oct. 1995.



The visible impact of the chip industry and the prospect of substitution has also aroused broad public interest. Chile's urban middle class has grown during a decade of prosperity, and appreciation of the temperate rain forest of the Lake Region has grown even faster. The most enthusiastic members of the expanding environmental movement are the middle class's teenage children, who every summer can be seen hitching rides to the south to explore. From 1986 to 1994, visitors to the country's parks and protected areas grew by 40 percent to more than nine hundred thousand. Visits to the parks in the Lake Region during the same period have increased by 250 percent. It became the country's most popular destination in 1992, accounting for 29 percent of all visitors one year later (INFOR 1994).

As their activities have come into the public spotlight, the chip industry and its allies find themselves on the defensive. CORMA complains of environmental ignorance among the public, little affected by CORMA's campaign because "the people think that our message is slanted" (*Chile Forestal* 1995c). Chilean foresters, industrial and academic alike, are increasingly embattled as their timber-first orientation is greeted with growing skepticism. With the deterioration of the chip industry's public image, the issue of compensation for the lost opportunity to plant exotics is mentioned with increasing frequency.

Some foresters have attempted to stake out a middle ground in the polarized debate, opposing both exotic substitution and preservation. Accepting the need to commercialize the native forest, they propose alternatives to the indiscriminate clear-cutting widely practiced in the Lake Region. In the southern-beech forests, systematic thinning of dense second-growth stands offers clear promise (P. Donoso et al. 1993). Unfortunately, they also accept the homogenization of old-growth forests by promoting the conversion of high-grade southern-beech forests to young stands (C. Donoso and Lara, as cited in Veblen et al. 1996). For the complex evergreen forest, clear-cutting in narrow strips has been proposed to promote regeneration of the faster-growing and more valuable pioneer species (C. Donoso 1989; Troncoso 1995; see also table 1). Both approaches are preferable to clear-cutting but treat the country's shrinking old-growth forests as an obstacle to timber production rather than an invaluable ecological resource.

Figures from disciplines other than forestry have increasing influence over the sector. Over the objections of foresters, geographer René Saa Vidal was appointed as the new director of the Instituto Forestal (INFOR) (*Chile Forestal* 1995b). His agenda stresses interdisciplinary work with small landowners and peasants. The conflicts between forestry and other disciplines also extends to biology, which could gain influence with the country's formal commitment to a gap analysis. This ecological study will determine the proportion of each of the nation's ecosystems that is protected (Harding 1994), with a view toward increasing protection of ecosys-

tems now underrepresented in the national system of natural reserves. New Zealand's formal preservation of its remaining native forests and its separation of conservation (indigenous forest) from production forests (exotic plantations) are viewed (with hope or dismay) as a model that could be applied to Chile.

The state government is divided. The Center-Left coalition governments of Aylwin and Frei represent the first democratic governments after sixteen years of military rule. Their worst fear has been that their economic record will be judged against the buoyant economy of the last five years under the military and found wanting. The primary mission has been to show that a democratic government can combine capitalist growth with redistributive measures. The environment is a secondary priority. As Alan Angell and Benny Pollack have observed, "There is remarkable unanimity . . . in favor of [the environment], but everybody disagrees on the ways to improve it" (Angell and Pollack 1995, 119).

The government has found it easier to create parks and formal procedures than to address the effects of the chip industry. The Frei administration enacted a formal requirement for environmental impact assessment and has also expanded the *Systema Nacional de Areas Silvestres Protegidas* (SNASPE). Between 1990 and 1995, SNASPE added two new national parks (both in the northern deserts) and seven national reserves. Although it encompasses 18 percent of the country's land area, the park system avoids the most biologically productive zones. Eighty-five percent of the protected land is located in the uninhabited glaciers and fjords of the southern regions of Aysen and Magallanes (INFOR 1994). Protected areas in the Lake Region account for a mere 4 percent of the total area, even though the region has the most diverse forests and the highest demand for ecotourism.

CONAF operates under a dual mandate, charged with economic development and environmental conservation—with wildlife preservation as well as logging. Its ranks include committed environmentalists and commercial foresters alike. The *Ministerio de Agricultura* appears to favor management subsidies as an alternative to substitution, but ministerial rhetoric varies according to the audience, alternately reassuring the industry and placating environmentalists. The *Ministerio de la Economía* is concerned above all with maintaining economic growth and has opposed restrictions on the chip industry, while the *Ministerio de Hacienda* is reluctant to commit to subsidizing forest management. The conflicts persist, leaving government policy in gridlock.

#### ENDGAME: THE NEXT FOREST LAW

Given the mounting controversy, all eyes are turned to the *Proyecto de Ley de Bosque Nativo*, the legislative process expected to culminate in a native forest law. *Decreto-Ley 701* of 1974 expired in 1994, when a suc-

cessor was expected. No replacement has yet emerged. The DL 701 afforestation subsidies have been continued via stopgap measures, but the larger environmental issues remain unresolved and have been tied to the extension of resource-led development to the native forest. Early drafts focused narrowly on subsidy levels for forest management. Recently, however, the substitution controversy and the chip industry have broadened the scope of the debate to include exotic substitution, the regulation of logging practices, and the criteria for preservation. The new forest law is expected to decide all these questions at one time (Troncoso 1995).

