J. W. GOTTSTEIN MEMORIAL TRUST FUND

The National Educational Trust of the Australian Forest Products Industries

TEMPERATE NATIVE FORESTS IN CHILE: MANAGEMENT, CONSERVATION AND FOREST PRACTICES

FRED DUNCAN

2006 GOTTSTEIN FELLOWSHIP REPORT

JOSEPH WILLIAM GOTTSTEIN MEMORIAL TRUST FUND

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Bill Gottstein was an outstanding forest products research scientist working with the Division of Forest Products of the Commonwealth Scientific Industrial Research Organization (CSIRO) when tragically he was killed in 1971 photographing a treefelling operation in New Guinea. He was held in such high esteem by the industry that he had assisted for many years that substantial financial support to establish an Educational Trust Fund to perpetuate his name was promptly forthcoming.

The Trust's major forms of activity are,

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Fred Duncan has worked as a botanist in New South Wales, Arnhem Land and Tasmania since graduating from Sydney University in 1975. His current position is Senior Botanist with the Tasmanian Forest Practices Authority, where he has worked since 1987. Much of his work involves incorporating research results and conservation requirements into Codes of Practice, planning tools and practical prescriptions that can be applied on the ground. This requires liaison with forest owners and managers, planners, researchers and field workers. Fred has studied Spanish for 5 years, in large part with the aim of developing better links with forest managers and researchers in Latin America.

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Temperate Native Forests in Chile:
Management, Conservation and Forest Practices

Executive Summary

This report discusses management, conservation and forest practices in Chile's temperate forests, and relates these to the situation in Tasmania's forests. Temperate forests in both places share a flora of Gondwanan origin and have many ecological attributes in common. There are also similar threads in their management and conservation, both of which have attracted a great deal of attention. Native forests are used for production of wood and other products, and are also important for the protection of soil and water values and biodiversity.

Native forests currently cover about 13.4 million ha of Chile – about 18% of its land area. Non-native forests, primarily plantations of *Pinus radiata* or eucalypts, cover an additional 2.2 million ha (3% of the land area). Native forests cover 3.2 million ha (45%) of Tasmania's land area and plantations cover 220,000 ha (3%). About half of Chile's pre-European (pre-1550) forest area remains, compared to about two-thirds of Tasmania's pre-1750 forest area.

In Chile, a single agency, the National Forest Corporation (CONAF), is primarily responsible for developing and implementing policies on land use and conservation, and regulating forestry activities. In Tasmania, such functions are performed by several agencies, with the Tasmanian Forest Practices Authority being primarily responsible for regulation of forest operations. National policies in Chile have been influenced by responsibilities under international agreements. There is strong support for industry certification from the Chilean government and forest industry, to ensure access to foreign markets.

Both Chile and Tasmania have a relatively high proportion of their forests in national parks and other formal reserves. 3.9 million ha (29%) of the current area (13.9 million ha) of Chile's native forest is reserved, much in upland areas and in the south of the country. This compares with forest reservation in Tasmania of about 1.5 million ha (46%) of its 3.2 million ha native forest estate. In both places, important areas of forest are also contained in private reserves. In Chile, many private reserves were acquired with external funds, and are managed by conservation organisations and research institutions.

In scenarios reminiscent of those in Tasmania, there are three main focuses for further conservation of forests in Chile: forests that have been extensively cleared and are poorly reserved (e.g. the sclerophyll forests and woodlands of central Chile); forests that have high biodiversity (e.g. Valdivian rainforest); and frontier forests (large tracts of relatively undisturbed forest in remote areas – similar to wilderness or oldgrowth forests in Tasmania). The wetter forests with high biodiversity and the frontier forests have most captured the interest of international environmental organisations. However, the less charismatic sclerophyll forests and woodlands are under more immediate threat of continued clearance and modification. Processes to achieve better protection of the range of forest communities and species are considerably more advanced in Tasmania.

There have been recent developments in Chile to identify and protect forest species and communities with a high priority for conservation. They include analyses of the distribution and conservation status of communities (with similarities to analyses associated with the Tasmanian Regional Forest Agreement); proposals for additional reserves; and the development of a National Biodiversity Strategy (approved in 2005). A review of the conservation status of Chile's fauna and flora has commenced – this will add substantially to the current out-dated listing of less than 140 threatened species. This compares with

Australia's current national list of 1688 threatened species, and the resource-draining 652 rare and threatened species that are listed under Tasmania's Threatened Species Protection Act.

Chile seems to be at a point, as was Tasmania in 1997 (when the Regional Forest Agreement was signed), when forest conservation and management is about to become much more complex. Significant challenges include developing incentives and agreements to protect areas on private land. Ratification of a law to encourage better protection, rehabilitation and sustainable management of native forest, which has languished in the Chilean Parliament since 1992 (in part because of opposition by agricultural interests to constraints on further conversion of drier forests in central Chile), is seen by many researchers and conservation organisations as a test of government resolve.

The standard of research on forest ecology and management in Chile is very high, with many researchers having a background in both subjects. There are active scientific societies, and complex partnerships connecting Chilean research institutions (universities and government) and other stakeholders, including international funding bodies. However, many researchers identified problems with transfer of research findings to government agencies (mainly CONAF) and incorporation of research recommendations into forest policy and planning. Ecological researchers in Chile seem to act as intermediaries between government agencies and conservation groups (some of whom have a deep mistrust of government).

Much of the research being undertaken in Chile is relevant to forest researchers and managers in Tasmania (and other parts of Australia) – this includes assessments of the wood production, silvicultural and biodiversity outcomes of alternative silvicultural systems in wetter forest types; dendrochronological studies into long-lived conifers; and research into forest hydrology and nutrient cycling.

The on-ground processes for regulating forestry operations in Chile have many similarities with those used in Tasmania. In Chile, Management Plans are required for logging or clearing forest on public and private land, and are usually prepared by accredited Forest Engineers. The Management Plans must be approved by CONAF staff, who may also audit operations on completion. Management Plans fulfil a similar function to Tasmanian Forest Practices Plans, which are prepared by Forest Practices Officers accredited by the Forest Practices Authority. Forest Practices Plans are required for logging and clearing forest on all tenures, and may also be audited by the Authority. As with the Tasmanian forest practices system, a fee may be charged by CONAF, depending on the size and type of operation.

Chilean Management Plans for native forest logging contain a great amount of silvicultural information, but treatment of other natural and cultural values (other than soil and water) tends to be cursory. There is a requirement that some biodiversity issues are considered – notably the occurrence of threatened flora or fauna. However, the processes used to cater for the presence of threatened species and other biodiversity values (e.g. threatened vegetation communities, habitat retention, dispersal of logging) are less rigorous than those required through Tasmania's forest practices system.

There was a great deal of interest in Chile about Tasmania's forests and forest practices system, including the Tasmanian Forest Practices Code and other planning tools, and the transfer of information (field data, research findings, training material and operational advice and prescriptions) between researchers, government agencies and industry.

Chilean researchers and forest managers have forged productive links with institutions and peers in Europe, North America and other parts of Latin America. There are many issues of mutual relevance to researchers, regulators and managers of Tasmanian and Chilean forests. Further liaison and collaboration on the biodiversity and sustainable management of our shared Gondwanan inheritance should be encouraged.

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Background

Sustainable forest management is an issue for forest managers throughout the world. Much of the world's production forests are located in Spanish-speaking countries. Despite dealing with common issues, there is little flow of information between Australian and Spanish-speaking workers involved in management of native forests.

I was fortunate to receive support from a Gottstein Fellowship and my employer, the Tasmanian Forest Practices Authority, to undertake a study tour to Chile and Argentina in November and December 2005. My project was to examine forest conservation and management and forest practices (particularly relating to biodiversity issues) in temperate forests, which have biogeographic and ecological links with Tasmania's wetter forests. Attention would be focussed on:

- Regulation of forestry operations on public and private land;
- Conservation and forestry operations in native forests, in the south of these countries, with affinities to Tasmania's wet forests;
- Research on forest ecology and biodiversity and incorporation of research results into forest management and planning;
- Trends, priorities and stakeholder attitudes about forest conservation and management.

The itinerary of the study tour is given in Appendix 1. Map 1 shows centres and sites visited in the course of my travels. I talked to people involved in many aspects of the forest industry – policy development, regulation, research, conservation and management. They included forest owners, managers and workers; staff of universities and government agencies; and members of conservation organisations. My contacts were invariably helpful and kind, on many occasions going out of their way to give me information and assistance. Appendix 1 indicates people and organisations who contributed significantly to my study tour.

There were many opportunities for exchange of information about the attributes and management of the temperate forests of Tasmania and southern Chile and Argentina. There was a lot of interest, amongst my hosts, in the ecology, management and conservation of Tasmania's forests, and in the operation of Tasmania's forest practices system. I gave eight presentations on these subjects to different interest groups and at public meetings. I also distributed a great deal of written material, which provided opportunities for discussion, as well as making room in my pack for similar volumes of material of South American origin.

There was never a possibility of gaining a comprehensive understanding of native forest management in Chile and Argentina – the issues are similar in variety and complexity to those in Tasmania (and Australia generally). My report concentrates on the temperate forests of Chile. There are several reasons for this. I spent less time in Argentina, and had less contact with the range of stakeholders that I met in Chile. In the case of research and field operations (silviculture and on-ground regulations) in temperate forests, the processes and issues in Argentina are similar to those in Chile – in fact, there is a great deal of exchange of information between people engaged in these fields. I have incorporated relevant information from my Argentinean experiences into the discussion about Chilean forests.

I have translated the names of most Chilean institutions and positions into their English equivalents. I am happy to provide readers with contact details of people and institutions mentioned in the report.

Most of my report discusses forest practices, management and conservation in Chile, and does not give comprehensive comparisons with the situation in Tasmania. Section 8 provides a more detailed overview of similarities and differences, and discusses possibilities for collaboration in the future.

Map 1: Location of sites visited during study tour in Chile and Argentina, in order visited. Most field surveys were undertaken on Sites 2, 3, 9, 10, 11 and 12. More details of the sites and activities are contained in the itinerary given in Appendix 1.

1. Introduction to Chile

1.1 Geography and government

Continental Chile has an area of about 755,000 km². It extends some 4,300 km from latitude 17º30'S to latitude 56º30'S. It averages only 160 km in width (maximum width of 400 km). 33% of Chile's land is publicly owned – this is concentrated in the north and the south of the country, where the terrain or climate are relatively inhospitable.

The great diversity of environments inherent in such a latitudinal range can be appreciated by considering Australia's eastern seaboard, which extends for a similar distance. Chile's longitudinal diversity is augmented by the remarkable east–west topographic variation that occurs from the coasts of the Pacific and Southern Oceans, through the broad plains and coastal ranges, to the towering Andes, which are the source of Chile's major streams, and form the western border of much of the country. Less obvious, but also important, are the influences on climate of ocean temperatures and currents. To these factors, are added the less predictable environmental effects of being located along one of the world's most enthusiastic tectonic belts.

Chile has a population of 15.5 million people. The country has a democratic government with a bicameral system – this was restored in 1990, following 17 years of military dictatorship under General Augusto Pinochet. This period had a profound effect on the psyche of the people, and on the economic development of the country, including (in very large part) the forestry sector.

Government and administration is centred in Santiago, the populous capital (5 million people and growing rapidly). The country is divided into thirteen administrative regions. Map 2 shows the location of regions in the southern part of the country. These regions have little autonomy compared to Australian states or the provinces of Argentina.

A single government agency, the National Forest Corporation (CONAF), is responsible for much of the regulation and policy development related to forest management in Chile. Regional offices of CONAF undertake much of the on-ground management and regulation of forest practices and conservation. In a Tasmanian context, most of the responsibilities of Forestry Tasmania, Forest Practices Authority, Private Forests Tasmania and the Tasmanian Parks and Wildlife Service would fall within CONAF's ambit. The National Commission for the Environment (CONAMA) is responsible for environmental and conservation planning and regulation and has close ties with CONAF. The regulatory system applying to Chile's forests is discussed in more detail in Section 4 and Section 7.

1.2 Vegetation

Continental Chile is isolated biologically in the north by the Atacama desert, to the east by the Andes, and to the south and west by oceans. The native vegetation within this area is diverse – it includes sparse desert vegetation, summer-dry scrublands, the puna occupying the dry cold steppes of the high Andes, the sclerophyll forests and woodlands of north-central Chile, and the temperate forests of its humid south (Map 2). There are also large areas of modified vegetation, the majority resulting from conversion of sclerophyll and temperate forests.

Chile's native flora comprises about 5,000 species of vascular plants. About half of the native species are estimated to be endemic to Chile – this proportion is expected for oceanic islands but unusually high for a continental area. By comparison, Tasmania has a vascular flora of about 1,850 native species (22% endemic).

Map 2. Map of the southern cone of South America showing occurrence of forest and boundaries of administrative regions in Chile (from Armesto *et al.* 1995)

The map shows the distribution of temperate forests (magenta) along the western margin of the continent. The sharp eastern boundary of the temperate forests is determined by the presence of the Andes Range, with maximum elevations from 1000 to 5000m. Semi-arid land barriers (brown) to the north (matorral) and east (steppe) and the location of the nearest tropical or subtropical forests (dark blue patches in upper part of figure) are also shown.

Inset: Map of Chile showing its six southern administrative regions.

Landscape in southern Chile: Snow-covered volcano near Villarrica, with rainforest in foreground.

2. Forest vegetation of Chile

Table 1 shows the current extent of forest cover in Chile. The table is from a national analysis (CONAF *et al*., 1999) undertaken by CONAF, CONAMA and researchers from three leading universities (University of Chile, University of Southern Chile, Catholic University of Chile). The analysis was part-funded by the World Bank, and has been integral to recent conservation planning in Chile.

Native forest currently covers about 13.4 million ha of continental Chile – about 18% of its land area. Non-native forest, primarily plantations of *Pinus radiata* or eucalypts, covers an additional 2.2 million ha (3% of the land area). Comparable figures from Tasmania are: native forest cover of 3.2 million ha (45% of Tasmania's land area) and plantation cover of 220,000 ha (3% of the land area).

Table 1: Area of forest in Chile. All forest classes have a cover (closed canopy) = 25% and a height = 2 m. Mature forest and mature/regrowth forest have a height = 8 m. Regrowth forest has a height or potential height = 8 m. Low forest has a maximum height of 8 m.

Forest class and use	Total area (ha)	Proportion of total forest area	Characteristics
NATIVE FOREST			
Mature forest	5,977,996	38.2	Undisturbed (oldgrowth) forests, generally heterogeneous in age and structure.
Regrowth forest	3,582,427	22.9	Predominantly regrowth forests, regenerating after natural or human-induced disturbance.
Mature-regrowth forest	865,525	5.5	Forest with an overstorey of mature trees, and dense regrowth, usually resulting from fire
Low forest	3,017,209	19.3	Low and slow-growing forests growing on unfavourable sites (e.g. high altitude, low temperatures, strong winds, aridity, poor drainage).
Total native forest	**13,443,157**	**85.9**	
NON-NATIVE FOREST			
Plantations	2,118,840	13.5	Areas of exotic species that were planted for harvesting – usually *Pinus radiata* or eucalypts.
Mixed forest	87,744	0.6	Areas of native forest co-occurring with plantations
Total non-native forest	**2,206,680**	**14.1**	
TOTAL FOREST	**15,647,742**	**100.0**	

2.1 Native forests

Arroyo *et al*. (1995) estimate that 850 to 900 species of vascular plants occur in Chile's forests (a similar number to Tasmania's vascular forest flora). Chile's forests have a relatively high biodiversity in the medial latitudes, with diversity decreasing substantially in more southern latitudes. There is a high proportion of endemic species – both flora and fauna. The latter include: 11 species of mammals, 24 species of amphibians, 5 species of reptiles, 13 species of birds, and 13 species of fish. Plant species of interest include: the Chilean palm (*Jubaea chilensis*), evergreen and deciduous species of *Nothofagus*, canelo (*Drimys winteri* – a primitive angiosperm of great significance to indigenous people) and two long-lived conifer species: araucaria (*Araucaria araucana*) and alerce (*Fitzroya cupressoides*) – the latter

species is important both for its timber and for its contribution to climatic research, with some individuals being dated at over 3,600 years (Lara and Villalba, 1993).

There are two major formations in Chile's forests. They are sclerophyll forests and woodlands located in the drier central regions of the country, and temperate forests found in the more humid environments of southern Chile (Map 2). The temperate forests are used for wood production, and were the main focus of my tour.

There have been extensive studies of the structure, composition and biogeography of Chile's forests (e.g. Donoso, 1981, 1993; Lara *et al.* 2000). The broad forest types given in Table 2 (from CONAF *et al*., 1999) are widely used in current analyses, reporting and broad-scale conservation planning (see Section 5). All but the first two forest types fall into the temperate forest category.

Table 2: Extent and characteristics of broad forest types occurring in Chile, based on the classification of Donoso (1981). The table is from CONAF *et al.* (1999). The arrangement of communities in the table approximates their distribution from north (sclerophyllous forest) to south (Magellanic coihue), though some communities (e.g. lenga forest) have a wide geographic range.

Forest type	Dominant species and key associated species	Area (ha) (% of area)
Sclerophyllous	Espino (*Acacia caven*), quillay (*Quillaja saponaria*), maitén (*Maytenus boaria*), trevo (*Trevoa trinervis*), guayacán (*Porliera chilensis*), and algarrobo (*Propopis alba*).	345,324 (2.6)
Chilean palm	Chilean palm (*Jubaea chilensis*) with litre (*Litrea caustica*), peumo (*Criptocarya alba*), boldo (*Peumus boldo*), maitén, and espino.	Minimal (<0.1)
Roble - Hualo	Roble (*Nothofagus obliqua*), hualo (*Nothofagus glauca*), peumo, maitén, quillay, litre, avellano (*Gevuina avellana*), and radal (*Lomatia hirsuta*).	188,323 (1.4)
Cordilleran Cypress	Cordilleran cypress (*Austrocedrus chilensis*), peumo, boldo, maitén, and quillay.	44,996 (0.3)
Roble-Raulí-Coigue	Roble, raulí (*Nothofagus alpina*), and coigue (*Nothofagus dombeyi*). These are mainly secondary forests or a mix of these three species with luma (*Amomyrtus luma*) and arrayán (*Luma apiculata*).	1,460,531 (10.9)
Lenga	Coigue, roble, araucaria (Araucaria araucana), ñirre (*Nothofagus antarctica*), and Magellanic coihue (*Nothofagus betuloides*).	3,391,552 (25.3)
Araucaria	Araucaria, coigue, roble, ñirre, canelo (*Drimys winteri*), and lenga (*Nothofagus pumilio*)	261,073 (1.9)
Coigue-Raulí-Tepa	Coigue, raulí, tepa (*Laureliopsis philippiana*), trevo, and olivillo (*Aextoxicon punctatum*).	563,519 (4.2)
Evergreen	Tepa, luma, canelo, and tineo (*Weinmannia trichosperma*).	4,148,669 (30.9)
Alerce	Alerce (*Fitzroya cupressoides*), Magellanic coihue, Chiloé coigue (*Nothofagus nitida*), prickly-leafed mañío (*Podocarpus nubigena*), tineo, and Guaitecas cypress (*Pilgerodendron uviferum*).	263,192 (2.0)
Guaitecas Cypress	Guaitecas cypress, Chiloé coigue, prickly-leafed mañío.	970,326 (7.2)
Magellanic Coihue	Lenga, tineo, prickly-leafed mañío, Magellanic coihue, and Guaitecas cypress.	1,793,098 (13.4)
Total		**13,430,603 (100.0)**

Many characteristics of the temperate forests are the result of prolonged isolation, and the great variation in topography and climate that occurs across their range (Armesto *et al*., 1995). Chile's temperate forests have been recognized by the International Union for Conservation

of Nature (IUCN) and the World Wildlife Fund (WWF) as being important for conservation at a global level. Chile's forests also play an important role in maintaining landscape or catchment values, including soil and water quality. Critics of current forest practices claim that there has been a lack of progress in achieving many of the recognised goals of sustainable management.

The flora of Chile's central and southern regions has biogeographic and ecological links with the flora of southeastern Australia and New Zealand, as a result of their shared connection some 65 million years ago, prior to the break up of the Gondwana supercontinent. Chile's temperate forests, in particular, have resonances with Tasmania's rainforests (695,000 ha) and wetter eucalypt forests (830,000 ha). They contain many families and genera that would be familiar to Tasmanian foresters and botanists. It was a great experience for me to see many components of this flora. They include (with Tasmanian common names indicated): *Nothofagus* (myrtle or beech), *Eucryphia* (leatherwood), *Aristotelia* (heartberry); *Gaultheria* (snowberry), *Lomatia* (guitar plant), *Pseudopanax* (fernbush), and *Drimys* (related to *Tasmannia* - native pepper). More primitive genera include *Podocarpus* (plum pine) and many ferns, including *Gleichenia* (coral fern), *Blechnum* (hard-fern or waterfern), *Histiopteris* (wet fern), *Hymenophyllum* (filmy fern), *Grammitis* (finger fern) and *Lycopodium* (clubmoss). Several herbaceous genera, often with a more cosmopolitan distribution, occur in both Tasmanian and Chilean forest environments.

As well as the variation in the distribution of species and vegetation types resulting from Chile's environmental heterogeneity, human influence has had a great effect on the distribution, composition and structure of its vegetation. The activities of indigenous people (Mapuche in the south of Chile) caused changes at a local level – or landscape level in the case of fires (Veblen *et al.* 2000*)*. Such changes, along with tectonic events, would have initiated successional processes with some affinities to those described for southwest Tasmania (e.g. Brown and Podger, 1982, Read *et al*; 1999).

More substantial changes to the extent, composition and structure of native vegetation were initiated by the arrival of Spanish conquistadors in the 16th Century, and the subsequent colonisation by Europeans. Principal agents of change to composition, structure and extent of native forest include extensive use of fire; clearing for agriculture; exploitation of timber and fuelwood for settlements, mining enterprises and export; browsing by domestic animals; and conversion to plantations of pine or eucalypt (particularly since the mid-1970s). Fire is still a significant factor: Neira *et al*. (2002) note that in the two decades prior to their report, an average of 13,660 ha of native forests was destroyed each year by fires, most lit by people.

Not surprisingly, the greatest changes in native forest cover and diversity are in the agricultural heartlands of central Chile; areas amenable to plantation development (in the central-south); and areas containing valuable mineral resources (in the north) or valuable timber (in the south). The current cover of native forest is about 50% of the extent of forest vegetation prior to European conquest. Some forest types and communities have been substantially modified, while others retain most of their pre-European extent (Section 5).

There are strong pressures, from within and outside Chile, to arrest the loss of native vegetation and change management practices. Much of this pressure is focused on its native forests. There have been many catalysts for recent changes to regulations and policies related to forest management and conservation. They include: requirements of international protocols and agreements; activities of researchers (particularly ecologists); support from some sections of the forest industry (partly because of certification requirements); and campaigns by local, national and international organisations.