Several drafts have been discussed, revised, and abandoned as the chip industry has grown and environmental protests have intensified. In the succession of drafts, the outlines of the ultimate compromise are gradually emerging. A 1992 draft proposed creation of a commercial native forest, and the determination to expand uses of the native forest continues. Public incentives for managing the native forest have been proposed as the alternative to clear-cutting and exotic substitution. A management plan is envisioned as the primary mechanism of regulation, with CONAF in charge of enforcement. Four types of interventions in the native forest are candidates for subsidy: management of second-growth forests, enrichment of existing forest with native species, reforestation with native species on cleared land, and the conversion of old-growth forests to young stands. The state would subsidize 75 percent of landowners' costs, the same level that has applied to plantations since 1974. In reaction to charges that large companies benefit disproportionately from the DL 701 subsidies, smallholders will be reimbursed at the higher rate of 85 percent (*Chile Forestal* 1992).

The draft struck a complex compromise on the issue of substitution. It was to be forbidden on slopes steeper than 45 percent, in the habitat of rare species, and in ecosystems underrepresented in the national system of protected areas. Substitution was also forbidden in forests of alerce, araucaria, Chilean incense cedar, Guaitecas cypress, and Chilean palm (all rare forest types) and in forests of lenga, raulí, coigüe, and coigüe de Magallanes (easily managed southern-beech forests). Early drafts permitted exotic substitution in the evergreen rain forest on as much as half of the "degraded forest" on a property and on a quarter of other forests (Grosse 1993), but no agreement has been reached on what constitutes "degraded forest."

Neither is there consensus on the definition of production, protection, and preservation forests, which are devoted respectively to timber production, watershed protection, and wildlife habitat. The devil is in the details: the maximum slope angle on which forests can be managed for timber production, the width of the riparian reserves, and the percentage of land eligible for substitution. Tiny changes in the final formula could make great differences in available timber volumes, soil and water quality, and the visible landscape. Until a native forest survey is completed in 1997 or 1998, no final formula is likely.

Since President Aylwin sent the proposal to the Chilean Parlamento in April 1992, it has suffered numerous delays. The Cámara de Diputados approved a draft law in March 1994 and sent it to the Agriculture Committee of the Senado, where it was frozen well into 1997. The public position of the government was that the bill was frozen to try to develop consensus among the industry and environmentalists, but no consensus has been forthcoming. The lack of reliable data on the extent and condition of the forest has become an excuse for inaction.

The premature release of a controversial national environmental account has broken the impasse. Conducted by Chile's Banco Central to meet United Nations standards for national accounts adjusted to reflect resource depletion and environmental degradation, the report was apparently leaked to the press in October 1995. Although officially unpublished, it has been widely circulated and cited. The report estimates that between 1985 and 1994, 5 to 15 percent of the native forest was cleared, with most of the deforestation occurring in the Lake Region (*Chile Forestal* 1995f). The report, basing projections on the first decade of the chip export industry, estimates that by 2025 half of the remaining native forest will have been cleared as well as all forests in the Lake Region outside protected areas.

Environmentalists have pointed to the study as evidence that the situation is "worse than we thought."<sup>32</sup> Beyond renewing calls for a moratorium on chip exports, they propose that Chile adopt New Zealand's solution to forest conservation by shifting responsibility for Chile's native forest to a new department with a mandate for preservation and the authority to reject management plans. The forest industry has rejected the study as unscientific and untrustworthy, insisting that any projections must be based on the results of the uncompleted forest survey.

The public controversy generated by the report placed the government in the awkward position of appearing to block legislative action while the Chilean forest suffers catastrophic decline. The government responded to the urgency of the message, but condemned the messenger. After objecting for years to a long-term commitment of funds, the Ministerio de Hacienda finally agreed in principle to subsidies for forest management,<sup>33</sup> and the law has once again come under discussion in the Senado. At the same time, Agriculture Minister Emiliano Ortega attacked the study's authors as "frivolous, irresponsible, ill-intentioned and infantile."<sup>34</sup> He claimed that the report damaged "the prestige" of Chile's forest industry, and he threatened the report's writers with professional dis-

32. Ibid.

33. Although the Ministerio de Hacienda agreed to the subsidies in principle, it has not yet settled on the amount of public money to be made available or the duration (*Chile Forestal* 1995f).

34. "Min. Ortega fustigó estudio de B. Central sobre bosque nativo," *El Mercurio*, 8 Nov. 1995, pp. A1, C8.

ciplinary action by the industry-aligned Colegio de Ingenieros Forestales. The director of the department that produced the study has been relieved of his duties,<sup>35</sup> and the president of the nominally independent Banco Central was summoned to face the displeasure of the Senado.