2.2 Plantations

Forest laws in 1931 and (particularly) 1974 (Law 701) provided generous incentives for plantation establishment on public and private land in order to: ensure long-term supply of industrial timber and ensure industrial expansion; reduce pressure on native forests; improve soil and water conservation; and promote employment and social development in rural areas. Plantation expansion was also facilitated by land acquisitions during the Pinochet era; technical and scientific support from CONAF (created in 1972); and the development of efficient fire management programs.

There have been many critiques of plantation policies and the effects of plantation development in Chile (e.g. Clapp, 2001). Some researchers and conservation organisations consider that, although most plantations were located on areas cleared previously for agriculture, a high proportion were also established through conversion of native forest, including sites with threatened species, poorly reserved vegetation communities or other significant values. The success of the plantation programs in achieving social objectives and in protecting the physical environment has also been questioned.

Plantations (including areas of mixed forest – see Table 1) cover about 2.2 million ha – 14% of Chile's forest estate. Plantations of *Pinus radiata* comprise about 75% of this area. They are used for production of sawlog, roundwood, woodchips and pulp. Radiata pine plantations are typically managed on a 20–25 year rotation with an average yield of 20–30 m^3/ha. Eucalypt plantations are grown mainly for pulpwood, though there is an increasing quantity of sawn timber produced from this source. Rotation periods are similar to those of *P. radiata*, but higher yields are possible (25–40 m^3/ha/yr). Although *E. globulus* is the main species utilised, *E. nitens* is also grown (140,000 ha in 2005), and offers possibilities for sawlog production on a 15–20 year rotation for pruned trees. Plantations of blackwood (*Acacia melanoxylon*) and silver wattle (*Acacia dealbata*) have also been established.

Management of plantations was not a focus of my study tour. However, plantation policies and management have some relevance to conservation, structure and composition of native forests and native forest species. Reasons include:

- Substantial areas of native forest were cleared in the course of plantation establishment, and some areas of native forest continue to be cleared for plantations;
- Some forestry operations involve a mixture of harvesting plantation and co-occurring native forest species;
- The potential for plantation species (e.g. *P. radiata, E. globulus, A. dealbata* and *A. melanoxylon*) to invade native vegetation;
- Some conservation efforts and ecological research are being directed towards maintaining or increasing biodiversity in plantations. From discussions with Dr Javier Simonetti (Dept of Ecology, University of Chile), such research projects include:
  - Biodiversity of remnant forest in plantation landscapes;
  - Use of plantations by animal species (including threatened species);
  - Evaluation of different plantation management and harvesting techniques.

Species from Chile's temperate forests: Palo brujo (*Latua pubiflora*); lenga (*Nothofagus pumilio*); notro (*Embothrium coccinenm*); ulmo (*Eucryphia cordifolia*); *Blechnum penna-marina* (this species also occurs in Tasmania); chilco (*Fuchsia magellanica*).

3. The importance of the forest industry to Chile

It is impossible to travel in central and southern Chile without being aware of the importance of the forest industry. Travelling across Regions VII to X, one can see the vast expanses of plantations and, in some places, extensive areas of native forest. An armada of trucks cart logs and timber along the highways and back roads. Several ports boast piles of woodchips, logs and sawn timber, most destined for export. Along major roads, advertisements for chainsaws vie with those featuring attractive senoritas extolling the virtues of mobile phone companies.

In the plantation nodes, modern mills, cellulose plants and processing facilities do their business, their wood supplied by harvesting processes that would be familiar to most Tasmanian forest workers. Rows of pines and eucalypts cover vast areas – flights give an overview of their extent and the patterns of roading and logging operations. Even in Santiago, the forested hill parks of Cerro Santa Lucia and Cerro San Cristobal provide a reminder of the crucial role of exotic tree species in the Chilean economy, with naturalised Tasmanian species (notably *Eucalyptus globulus*, *Acacia dealbata* and *Acacia melanoxylon*) being amongst the most conspicuous trees in these urban "bushlands".

Some areas of native forest are also managed at an industrial scale. Native forest operations that I visited in the Temuco–Melapeuco–Villarrica area were comparable to those occurring in native forest in Tasmania, in terms of planning, equipment being used and standard of roads and landings. There are many Chilean forest species that provide timber for a range of uses. I went to two small to medium-size sawmills in Chile (one located within its own forest estate near Melapeuco, the other in the city of Castro on Chiloé) and was impressed with the layout of the mills and the high utilisation of products – veneer, sawlogs and briquettes of compacted sawdust for use in domestic heaters (in the Melapeuco mill).

In more remote areas, where land is often owned by small holders or Mapuche communities, forestry takes place at a steadier pace, using techniques in keeping with the scale of the operation and the resources of the forest owners. Tractors and yoked oxen are often used to extract timber – the latter being used to drag logs across some remarkably steep slopes. The main wood products include firewood and native species that are sawn in small mills – sometimes transient bush mills – for local use and lower grade timber, including railway sleepers [curiously, also called sleepers (durmientes) in Spanish]. Firewood accounts for about 80% of the wood harvested from some native forest (Lara *et al.*, 2003). Other native forest products include charcoal, and plants and fungi used for food, medicinal and craft purposes – some of these are also exported.

Currently the Chilean forestry sector is riding high. After mining (principally copper), it is Chile's biggest export earner. Figures from *Lignum: Bosque, Madera y Tecnologia* (the wood products journal of Foundation Chile, May 2005 – given to me by a fellow passenger on a bus from Puerto Montt to Chiloé) showed total exports of timber products worth almost $US273 million for January 2005 – an increase of 23% over the same period in 2004. Exports to the United States, principally furniture and sawn products, provided 68% of the export income. The biggest volumes of wood product exported comprised bleached pulp, major markets being China and Japan. The vast majority of export wood products are derived from plantations.

An important driver in forest industry development is the recognition, amongst the Chilean government and larger companies at least, of the desirability of certification to ensure access to foreign markets (particularly markets in Europe and North America). A government bofy, Foundation Chile, is an important facilitator of certification and also plays a role in developing standards and codes of practice. Many businesses have ISO1400l certification,

and there is a strong movement, by larger industry players, towards gaining PEFC and FSC certification. This has been enhanced by the recent decision of the British government with respect to its procurement policies. In April 2006, a comprehensive certification policy was released by Foundation Chile for public comment.

Despite the recognition by the larger industry players and the Chilean government of the need for a "sustainable" industry, there is considerable unease amongst many forest researchers, ecologists and conservation organisations about the commitment of industry and government to forest management that takes into account:

- Conservation priorities, including a representative system of reserves, protection of threatened species, and protection of "frontier forests" (i.e.) large areas of (relatively) unmodified forests;
- Physical environment (particularly protection of soils and water quality);
- Social factors, including the displacement of rural poor by mechanisation in the industry, and acquisition of traditional Mapuche lands (mainly in south-central Chile) by forestry companies in the Pinochet era;
- Effects of forestry operations on other industries, particularly tourism and aquaculture (the latter is one of Chile's major primary industries, and is concentrated in bays and estuaries that often have significant forestry activities in their catchments).

Some of these concerns were demonstrated in 2004 and 2005, as a result of effluent releases from a modern cellulose plant (pulp mill) into the Río Cruces, near Valdivia (Region X). This received national attention after thousands of black-necked swans (*Cygnus melanocoryphus*) died in the Río Cruces Wildlife Sanctuary (about 30 km downstream of the plant). The gravity of the releases was reinforced by the importance of the sanctuary and its swans for tourists visiting Valdivia, and the fact that the prestigious University of Southern Chile, located in Valdivia, has a strong research focus on forest ecology and management; hydrology and aquaculture. The causes and effects of the effluent releases, and the processes used by CONAF to investigate their magnitude, were still receiving a lot of media attention when I visited Valdivia in November.

On a more positive note, there are comprehensive systems of regulation for forestry operations in Chile, although biodiversity issues do not rank highly in the regulatory process. Implementation of a National Biodiversity Strategy (CONAMA, 2003), which was approved in April 2005, will assist Chile to achieve conservation goals (e.g. protection of high priority species and forest types) on public and private land (see Section 4.2.1).






Aspects of Chile's forest industry: Bullocks are often used to haul timber on small-holdings; edible fungi – common in *Nothofagus* forest; Boards of lenga (*Nothofagus pumilio*), Tierra del Fuego; Production of veneer from roble (*Nothofagus obliqua*); "Bush mill" in a forest managed by a Mapuche community near Melapeuco (south-central Chile); Use of timber in a Mapuche village near Nahuelbuta National Park.

4. Forest legislation and policies

4.1 Current forest laws

The first Chilean law restricting forest exploitation was passed in 1872, in response to concerns about large-scale burning and clearing of native forests (mainly for agriculture) and associated soil erosion and adverse effects on water quality. (Comparable legislation was also enacted in Tasmania in the 1870s). The effects of forestry activities on soil and hydrology have been major focuses of forest policy and legislation in Chile since then, and are an important consideration in current forest harvesting.

The 1931 Forest Law built on the 1872 law by prohibiting the felling of trees and shrubs within 400 m of water sources in the mountains and 200 m on flat terrain, and within 200 m of streams. It also prohibited logging on slopes over 45%; regulated the use of fire; and introduced regulations to create parks and reserves to ensure the survival of particular species and conserve the beauty of the landscape. It can be considered the first conservation-oriented forest legislation in Chile.

The Forest Development Law of 1974 (Law 701) has significantly influenced the direction of Chile's current forest industry, and its structure and regulation. A major intention was to provide subsidies for plantation establishment on degraded land (which often extended to conversion of native forest). Law 701 also specified that a Management Plan must be in place prior to the felling or exploitation of native forests or plantations and contains provisions for enforcement and penalties for violations. Management Plans are required for logging or clearing forest on public and private land, and must be drawn up by accredited Forest Engineers (or Agronomy Engineers). They have many similarities, in structure and function, to Forest Practices Plans required under the Tasmanian forest practices system. They are discussed in more detail in Section 7. There have been numerous changes and additions to Law 701 since 1974. In some ways, this law can be viewed as a (combined) analogue of Tasmania's Forestry Act (1921) and Forest Practices Act (1985).

Other national laws relevant to forest management deal with protection of threatened species and species identified as "national monuments". Currently seven species of plants are protected under these laws, including three iconic species: alerce (*Fitzroya cupressoides*), araucaria (*Araucaria araucana*) and ruil (*Nothofagus alessandri*). In the case of alerce, there are provisions for harvesting timber from dead trees of this species, leading to many instances of logging of living trees or the deliberate firing of living stands to allow the "legal" extraction of the timber. The species is very long-lived (specimens have been aged at 3,600 years) and is the subject of a substantial research focus (dendrochronological, genetic and ecological). This research has provided a scientific basis for CONAF to prosecute some firms and individuals responsible for illegal cutting. There are also other policies relating to threatened species of plants and animals – these are discussed in more detail in Section 4.2.

There have been significant changes to existing laws, and the development of proposed new laws and policies, over the last decade. Chile's ratification of several international agreements (e.g. Convention on Biological Diversity, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere and the Montreal Process) has been a catalyst for some of these developments. Other important factors include pressure from within and outside Chile to improve the conservation status and management of native forests. The implementation of the National Biodiversity Strategy (Section 4.2.1) will help achieve these objectives. The failure of the Chilean parliament to pass the Native Forest Law (which was

first drafted in 1992), gives an indication of the different perspectives of various stakeholders with an interest in management of Chile's forests (Section 4.2.3).

4.2 Recent and proposed legislation

Some recent and proposed legislation and policies that are relevant to native forest management in Chile are discussed below.

4.2.1 National Biodiversity Strategy

A National Biodiversity Strategy was developed by the National Commission for the Environment (CONAMA) in association with other parties (CONAMA, 2003). Development of the strategy followed similar processes to those used in preparation of the Tasmanian Biodiversity Strategy and the Tasmanian Regional Forest Agreement, and had similar proposed outcomes. It involved analyses of many facets of Chile's biodiversity, including the reviews of the extent and conservation status of forest types (CONAF *et al.*, 1999) described in Section 2.1. Submissions were invited from stakeholders with an interest in conservation and management of Chile's natural resources. The National Biodiversity Strategy was approved in April 2005 and has a detailed program of implementation (2005–2015). The main lines of action are to:

- Conserve and restore ecosystems, including important sites on private land. (*The 2003 CONAMA analysis of priority sites provides the initial goals*);
- Preserve species and genetic diversity, including reviewing the conservation status of Chile's flora and fauna. (*This has already commenced with the formation of a specialist group and changes to legislation*);
- Promote sustainable practices and maintain biodiversity on public and private land. (*The current review of certification and auditing systems is consistent with this objective*);
- Develop education and incentive programs, and systems of assessment (indicators and auditing);
- Encourage research into conservation and sustainable management of Chile's biodiversity. (*Research is being undertaken by several organisations*).

4.2.2 National Policy for Protection of Threatened Species

Threatened species management in Chile is primarily based on regulations pertaining to species which are "natural monuments" (Section 4.1) and occurrence of species on the IUCN Red List – these are based on a 1989 review by CONAF of the conservation status of Chile's flora and fauna. In 2006, 133 Chilean species were recognised as threatened (i.e. extinct, endangered or vulnerable) – 40 plant species and 93 animal species (Table 3). Occurrence of threatened species must be considered in preparation of Management Plans for forestry operations (Section 7).

Table 3: Summary of Chile's threatened species, as identified on the IUCN Red List (2006).

Group	Extinct or Endangered	Vulnerable	Total
Flora – confined to woody species; most endemic to Chile	20	20	40
Fauna – mainly mammals, bird, amphibians and freshwater fish	34	59	93

This number is very low (even taking into account that only trees and shrubs are included in the list of threatened flora species) when one considers the great range of environments in Chile, and the extent of modification to Chile's vegetation. [For comparison, 466 species of plants (183 threatened; 283 rare and at risk) and 186 species of animals (85 threatened; 101 rare and at risk) are listed on Schedules of the Tasmanian Threatened Species Protection Act, and require consideration if they will be affected by development activities, including forestry operations. At a national level, 1688 species (393 fauna, 1295 flora) are listed as threatened on the Environment Protection and Biodiversity Conservation Act, administered by the Australian government's Dept of the Environment and Heritage].

A National Policy for the Protection of Threatened Species was approved in December 2005, in line with the goals of Chile's National Biodiversity Strategy. The policy acknowledged the threat to Chile's biodiversity from past and continuing threats, including conversion and instances of non-sustainable logging of native forest. The policy also identified several lines of action, including :

- Reviewing the conservation status of Chile's fauna and flora, using results from scientific research and surveys; and
- Increasing support for protecting threatened species through incentives, education, recovery actions, mitigating threats and encouraging research.

The review commenced in 2005 under the auspices of a scientific committee, and used IUCN guidelines and comparable systems of analyses to assessment processes used in Australia (though 35 species were accepted as threatened without such analyses – they included the peregrine falcon (*Falco peregrinus*); the puma (*Puma concolor*) and several other species of felines; two species of fox (*Pseudalopex* species); and three species of deer, amongst them the pudu (*Pudu pudu* - probably the world's most easily remembered scientific name). Plant species included ruil (*Nothofagus alessandri*) – a species with a very restricted distribution in central Chile. As mentioned previously, some iconic species of plants (e.g. alerce, araucaria) are protected because of their status as "natural monuments."

The current review of the conservation status of Chile's fauna and flora is due for completion in 2010. There is no doubt that the number of listed species will be much higher than in CONAF's 1989 review. The status of species listed as a consequence of the current review will presumably need to be considered in Management Plans for forestry operations (Section 7). The need to develop mechanisms to manage the species (e.g. by developing prescriptions) is foreshadowed by the National Biodiversity Strategy and the Threatened Species Policy. There is good information available in Chile for some threatened species (e.g. Hechenleitner *et al.*, 2005 for Chile's central-south), and the new policy is likely to stimulate research into the ecology, distribution and management of listed species.

In its approach to management of threatened species in production forests, Tasmania uses an adaptive management approach involving a high level of consultation with threatened species specialists, to take account of policy requirements for threatened species management (see Appendix 2). Forest owners and managers are also frequently involved in active research and management into threatened species. However, the number of species listed under Tasmania's Threatened Species Protection Act – currently 186 species of animals (85 threatened; 101 rare and at risk) and 466 species of plants (183 threatened; 283 rare and at risk – representing about 23% of Tasmania's vascular flora) has the potential to drain limited resources. A review of listed species (distribution and threats) may allow resources to be used more effectively.

4.2.3 Proposed Native Forest Law

A Native Forest Law (strictly, the Law of Forest Restoration and Development) was drafted in 1992, with the aim of providing better protection to native forests by constraining further clearance, and by providing landowners with incentives (subsidies and advice) to retain and manage their forests. The failure of the Chilean parliament to pass the legislation in the subsequent 14 years is a function of the changing circumstances and agendas of many different stakeholders.

The law has been through several iterations since 1992. However, in recent years at least, several stakeholders on different sides of the forest management fence (government agencies, forest industry, researchers, conservation organisations) have worked cooperatively to achieve consensus or compromise on several issues. In 2003, Fernando Raga, national vice president of CORMA (the major Chilean Forest Industry Association) wrote of industry's hope that the bill would be soon passed (Raga, 2003) – in part because the law would assist industry to achieve desired standards of certification. In the same year, a major meeting of leading forest researchers in Valdivia, with the backing of four major scientific societies, produced a document (Lara *et al.,* 2003) that also supported passage of the Act (primarily because of their concern about ongoing native forest management and its effects on biodiversity, hydrology and other values) – providing that several perceived shortcomings were addressed. These related mainly to threatened species; threatened forest and woodland vegetation in drier regions; and more consideration of environmental values and reforestation of native species in Management Plans. Some of these concerns have been subsequently addressed in the National Biodiversity Strategy.

Despite guarded optimism that the hard-won accords would result in passage of the bill, it was not ratified by Congress. From discussions with several parties (government, researchers, forest industry, conservation organisations), the major sticking point is the resistance, by agricultural interests, on controls on clearance of the forests and woodlands of central Chile – particularly the poorly reserved and extensively cleared drier (sclerophyll) forest types, which have a very high priority for conservation. Expansion of the export market for products such as citrus fruit, avocados and wine, have increased pressure on many remaining forests and woodlands, which often occupy dissected terrain. Use of terracing and massive irrigation pumps has facilitated the ongoing replacement of such stands by orchards and vineyards, even on remarkably steep, dry slopes. Currently, clearing of such vegetation is generally approved by CONAF, providing that soil and hydrology requirements are met in Management Plans (see Section 7). The Native Forest Law will provide much greater constraints on clearing of forests and woodlands occurring in the central regions, and in particular the sclerophyllous vegetation types.

Meanwhile, the impasse continues. The adoption of the National Biodiversity Strategy, changes to threatened species lists and processes, and implementation of schemes to encourage landowners to protect priority vegetation and species, may see some of the objectives of the Native Forest Law being achieved by other means. Political support for its passage may increase (or resistance to its passage may weaken) with the recent election (December 2005) of the centre-left government of Dr. Michelle Bachelet.

Forest legislation and policies: Sclerophyll forests in Chile's drier regions have been extensively cleared and have a high priority for conservation; Establishment of orchards and vineyards continue to threaten drier forests; Araucaria (*Araucaria araucana*) is listed as a protected species – its nuts are also a valuable food for Mapuche people; Forest ownership is a source of conflict in some areas of southern Chile – this stencil says "From the forests we will rise like trees – We are river, sun and wind – Freedom to the Mapuche political prisoners"; Posters for candidates in the Chilean election (December 2005) – the return of a moderate left government may result in ratification by parliament of the Native Forest Law (introduced in 1992); Black-necked swan (*Cygnus melanocoryphus*) – thousands died from effluent released from a cellulose plant in 2004 – focusing national attention on the industry.

5. Forest conservation

In some respects, Chile has been a front-runner in conservation in Latin America, with 13.9 million ha (23%) of its land area formally reserved in National Parks or other protected areas. The National System of Protected Areas on State Land (SNAPSE) has been the principal tool to conserve biodiversity in Chile. Currently, 3.9 million ha of forest (28.9% of the native forest area) are contained in SNAPSE – primarily in National Parks and Regional Reserves managed by CONAF. In Tasmania, about 1.5 million ha of native forest (about 46%) is located in formal reserves.

Over the last decade, a rigorous analysis of forest reservation and development of priorities has taken place, in response to pressures from many different sources, within and outside Chile (including Chile's commitment to the UN Biodiversity Convention). There are striking parallels with analyses and processes that have occurred in Tasmania (and Australia generally) over a similar time period.

5.1 Analyses of forest reservation and priorities

The mapping and analyses of native vegetation in Chile (CONAF *et al.*, 1999 – see Section 2) provided a quantitative basis to analyse the reservation status of Chile's forest and non-forest vegetation. The process followed has many parallels with analyses connected with the 1997 Tasmanian Regional Forest Agreement.

The distribution of different forest types within the 3.9 million ha of reserved native forest nis far from representative (Table 4). Forest types occurring at higher altitudes and in the most southern regions (XI and XII), notably forests dominated by Magellanic coigue and Gauitecas cypress, have the highest proportion in reserves. Also relatively well-reserved are araucaria and alerce forests – dominated by iconic species that are protected by law. Generally, low forests and mature forests are proportionally well-reserved.

Table 4: Occurrence in reserves (SNAPSE) of different broad forest types. The analysis is from CONAF *et al.* (1999), and is based on forest types classified by Donoso (1981, 1993).

Forest type	National area (ha)	Area in SNAPSE (ha)	Percentage of national area in SNAPSE
Sclerophyllous	345,324	6,836	2.0
Chilean palm	minimal	minimal	
Roble - Hualo	188,323	886	0.5
Cordilleran Cypress	44,996	2,866	6.4
Roble-Raulí-Coigue	1,460,531	40,796	2.8
Lenga	3,391,552	561,091	16.5
Araucaria	261,073	122,709	47.0
Coigue-Raulí-Tepa	563,519	95,052	16.9
Evergreen	4,148,669	1,424,975	34.3
Alerce	263,192	46,238	17.6
Guaitecas Cypress	970,326	678,380	69.9
Magellanic Coihue	1,793,098	906,052	50.5
Total	**13,430,603**	**3,885,882**	**28.9**

The trends given in Table 4 are reinforced by analyses (not presented here – see CONAF *et al*., 1999) of forest extent and reservation by administrative region; and the separation of forest types into subtypes [these would correspond to the level of community differentiation used in the Tasmanian Regional Forest Agreement and the current Tasmanian vegetation mapping program (Harris and Kitchener 2005)]. Within some broad forest types, there is disproportionate representation in reserves of some component subtypes: for example, the Coihue de Chiloé subtype comprises the vast majority of the 1,424,975 ha of Evergreen forest type that is reserved. At the other end of the scale, the Olvillo del Norte subtype is in desperate circumstances – confined to the much-modified central regions (IV and V), where it has a total area of only 1,224 ha. Forests in the central and northern regions have been substantially cleared for agriculture and settlement, and provision of fuel and timber for mining and other industries. No forest was mapped in Chile's two driest regions (II and III) – the small ribbons which once flanked watercourses and depressions now survive only as battered and scattered remnants. Three of the central regions (IV, VI and VII) each have less than 1% of their current native vegetation in SNASPE.