The government's threats of retribution are based on two substantive but questionable claims. First, the continuation of a current trend is never certain, and its projection far into the future is only a best guess. Second, the study did not use the preliminary data from the native forest survey.<sup>36</sup> But the projections are conservative. The study assumes annual growth rates for the forest industry of 5 percent, although the consensus figure among industry economists is close to 8 percent. If the study's projections are incorrect, they appear to err on the side of underestimating rather than exaggerating. Furthermore, the industry cites preliminary results of the national forest survey in support of its claims that the native forest has not declined. Indeed, the survey appears to have been designed to arrive at such a conclusion: it redefines the native forest broadly, thereby enlarging the native forest area. Survey director Leonardo Araya has acknowledged "the change of concept in the definition of a forest. . . . We are going to arrive at figures for the native forest greater than the historic figures. In our maps, what before was blank space now has vegetation" (*Chile Forestal* 1995e, 10).

## CONCLUSION

The current path of forestry in Chile is unsustainable and threatens the existence of its forest ecosystems. Preservation of the genetic diversity and habitat of endangered species is mandated by Chile's various environmental laws (Gallardo 1989), but the consequences of this commitment to preserving habitat have not yet been addressed. The most detailed research on the native forests has been conducted on ecological succession, with an emphasis on trees. Few results are available on wildlife habitat and interactions between trees and other forms of life, from fungi to insects. That emphasis reflects the funding available for research on the possible commercial use of the native trees but not on the ecosystem as a whole.<sup>37</sup> Ecological studies progress, but slowly, and the consequences of rain-forest conversion or substitution remain unknown. Until recently, most Chilean scientists have been reluctant to oppose forest conversion

35. *The Economist*, 17 Feb. 1996.

36. Gabriel Vergara, "Polémica genera situación del bosque nativo," *El Mercurio*, 8 Nov. 1995, p. 1.

37. During the university purges and hard times under the military regime, Chilean scientists learned to avoid political debate and to justify themselves economically. Books on Chilean trees invariably include hopeful conclusions praising the species' aptitudes for commercial use. Biologists, whose work does not generate immediate economic results, are few and underfunded.



without hard data to support their arguments. Without such data, opponents of logging will quickly be labeled as extremists.

Given those impediments, is an environmentally sound native-forest industry possible in Chile? In making that judgment, the potential for valuable hardwood exports in the next century must be weighed against Chile's poor record in enforcing economically sustainable forest exploitation, let alone ecologically sustainable resource use. Should the draft become law, Chile will begin to put the same resources into native forest management as into plantation forestry. It is also likely that subsidies will be withdrawn for reforestation with pine and eucalyptus, which have already proved to be profitable ventures. Planting of these two exotics is certain to continue, but the forest industry will in time come to depend on a far more diverse supply of woods. Those writing the law have taken three risks: first, that landowners will find the subsidy sufficient incentive to choose forest management over the alternative, which is to clear-cut and plant exotics; second, that the emergence of value forestry is likely and thus little-known Chilean hardwood lumber of high quality will find an ample market several decades from now. Both are sensible risks, worth taking.

The third risk—the subsidized destruction of old-growth forests—is less farsighted. Opposition to such destruction is mounting but faces the formidable obstacle of the well-organized forest industry. The state could confer a measure of protection on old-growth simply by restricting government subsidies to the management of native second-growth forests, which offer the most promise for rapid yields. Ironically, Chile's best hope is that plantations and second-growth forests of raulí and the other southern beeches prove so successful that they generate the same economies of scale and agglomeration that have promoted an exotic forestry complex in south-central Chile (Clapp 1995a). Chile's best hope for sustainable forest-based development is thus a narrowly focused hardwood silviculture and allied processing industry, concentrated in the deciduous forests of the lakes and foothills.

The localized success of value forestry is no guarantee of safety for other forests. Not all Chilean forests can support sustainable timber management from an economic point of view, much less from an environmental perspective. The old-growth evergreen rain forest, with its many species and uncertain regeneration, would better be left untouched to serve as an ecosystem reserve. As timber, these forests offer only what plantations already offer at a lower price. As habitat and wilderness, old-growth forests cannot be replaced or reproduced in our lifetime. The need for their protection is urgent. Their greatest economic value in the long term is probably as an environment for ecotourism. Their survival in the short term, however, continues to depend on environmental politics—and ultimately on state action.

The extent of subsidies for forest conversion remains uncertain while the forest law is stalled in the legislature. Because the extent of forest clearing and the scarcity of old-growth forests are empirical questions without definitive answers, final action will probably be postponed until the forest survey is completed. Its eventual publication will give courage to one side or the other, but it cannot establish the trend or rate of clearing nor resolve Chile's environmental conflicts.

The forest survey will provide an essential empirical base for ecological land-use zoning but will not reconcile environmental and industrial values. The survey is likely to reveal where Chile's ancient forests still stand, but given the continued dominance of developmentalism, that knowledge may only accelerate their removal. In an ideal world, land-use zoning would protect ecological and cultural values and would designate only highly productive areas for intensive timber management. It is more likely to designate large areas of old-growth forest for subsidized conversion to tree farms. In that event, environmentalists may win only the concession that native species must be used as the new crop. The third and most likely path is political stalemate and continued delay. The perils of delay are already apparent: clear-cutting continues in the Valdivian rain forest while the polemic escalates.

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