Chile retains about half of its pre-1550 forest cover, based on analyses of change in forest cover in Regions VII–XI by Lara *et al*. (2000) and my interpretation from current forest cover in other regions. As with Tasmania (which retains about two-thirds of its pre-1750 forest area), many of Chile's poorly-reserved forest types have been extensively cleared and occur mainly on private land – they are also often associated with the presence of threatened species. On sites amenable to agricultural development, as discussed in Section 4, there is continued pressure to convert forest and woodland communities that occupy only a small proportion of their pre-1550 extent. Current legislation and processes have limited capacity to constrain this attrition, and there appears to be little commitment by government to provide incentives to landowners to protect these vegetation types. However, other circumstances have resulted in significant reservation of forest on private land in Chile (see Section 5.2).

In Tasmania, over the last 25 years there have been various programs operating that were designed to achieve better reservation and conservation of the range of forest (and non-forest) communities and species. These programs included establishment of reserves on public land through the Recommended Areas for Protection Program (North *et al*., 1998) and the 1997 Tasmanian Regional Forest Agreement (RFA); and establishment of reserves on private land, mainly through incentives offered through the RFA-initiated Private Forest Reserves Program. The RFA and subsequent policies also placed constraints on continued conversion of threatened forest communities or areas containing threatened forest species. These constraints are exercised through the Tasmanian forest practices system.

My discussions with many people in Chile (from a range of backgrounds – government agencies, foresters, forest owners and managers, researchers, people in NGOs) suggest that the analyses and ongoing debate about forest conservation have delivered three main thrusts for further protection and conservation management. Different stakeholders accord greater value to particular directions, though there are degrees of overlap. The situation has obvious parallels to the ongoing debate about conservation priorities and direction in Tasmania. The main thrusts for further protection of native forest in Chile are:

- Protection of poorly reserved and extensively cleared communities, such as the drier sclerophyll forests and woodlands, which are associated with many threatened species. These forests are not very important for the production of wood products, but their terrain is under pressure for agricultural development, particularly establishment of orchards and vineyards. Large areas of these forests are degraded and have significant land management issues.

- Protection of forests with high biodiversity, and frequently with high aesthetic and conservation values (such as the Valdivian rainforest – a component of the Evergreen forest type);
- Protection of forests which occupy large and relatively undisturbed areas, mainly in remote parts of southern Chile (e.g. Tierra del Fuego). These forests (often called frontier forests) are typically mature, and correspond to oldgrowth and wilderness forests in Tasmania. Most forest types forming the frontier forests are relatively well reserved. The strongest calls for protection of such forests come from North American-based groups (Neira *et al.*, 2002).

As in Tasmania, debate about conservation priorities and implementation has been marked by a mixture of cooperation and disagreement. In Chile, there is consensus amongst researchers and many conservation groups that production of timber and other wood products can be compatible with conservation of forest values.

5.2 Future pathways for forest conservation

The implementation of the National Biodiversity Strategy, and ratification of the proposed Native Forest Law, would provide greater protection to Chile's priority forest and woodland communities. This would be achieved by:

- Identifying forest types; communities and species with a high priority for conservation or protection;
- Establishing target areas and potential sites for conservation on public and private land;
- Providing incentives and advice to landowners to encourage conservation-oriented management;
- Providing and enforcing greater controls on clearance.

A similar approach has been adopted in Tasmania, using a combination of policy enacted through its forest practices system, and incentives and advice offered to landowners through programs like the Private Forest Reserves Program and the Commonwealth–Tasmania Community Forest Agreement.

The Native Forest Law has had a rocky road through Chile's Parliament, since it was first introduced in 1992. Despite constructive dialogue between some of the major stakeholders (forest industry, researchers and conservation NGOs) and changes to its wording, the bill remains unpassed, apparently because agricultural interests are concerned about controls on agricultural clearing.

Chile's National Biodiversity Strategy was approved in April 2005, providing goals for conservation planning. IUCN standards were used to establish reservation targets – a minimum 10% of current area for forest (and non-forest) types. CONAMA had carriage of a program to identify priority areas to add to the system of protected areas in Chile. 311 potential sites were identified across the 13 regions, based on priorities for community reservation (to achieve the IUCN targets), but also considering other factors such as locations of threatened species and potential of sites to support other uses and values (e.g. education, research, tourism, landscape and water protection, linkages to other natural areas). Public submissions were invited, after which CONAMA winnowed the 311 sites to 72, which were considered to be achievable in the short- to medium-term. Most of the sites are on public land, and are relatively uncontroversial.

The process and final selection of sites were criticised by researchers from different centres, who pointed out short-comings (e.g. the inevitable problems with vegetation mapping) and

claimed that expert opinion had been ignored or over-ruled for political or other reasons. (It is likely that criticisms were also received from the other side of the forest management fence, but they were not mentioned to me). Recommendations and time frames to develop a comprehensive network for biodiversity conservation were subsequently prepared by a scientific committee (Lara *et al.*, 2003), and supported by four Chilean scientific societies.

33% of Chile's land area is public land – this is concentrated in the north (where there is very little forest) and the south of the country. In Chile, even more than in Tasmania, effective conservation will require successful outcomes on private land. In some regions, this will be complicated by confusion and conflict about land ownership and existing forest agreements, particularly in areas with a large indigenous population.

Successfully engaging with private landowners will require a range of approaches and incentives, if a comprehensive and representative system of forest reservation and conservation is to be achieved. However, conservation on private land has a long history in Chile, though, until recently, its focus has been more on protection of more charismatic forest areas, and the "frontier forests" of more remote areas. Individuals and organisations from Chile and other countries have been acquiring and managing private land for preservation of flora, fauna, landscape or other values for decades. In 1994, the Chilean parliament passed a law to encourage the creation of Private Protected Areas (ASPP), with areas being certified by CONAF into three categories or levels, which vary from total protection to limited utilisation of resources (compatible with conservation objectives) – this may include hunting and extraction of timber and non-wood products. The regulation specifies that certified ASPPs have a "lifespan" of not less than 25 years, and an agreed plan of management (developed by the owner in conjunction with CONAF).

Areas of private land that are currently certified as ASPPs include:

- The Senda Darwin Biological Research Station – an area of 120 ha located in coigue forest on the island of Chiloé. The station is managed by the Centre for Advanced Studies in Ecology and Biodiversity through the Catholic University of Chile.
- San Pablo de Trega – an area of 2200 ha of diverse Coigue – Raulí – Tepa forest northeast of Valdivia, owned by the University of Southern Chile.

The management objectives of both properties include:

- To protect communities and species with a high priority for conservation;
- To foster collaborative ecological research;
- To integrate conservation of biodiversity and sustainable use of natural resources (including timber harvesting);
- To educate the public and local community.

It is worthy that these areas were the first ASPPs certified. Scientists of both universities have an international reputation and incredible enthusiasm for ecological research, particularly relating to forest processes (from species to landscape levels), and have been significant catalysts for sustainable management and conservation of Chile's biodiversity.

There are much larger properties than the Senda Darwin Biological Research Station and the San Pablo de Trega properties that are being managed primarily for conservation purposes. Some of these are candidates for ASPPs certification, while others, for various reasons, are unlikely to seek it in the foreseeable future.

Three large private reserves in south-central Chile are worth discussing in more detail, as they have had unusual origins, and illustrate different circumstances and approaches to conservation on private land in Chile.

Parque Pumalín

Parque Pumalín protects 270,000 hectares of Valdivian temperate rainforest in Region XI (to the south of Puerto Montt). It was established by US conservationist Douglas Tompkins (founder of Esprit clothing) over the last three decades, by progressively purchasing contiguous areas of private land through his California-based Conservation Land Trust. The Trust also owns another 90,000 ha of land, mainly rainforest. The park is used for a variety of purposes, including ecotourism. The concept and actuality of Parque Pumalín has generated considerable controversy. One reason is its foreign ownership (though Tompkins intends to donate the land to a Chilean foundation). Another is that the location of the park, stretching from the Argentine border and to the Pacific Coast, has stymied long-held plans to build a highway through the property, which would provide access to large unroaded areas and eventually the Carretera Austral (Southern Highway) to the south of the park.

Parque Pumalín also inspired Sebastián Piñera, a leading Chilean businessman and conservative politician, to purchase 115,000 ha of forest on Chiloé Island and develop the property for ecotourism.

Karukinka Reserve (Tierra del Fuego)

The history of the Karukinka Reserve is a good example of conflicting attitudes to forest use in South America. In 1994, Trillium Corporation, a large American forestry company based in the Pacific Northwest, purchased 625,000 ha in the Chilean sector of Tierra del Fuego (and a further 185,000 ha in the Argentinean sector of the island). Trillium's intention was to log the lenga (*Nothofagus pumilio*) forest which formed a large part of its holding. The company announced that the harvesting would be for sawn timber only, and would be conducted in a sustainable manner using shelterwood systems, and with environmental standards above those required by Chilean regulations. The company enlisted the support and advice of foresters with respected environmental credentials, including Professor Jerry Franklin of the University of Washington and Claudio Donoso of the University of Southern Chile. The project, with its promise of boosting employment in this remote area, was also supported by the Chilean and regional governments.

The project was opposed by national and international environmental interests, including Douglas Tompkins of Parque Pumalín fame. It was halted in 1996 when a Chilean court upheld an appeal against the government's approval of Trillium's Environmental Impact Statement. The company ran into financial difficulties, and in 2002 investment banking firm Goldman Sachs acquired the loans that had backed the project – and with them the property itself – as part of a package of distressed debt. Two years later the firm donated the land to the Wildlife Conservation Society (WCS) of New York. As part of the arrangement, Goldman will provide a further $12 million and funds will be also be raised independently by WCS. The initial management priority is to contain the beaver (*Castor canadensis*), which was introduced to Tierra del Fuego in 1946, and has subsequently run amok, causing extensive damage to trees and riparian systems on the island (adversely affecting about 7% of the forests in some areas, and 3% overall).

Reserva Costera Valdiviana

In 2003, a US-based conservation organisation, The Nature Conservancy, with the financial and technical support of the World Wildlife Fund (WWF) and other national and international organisations, bought 59,700 ha of land on the Cordillera de la Costa (Coastal Range) south of the township of Corral (a timber and woodchip exporting port on the estuary of the Rio Cruces). The land was purchased from a bankrupt timber company and comprised 83% Valdivian rainforest (Siempreverde forest type) and alerce forest, 7% eucalypt plantation and about 35 km of Pacific Ocean frontage. It is one of the 72 sites identified in the National

Biodiversity Strategy. Currently, the University of Southern Chile is undertaking detailed digital imaging and mapping, to assist with management planning. Apart from conserving forest of very high conservation value and endemic species richness, the reserve will provide work and skill development projects for local Mapuche communities, and opportunities for research. Ironically, highway construction was also proposed, and had in fact commenced, through the rainforest now within the reserve (and forest to its east and south) – the future of the highway is currently under review (see Section 5.3).

5.3 The role and perceptions of conservation organisations

Local, national and international environmental organisations (NGOs) have played an important role in raising public and political awareness of conservation issues in Chile, especially those relating to forests. There are many active groups, with a spectrum of interests and shades of green, and a wide range of approaches to getting their message across and implementing their agendas.

There are many working relationships between groups, and (to some extent) with ecological researchers, landowners and local communities. Links to government agencies generally seem to be poorly developed and sometimes antagonistic, though (in Valdivia at least) active working groups involving environmental organisations, researchers, landowners, local communities and CONAF officers have been established to manage and protect stands of alerce in this region.

It is worth mentioning that my NGO contacts were not totally opposed to forestry activity in native forests, and the concept of sustainable use seemed to be well accepted. This included the need to reserve representative examples of different forest types, and to protect forest types, habitats, landforms and species that were susceptible to disturbance.

One of the high profile conservation issues in recent years, which has ramifications for the Reserva Costera Valdiviana, was the campaign to stop construction of a coastal highway through about 200 km of rainforest south of Valdivia, including forest that is now protected in the recently established reserve. Construction commenced in 1994, and was opposed locally by the Coalition for the Conservation of the Coastal Range and Mapuche communities, as well as national and international conservation groups, including World Wildlife Fund. Despite having made significant progress along the route, the government has agreed to halt proceedings to allow further assessment of environmental values and consider alternatives to the current route.

Environmental groups see roads as a very significant issue in Chile. Apart from the direct effects of constructing major roads through forests (e.g. erosion and potential threats to habitat, scenic values and water quality), there is ample evidence that roads either overtly or covertly provide access to timber and other resources, and are a major contributor to land use change at local and landscape levels, as a result of clearing, firing or otherwise modifying native vegetation.

Publications produced by some groups, including WWF and Defenders of the Forests, are of very high quality, often having input from well-credentialed researchers, and providing factual and accessible information about forest species, ecology and processes (as well as promoting conservation-oriented actions).

The WWF is undertaking other forest-oriented projects in south-central Chile, including elsewhere on the Cordillera de la Costa, the Cordillera Nahuelbute, and the Coastal-Andean corridor. Projects often involve partnerships with researchers and other groups (including Parques para Chile – Parks for Chile, a group initiated by University of Southern Chile). They are frequently supported by funds obtained from the public, private sector (including

forestry companies) and international bodies. The latter includes the Global Environment Fund – an independent financial organisation, with links to the World Bank and United Nations programs, which provides grants to developing countries for environmental and community-based projects, including many programs in South America. WWF projects include working with private landowners, local communities and government agencies to manage, restore and protect important areas of remnant forest and stands of alerce; developing standards, criteria and strategies for private protected areas (currently about 150 under consideration); and promoting the value of environmental services (e.g. water quality) provided by careful management of native vegetation.

Conservation groups, including WWF and Defenders of the Forest, provided input to the National Biodiversity Strategy, but representatives of many NGOs were critical that many comments and recommendations made by conservation interests had been ignored.

Discussion about the Biodiversity Strategy provide a catalyst for many criticisms of the activities and attitudes of the culture and staff of CONAF and CONAMA, in their role as environmental (particularly forest) managers and regulators. Researchers (who tended to be less critical than spokespeople from NGOs) indicated that one of the problems was inadequate engagement and information flow between university-based scientists (at least in the ecological field) and government staff. The coming decade is likely to provide a lot of opportunities for constructive dialogue – they include the implementation of the Biodiversity Strategy; the challenges of integrating ecological information and principles into resource use in native forests; and the desire of the Chilean timber industry to be recognised and certified for its commitment to sustainable forest management.

The main grounds for criticism of government agencies included:

- CONAF has too many functions leading to significant conflicts of interest (particularly in its role as a manager and protector of natural resources);
- A lack of appreciation of the medium- and long-term impacts of some forestry activities at ecosystem and landscape levels (e.g. loss of biodiversity, accelerated erosion rates, deterioration in water quality and the health of affected communities and industries);
- CONAF (and possibly CONAMA) have too many people with a forestry background in high level positions, and insufficient representation of biologists and ecologists. This has resulted in a pro-development mind-set and a lack of acceptance and promotion of "alternative" land use possibilities (e.g. ecotourism, utilisation of non-wood products and small-scale enterprises);
- CONAF and CONAMA are not sufficiently staffed, funded or motivated to discharge their responsibilities – this is often exacerbated by low levels of pay;
- Different and inconsistent approaches taken by CONAF staff in different regions;
- Insufficient commitment to monitoring forestry operations and law enforcement (e.g. illegal logging of alerce);
- There is a lack of environmental will or interest at a political level, which is a significant contributor to all of the above.

Most of the people who made these comments also mentioned that there are dedicated people working in CONAF and CONAMA, both in the regions and Santiago. There was also recognition that there are significant barriers (apart from the staffing and funding issues) that hamper the efforts of CONAF staff in the field – they include problems with access and

unresolved land tenure issues in some regions, such as ownership claims by Mapuche communities and individuals).

The 14 year delay in passing the Native Forest Law was seen as a demonstration of lack of political will to bring in meaningful changes to protect native forest. This is probably a simplification of the situation – there have been many opposing forces that have stymied the passage of the legislation at different times. However, some conservation organisations support the passage of the proposed bill, despite what they perceive to be short-comings.

The paucity of subsidies and other support to encourage conservation management and formal protection of private forest land was also seen as an indication of insufficient commitment to forest conservation, particularly as the forest industry, over the last few decades, has benefited from substantial support from government, including technical and financial support for clearing native forest for plantation establishment and agriculture. At the same time, there were comments that conservation was unlikely to be a major priority for government when health, education and other social programs were of more immediate concern to much of Chile's population.

Aspects of forest conservation: Forest dominated by alerce (*Fitzroya cupressoides*) – a long-lived and vulnerable species of conifer: Pudu (*Pudu pudu*) – vulnerable species of deer; Lenga (*Nothofagus pumilio*) forest, Torres del Paine NP – myrtle wilt does not infect Chilean species of *Nothofagus* following marking or mechanical damage; Bridge leading to Senda Darwin Research Station, a private reserve on the Island of Chiloé; Entrance to Nahuelbuta National Park, where a disjunct population of araucaria (*Araucaria araucana*) is reserved; Fire has devastated large areas of Chile's temperate forests.

6. Native forest research

There is a strong record of research into Chile's native forests, both silvicultural and ecological (including related fields such as botany and zoology). Researchers such as Mary Kaitlin Arroyo (e.g. Arroyo, 1995) have undertaken significant studies into the ecology and distribution of forest species. Claudio Donoso of the University of Southern Chile is revered for his work on the ecology of its temperate forests (e.g. Donoso 1981, 1993). His classifications of forest types and communities form the basis for current assessments of forest conservation requirements (e.g. CONAF *et al.*, 1999; CONAMA, 1993). Research into native forest silviculture also has a long history, much of it rooted in German forestry traditions.

I have treated "ecological research" and "silvicultural research" separately below. However, there is a lot of overlap between practitioners and researchers in these fields – perhaps more so in Chile than in Australia. Many people working as forest engineers, silviculturalists and researchers in the forest industry (private companies and government bodies such as CONAF, INFOR and Foundation Chile) undertook undergraduate or post-graduate ecological studies. Many people working in ecological or conservation fields (e.g. in CONAF or CONAMA) graduated as forest engineers, including Claudio Donoso. There is collaboration between silvicultural and ecological researchers at several institutions in Chile and Argentina. Native forest silviculturalists I met from the Dept of Forestry at the University of Chile had a very good knowledge and appreciation of forest ecology.

6.1 Ecological research

I talked with leading researchers (botanists, zoologists, ecologists) and members of research teams from the University of Chile (Dr. Javier Simonetti); University of Southern Chile (Dr. Antonio Lara) and the Catholic University of Chile (Dr. Juan Armesto). All were passionate about Chile's forests. There is a strong focus on integration of research results from a range of fields – they include flora; fauna; forest dynamics and ecology; the role of forests in hydrological systems and nutrient cycling; fire/vegetation relationships; and ecological and dendrochronological studies into the long-lived Patagonian conifers: alerce, araucaria and Guaitecas cypress.

There are strong networks between the various ecological research institutes in Chile and Argentina. Scientific societies, such as the Chilean Society of Ecology and Society of Botany, have active memberships. There is a clear commitment to disseminating research results through scientific publications and meetings. Ecological researchers are also active in community-based education campaigns, in an attempt to better integrate ecological principles into logging and other native forest land use; to encourage rehabilitation of degraded forest; and to manage and protect sites containing species or communities with a high priority for conservation.

Some of the funds for research and extension activities come from external sources – often from Europe and North America. Examples include support for field stations near Valdivia (University of Southern Chile) and on the island of Chiloé (Catholic University of Chile). These field stations have also been designated as private reserves – see Section 5. Other private reserves (e.g. Parque Pumalín) also offer research opportunities. There is a regular flow of graduates and students from the United States, Canada and Europe (particularly Germany), who take advantage of the research possibilities in Chile's temperate forests. There is also a flow of Chilean researchers in the other direction, with many scientists from Chile and Argentina undertaking postgraduate studies in other countries. Not surprisingly,

there is a great deal of collaboration and interchange of ideas and information that results from these interactions.

Some Chilean ecologists were working closely with government agencies (e.g. INFOR, CONAMA) and industry on biodiversity projects in native forests and plantations. Most ecologists I talked to were critical of some aspects of current management of native forests in Chile, though there was a general acceptance that advances have been made in the last few years. Their major concerns included:

- The delay in passage of the Native Forest law, and their perception of shortcomings in the proposed bill (e.g. in relation to provision of incentives to maintain and restore native forest, and inadequacy of constraints on continued conversion).
- The lack of commitment by government (CONAF and CONAMA) in identifying and protecting important forest conservation values – most recently in CONAMA's initial analysis of priority sites identified in the course of developing Chile's National Biodiversity Strategy;
- Inadequate auditing of Forest Management Plans by CONAF, and inadequate enforcement of regulations (e.g. regulations related to illegal logging of alerce);
- Ongoing conversion of native forest, particularly of communities which have already been extensively cleared (e.g. sclerophyll forests) and in forest types with high biodiversity (e.g. Valdivian rainforest).

Ecological researchers maintained close links with local, national and international conservation groups, and were involved in several cooperative projects. They included vegetation mapping and research in the Reserva Costera Valdiviana, which was acquired by the World Wildlife Fund (see Section 5). Ecological researchers are also involved in working groups (e.g. a group dealing with protection of alerce forest) with government agencies (CONAF, CONAMA), private landowners and conservation organisations. I got the impression that some of the leading ecological researchers functioned as "intermediaries" between conservation organisations and government and industry.

6.2 Silvicultural research

Research into native forest silviculture is undertaken primarily by forestry departments of major universities and government and semi-government agencies.

The latter include CONAF (through its regional offices) and Instituto Forestal (INFOR), which was established in the 1960s to conduct forest research and transfer information and technology. It functions in a similar way (but at a larger scale) to the research sections of Forestry Tasmania. INFOR has strong links with industry, CONAF and forest researchers at some universities. It has three main lines of investigation: forest resource and use (e.g. through inventories of plantations and native forest); forest management (e.g. silvicultural systems, health and management); and industry processes and wood products.

I spent four days with a group of foresters (mainly from INFOR and Foundation Chile) on a field tour assessing native forest management in the Temuco – Villarrica – Melapeuco area of central-south Chile – this included inspections of research sites established to assess regeneration, tree growth and forest health under different silvicultural treatments. Forests in this area were diverse, with a range of dominant species, including raulí (*Nothofagus nervosa*), coihue (*Nothofagus dombeyi*), roble (*Nothofagus obliqua*), ulmo (*Eucryphia cordifolia*) and canelo (*Drimys winteri*) – all species with a Tasmanian connection, and all species which are utilised for timber production. Several trial areas had been established on private land to assess the effects of different silvicultural regimes. The field tour also

assessed the success of pilot programs of augmentation planting of faster-growing native trees (mainly the *Nothofagus* species). This program was developed to rehabilitate degraded forest and to provide an ongoing timber source for owners of small to medium-size properties and local sawmills. Local communities and landowners were given technical and financial assistance and were actively involved in the projects.

I also had useful discussions with silvicultural researchers from the University of Chile, both in Santiago and in the field in the Punta Arenas area (Region XII), where I visited silvicultural research sites with Dr Gustavo Cruz (Head of the Department of Forestry). The research sites were in a demonstration forest on Monte Alto property, a 76,000ha property with about 35,000ha of commercial lenga (*Nothofagus pumilio*) forest – other areas on the property comprise non-commercial forest or pasture (part of which was established following severe wildfires about 1990, which destroyed substantial areas of forest). Monte Alto conducts its own logging and milling operations, managed by the company's Forest Engineer (Federico Hechenleitner), who accompanied us when we inspected three treatment areas, including a current selective logging operation.

Other University of Chile silviculture demonstration forests are located on the nearby Salta property, and on Tierra del Fuego (Chilean Sector). Apart from collection of data on forest mensuration and regeneration, research projects are investigating other site characteristics including microclimate, nutrient cycling and forest biota. Browsing by the native guanaco (*Lama guanacoe*) and introduced hares (*Lepus europaeus*) and cattle can cause failure of regeneration in these forests, and is also monitored. Livestock may displace guanaco from areas of grassland adjacent to forest, leading to higher densities of guanaco (and browsing) in some forest environments (e.g. gaps and forest margins).

Findings from the University of Chile's demonstration forests are detailed in a handy silvicultural guide (Schmidt *et al.* 2003). This guide (on waterproof paper) has a useful and well-illustrated overview of the process of planning, mapping and sampling for native forest operations in lenga forest. Sections of the guide are reproduced in Appendix 3 – in part because they may provide a model for development of similar publications for demonstration forest areas in Tasmania (e.g. Warra Long-Term Experimental Site). The main section of the guide illustrates the different silvicultural treatments (before/after photos) and presents information on forest mensuration and regeneration. Treatments include thinning and shelterwood (first cut and second cut following successful regeneration establishment) with different levels of canopy retention. Some of the treatments are in virgin forest, while others are in forests that had been logged in the past, in some cases by "floreo" techniques (i.e. high grading). The latter treatment was widespread in native forests in the past, but is not permitted under current CONAF Management Plan requirements (see Section 7).

In many ways, lenga forests are a useful ecosystem to study, and are the subject of strong research projects in southern Chile (e.g. Caldentey, 2005). They have a low diversity of flora and fauna – a function of the cool climate of its southern latitudes – reducing potential confounding effects in experimental treatments. Good standards of regeneration are typically achieved without the use of fire (which could facilitate erosion and have adverse effects on soil fertility in the inhospitable Patagonian environment). However, growth rates of trees are slow, with rotation periods of 120-200 years, depending on site attributes and silvicultural treatment. Findings from silvicultural and associated research are incorporated into prescriptions incorporated into Management Plans (see Section 7).

The research conducted by the University of Chile, other university departments and INFOR is complemented by detailed studies being undertaken by Argentinean researchers. They include researchers attached to the National Council of Scientific and Technical Research (INTA) and the Southern Centre of Scientific Investigations (CADIC), located in the

Argentina Sector of Tierra del Fuego, where silvicultural and ecological studies in lenga and ñirre (*Nothofagus antarctica*) forests are providing information on the ecology of the forests and possibilities for sustained yield under different silvicultural regimes (e.g. Deferrari *et al.*, 2001; Gea Izquierdo *et al.*, 2004; Martínez Pastur *et al.*, 2000, 2005; Martínez Pastur and Lencinas 2002).

In Tierra del Fuego (Argentinean sector), I visited historic research sites examining the effect of different thinning treatments at Aguas Blancas – these were established about 20 years ago and are still being assessed. I also inspected more recent experimental trials in lenga and ñirre forest on Los Cerros property, accompanied by Argentinean researchers Guillermo Martínez Pastur and Vanesa Lencinas [from CADIC and INTA] and Forest Engineer Ricardo Vukasovic. Research at Los Cerros is designed to assess the wood production, silvicultural and biodiversity implications of aggregated retention and dispersed retention, as alternatives to the shelterwood systems that are more widely practised – and which have resulted in landscape homogeneity and preferential removal of better quality trees. Data on timber recovery and volumes; regeneration success and biodiversity attributes suggest that aggregated retention is a viable alternative to shelterwood systems. By 2010, aggregated retention may be used in 80% of public forests that are logged in the Argentinean sector (Guillermo Martínez Pastur and Pablo Peri, pers. comm.).

Such research is important to the future of the timber industry, as there is a current crisis in timber supply to small and medium mills. Reasons include over-cutting (high grading) in the past, wildfires, agricultural clearing; browsing of regeneration by livestock; and the destructive activities of beavers (*Castor canadensis*) following their introduction in 1946. Recent pressure and commitments by the provincial government to reserve additional areas of forest has placed further pressure on the ability of public forests to supply timber.

The field trips in Chile and Argentina also allowed me to get a better understanding of how Management Plans are developed and implemented (see Section 7). The Management Plans I saw were characterised by thorough evaluation of the sites by Forest Engineers. The operations themselves were being carried out in accordance with the plans – in fact the physical aspects of the operation (standard of roads and landings, buffering of riparian vegetation etc.) were similar to those that would be seen in a Tasmanian wet forest operation.







Forest research: Regeneration trial, Curarreheu; Canopy of thinned forest, Villarrica; Researchers Guillermo Martinez Pastur and Vanesa Lencinas in lenga (*Nothofagus pumilio*) forest, Tierra del Fuego; Aggregated retention trial site in lenga forest, Tierra del Fuego; Dr Gustavo Cruz and Federico Hechenleitner in demonstration forest, Monte Alto property, southern Chile; Seedlings of lenga – good regeneration is one of the most important facets of native forest silviculture.

7. On-ground regulation of forestry operations

This section of the report describes the on-ground approach to regulation of forestry operations in Chile, with an emphasis on regulation of native forest operations through Management Plans and through requirements for transporting and storing forest products. Section 7.3 compares the Chilean on-ground regulatory systems with those operating in Tasmania, with emphasis on biodiversity issues.

The 1974 Forest Law (Law 701) is the main law regulating forestry activities on public and private land in Chile. The primary regulator is the National Forest Corporation (CONAF). CONAF is responsible for approving Management Plans and auditing after completion of operations. For the purposes of the regulations, forests are defined as vegetation dominated by trees, where tree cover exceeds 10% in arid and semi-arid areas and 25% in areas having more favourable conditions. The minimum area that defines a forest is 0.5 ha, with a width of 40 m. Forests can be dominated by native species (native forest) or exotic species (plantations). The process of preparing Management Plans (with an emphasis on those required for native forest operations) is described in Section 7.1.

The Tasmanian Forest Practices Authority is the main agency responsible for regulating forestry operations in Tasmania, through the Tasmanian Forest Practices Act and Regulations. The Forest Practices Code forms the basis for operational planning, but requirements of other legislation and policies also need to be considered. The definition of forest (for the purpose of forest practices planning) has evolved since the Forest Practices Act was passed in 1985, but has resonances with that used in Chile. Briefly: Forest is defined as any area containing woody plants, with the height or potential height of 5 metres or more, that are native to Tasmania or have been introduced for timber production. In most circumstances, a Forest Practices Plan is needed where the area of forest proposed for logging or clearing exceeds a hectare per rateable property in a year; or the timber volume exceeds 100 tonnes (whatever is the lesser). More details of the requirements and processes relating to the Tasmanian forest practices system are given in Appendix 2.

7.1 Management Plans

7.1.1 Requirements for Management Plans

Under Law 701, Management Plans are required for most logging operations on public and private land and some land clearing activities. There are four types of plans, which cover:

- Plantations;
- Native forest logging and regeneration;
- Native forest clearing (mainly for agriculture);
- Forestry operations for civil works.

Management Plans pertaining to the first and second operational categories are designed to maximise the use of the forest resource, to achieve adequate regeneration, and to ensure the "preservation, conservation, improvement and growth" of the "said resources and their ecosystem." Management Plans have many similarities, in form and function, to Forest Practices Plans required under Tasmania's Forest Practices Regulations (this is discussed in more detail in Section 7.3). However, a single Management Plan may cover individual cutting units (equivalent to a coupe covered by a typical Tasmanian Forest Practices Plan) or several cutting units on the same property.

The major requirements and conditions of Management Plans are summarised below:

- Management Plans must be prepared by either a "Forest Engineer" or a "specialised Agronomist Engineer", who is accredited by CONAF. They invariably have tertiary qualifications in forestry, agronomy or equivalent. In most cases involving timber harvesting (as opposed to clearing of non-commercial forest for agriculture), Management Plans are prepared by a Forest Engineer (for convenience, this term is used in subsequent discussion in this report). In some circumstances, Management Plans need not be prepared by an accredited Forest Engineer when the total area of forest does not exceed 10 ha.
- A Management Plan has several parts, which must be submitted to the relevant CONAF regional office for evaluation, prior to commencement of an operation. The required formats can be downloaded from the CONAF website or are available on CD. The completed plan can be electronically transmitted to CONAF for their evaluation. The following documents must be submitted to CONAF:
  - A request for approval of the plan;
  - A technical study of the proposed operational area and the proposed operation itself (described in more detail below);
  - Maps of the area;
  - Land ownership information (and more detailed cartographic information in the case of properties adjacent to frontiers (inevitably Argentina).
- The period of approval/rejection of Management Plans is 120 days, except for plans for plantations located in regions V-X, where a 30 day period applies.
- There may be a fee for submitting a Management Plan to CONAF. The cost to owners depends on the size of the land parcel; the type and location of the plan; and the form of harvesting/land use proposed. There is no fee for owners of small parcels of land. The cost to other owners varies from 0.06 units/ha to 0.4 units/ha (although I do not know the financial status of the units, their range can be appreciated).
- If the Management Plan is required for non-forestry purposes (e.g. mining, service corridors), the proponent must demonstrate landowner approval for the activity.
- Management Plans are usually for a two year period from the date of approval.
- Different Management Plan templates have been developed by CONAF for different types of operation – these can be fairly specific. The template for harvesting in lenga (*Nothofagus pumilio*) forest is given in Appendix 4 as an example and is discussed in more detail below. Although the template is in Spanish, the format of the plan, and a fair degree of coincidence in Spanish and English word roots, will give most forestry-oriented readers an indication of the instructions developed by CONAF, and the information required from the Forest Engineer preparing the plan.
- Management Plan templates contain information and instructions relating to silvicultural requirements; environmental protection; natural values (e.g. flora, fauna, landscape); forest health and fire management. In effect, these prescriptions fulfil some of the prescriptive functions of the Tasmanian Forest Practices Code (see Section 7.3).

7.1.2 Details in Management Plans for native forest

This section of the report outlines the information that must be incorporated into a typical native forest Management Plan (see Appendix 4). Much of the required information deals

with silviculture and regeneration [e.g. density, basal areas and volumes of trees in operational areas (coupes) before and after harvesting]. Larger or more diverse coupes are typically divided into "rodals" – these are vegetation units identified by their structure [e.g. height and density of overstorey and development stage (mature or regrowth)] and composition (e.g. dominant tree species). Rodals correspond, more or less, to Tasmanian PI types, identified by interpretation of aerial photographs. There could be several rodals in diverse coupes with variation in environments or logging history). Each rodal needs to be considered separately for silvicultural and environmental attributes and treatments.

The format of the Management Plan is given below. I have commented in more detail for those sections dealing with biodiversity issues.

1. *General preface*

   Includes land title and location information and identification of neighbouring properties

2. *Diagnostic information*

   2.1 Description of the natural environment

   2.1.1 Climate variables

   2.1.2 Landforms and hydrology

   Includes the characteristics of landforms within rodals and the width and permanence of watercourses

   2.1.3 Flora and fauna with a priority for conservation

   The information in this part of the Management Plan is based on species protected by legislation or listed as threatened following CONAF's 1989 review of the conservation status of its fauna and flora that were listed on the IUCN Redbook. These comprise 69 species (45 flora, 24 fauna), not all of which occur in commercial native forests. The instructions require that priority fauna species be documented at the coupe level, whereas flora species are documented at the rodal level, including an estimate of density (individuals/ha). The current review of Chile's threatened species (required under the 2005 National Biodiversity Strategy) will substantially increase the list of Chile's threatened flora and fauna, by progressive addition as candidate species are assessed by a specialist committee over the next few years.

   From discussions with Forest Engineers information on occurrence of priority species is based on:

   - Recognition – some listed species of plants (e.g. alerce, araucaria, rauli) and animals (e.g. puma, pidu – a species of deer) are fairly distinctive;
   - Local knowledge (including habitat);
   - A limited amount of information on databases.

   Section 3 of the Management Plan includes prescriptions to cater for these species. From my discussions, these prescriptions seem to be based on the personal knowledge of the Forest Engineer, rather than the advice of conservation specialists (as occurs in Tasmania).

   2.1.4 Fire history and risk

   2.1.5 Other physical site characteristics

   These are considered at the rodal level, and comprise altitude, aspect, slope and detailed information on soil type, characteristics and capacity.

2.2. Description of the Forest Resource

2.2.1 Qualitative description of the forest

This is provided at the rodal level and comprises forest type, dominant overstorey and understorey species, forest structure, state of development (e.g. native, regrowth, scrub) and health (including potential problems).

2.2.2 Quantitative description of the forest.

This section requires a much greater level of sampling and detail than is required in Tasmanian Forest Practices Plans. It formed the largest part of the Management Plans that I saw on my study tour. The quantitative description includes, for each rodal, an indication of the sampling methods employed; the density, basal areas and volumes of different species of tree per hectare; and characteristics of the regeneration (e.g. species, height classes, frequency).

2.2.3 Environmental restrictions

Restrictions on operations are identified (for each rodal) for a range of environmental variables (topography, soil, flora and fauna, landscape). The Forest Engineer is required to consider if the restriction is "high, medium or low". Environmental restrictions are incorporated into prescriptions given in Section 4 of the Management Plan.

3. Management objectives

Indication of the general management objectives within each rodal (e.g. production of sawlog, production of pulpwood, protection of water etc.).

4. Treatments to achieve objectives

This section of the Management Plan is also very detailed, with the treatments to achieve the management objectives being indicated for each rodal.

4.1 Criteria for the silvicultural treatment

Includes: species to be harvested; age or diameter of species at the time of harvest; annual growth rate (volume) taking into account sampling undertaken (Section 2 of Plan), or previous sampling/scientific literature; method of regeneration proposed.

4.2 Description of the silvicultural treatment

The proposed silvicultural treatment may be dictated by CONAF requirements depending on forest type and structure, characteristics of the regeneration etc.

4.3 Estimate of forest structure at completion of the treatment

Density (diameter classes), basal area and volumes of retained trees.

4.4 Technical prescription and environmental protection

The silvicultural prescriptions including specifications for: selecting trees for harvesting; retaining and marking retained trees, regeneration establishment, stocking standards etc. Many of these requirements are dictated by CONAF.

Constraints and prescriptions to protect environmental values:

- Minimum requirements are set by CONAF for landform (slope), hydrology and possibly soils, and are identified on Management Plan templates. For example, permanent water courses require a streamside reserve (unlogged) of at least 30 m (horizontal distance); swamps or wetlands require a buffer of at

least 10 m; slopes exceeding 60% (for more than 30 m) cannot be logged; 30 m buffers are required adjacent to public roads; logging is not permitted in forests where adult trees do not exceed 8 m in height.

- Flora and fauna prescriptions are included in this section, but direction to Forest Engineers on management requirements/constraints were not identified in the formats of Management Plans that I saw. Apart from species protected by legislation (e.g. araucaria; alerce), information did not seem to be readily available. Discussions with Forest Engineers suggested that many constraints implemented were based on 'anecdotal' approaches to conservation.

4.5 Non-silvicultural activities

Construction and maintenance of roads, landings etc: some constraints are specified by CONAF (e.g. roads should not exceed 5% of the surface area of coupes).

5. Protection of the forest resource from disease and fire

Documentation of risk and prevention and control measures.

6. Maps

Detailed maps (scale of 1:20000 for properties exceeding 250ha; and 1:10000 for properties less than 250ha) must be submitted with the plan. The maps cover cadastral, topographic, silvicultural and environmental attributes of the Management Plan area.

7.1.3 Advice and procedures on completion of operation

CONAF must be formally advised that the operation has been completed, through presentation of a report summarising the silvicultural and non-silvicultural activities by rodal (once again, with an emphasis on mensuration data relating to pre-logging and post logging density and volumes, and regeneration). This advice has some parallels with the compliance certificate that is required at the completion of a Tasmanian Forest Practices Plan.

CONAF has the ability through its regional staff (Forest Engineers and Technical Foresters) to inspect operations following receipt of the "Advice of Completion". CONAF has the power to impose conditions or prosecute when forestry operations do not comply with requirements of Law 701 – this may comprise logging or clearing without a Management Plan; incorrect information being provided in a Management Plan; or non-compliance with conditions in a Management Plan. There were conflicting opinions (from many stakeholders – Forest Engineers, researches, conservation groups, CONAF staff themselves) about how frequently or effectively such evaluations are undertaken (see Section 7.3).

7.2 Law relating to transport of native forest products

The Chilean forest regulations (Law 701) provide another string to CONAF's regulatory bow, in its jurisdiction over native forest management and harvesting. Under Decree 193/98, people storing or transporting native forest products (including logs, sleepers, blocks and firewood) must provide a form to the closest police station demonstrating that the products have come from a legally authorised operation (i.e. an area with a Management Plan). The necessary document is a "Form for Transport of Forest Products", which is issued by CONAF to the owner of the land covered by the Management Plan. Different forms cover movement of wood/timber from forest to a storage or industrial site; secondary movement from storage sites; and also cater for opportunistic operators (e.g. firewood from isolated trees).

A person or business failing to comply with this regulation risks fines and possibly confiscation of the wood product in question. Although police and CONAF officials have great capacity to enact this law (given the quantity of native forest products being carted and

stored in some central and southern regions of Chile), there was criticism that it was not being enforced effectively or enthusiastically. A pamphlet illustrating and describing requirements of this regulation is included as Appendix 5 – although in Spanish it is a good example of an illustrated guide that provides clear information of requirements and penalties.

7.3 Comparison of on-ground processes used in Chile and Tasmania

The requirements for Management Plans in Chile (and Argentina) have some similarities with Tasmanian regulatory processes, including the requirement that plans are prepared by a person who is accredited by the regulator. In Chile, all Management Plans prepared by Forest Engineers are submitted for evaluation and approval (if appropriate) by Forest Engineers employed by CONAF. In Tasmania, Forest Practices Officers are accredited by the Forest Practices Authority to certify Forest Practices Plans on its behalf. There is considerable overlap in the technical information incorporated into Management Plans and Forest Practices Plans. There are also significant differences in approaches between the two systems.

I am uncertain of the number of Management Plans that are prepared in Chile each year – it would certainly exceed the number prepared in Tasmania. There are difficulties with making direct comparisons because some Management Plans in Chile cover a single cutting unit (coupe), while other Plans may contain more than one cutting unit (e.g. on larger properties). In the 1990's, about 150 plans per year were prepared for native forest operations in Region X (mainly for selective logging or shelterwood harvesting). CONAF staff in Punta Arenas (administrative centre of Region XII) indicated that about 35 plans were lodged each year – many from the Chilean sector of Tierra del Fuego. The number of Management Plans for native forest operations in Chile each year is probably of the same order of magnitude as the number of Forest Practices Plans certified in Tasmania (see discussion below).

In Chile, Management Plan templates contain prescriptive information and instructions relating to silvicultural requirements; environmental protection; natural values (e.g. flora, fauna, landscape); forest health and fire management – in effect, these prescriptions fulfil some of the prescriptive functions of the Tasmanian Forest Practices Code and other planning tools. The silvicultural data collected is far more detailed than in Tasmanian Forest Practices Plans, and is an important part of determining the silvicultural prescriptions that are permitted on the site (e.g. requirements for retention of trees, treatment of understorey etc).

As indicated in Section 7.1.2, consideration of most natural and cultural values is not as detailed as the Tasmanian forest practices system requires. Within the biodiversity sphere, Management Plans must consider the (potential) occurrence of threatened species, but information and advice seem to be less available and less comprehensive or authoritative than is the case when Tasmanian Forest Practices Plans are being prepared. Incorporation of prescriptions into plans to take account of habitat and ecology of the species seemed to be fairly cursory compared to the threatened species processes associated with forestry operations in Tasmania. Although the broad forest types are identified in Management Plans (and may dictate the Management Plan template that a Forest Engineer needs to follow), more detailed analysis of the classification and conservation status of forest communities present within the coupe is not undertaken. Other biodiversity considerations required through the Tasmanian forest practices system (e.g. specifications for wildlife habitat strips, wildlife habitat clumps, dispersal of coupes) were not specifically considered in the Management Plans for operations that I visited, though there were some constraints on felling individual mature trees in some forest types. There seemed to be an acceptance that Chilean Management Plans accommodate some of these biodiversity factors through statutory requirements and prescriptions to retain forest to protect watercourses, springs, wetlands, steep or unstable landforms and other features.

About 1000 Forest Practices Plans are certified each year in Tasmania, the majority (about 600 from June 2005 to June 2006) being for operations in native forest (either regeneration to native forest following logging, or conversion to plantation). Forest Practices Plans have a common template, which is designed to ensure that specified details are collected or evaluated by Forest Practices Officers when the plan is prepared, and that the plan (and the operation) complies with the Tasmanian Forest Practices Code and other relevant legislation and policies. Information on technical, legislative and policy requirements is provided to Forest Practices Officers through a range of sources. They include: the Tasmanian Forest Practices Code; technical manuals, technical notes and other planning tools produced by the Forest Practices Authority; comprehensive databases, maps and GIS coverage (e.g. relating to distribution of threatened species and forest communities); silvicultural technical bulletins (produced by Forestry Tasmania); and advice from researchers and specialists (e.g. Forest Practices Authority scientific staff, silviculturalists, and other scientific and technical staff employed by Forestry Tasmania and forest companies).

For all Forest Practices Plans, essential details (e.g. location and tenure information, type of operation and forest communities affected, and proposed land use) are forwarded to the Forest Practices Authority for databasing, reporting and auditing purposes. Proposed operations are also referred to the Authority's scientific staff when planning tools (databases, manuals etc) indicate to the Forest Practices Officer preparing the plan that specialist advice is needed for natural (flora, fauna, geomorphology, soils and hydrology) or cultural values (landscape, archaeology and cultural heritage) that could be affected by the activity. For the last few years, over half of the Forest Practices Plans for native forest logging have been referred to the Authority's scientific staff for advice on flora or fauna values (such advice is often preceded by more detailed field assessments). Biodiversity values can comprise: the presence of communities with a priority for conservation; the presence of threatened species or habitat for threatened species (a frequent and unsurprising reason for referral given the high proportion of Tasmania's biota that is listed on Schedules of the Tasmanian Threatened Species Protection Act); or other factors (e.g. potential for introduction of disease) that require special consideration. Prescriptions can generally be incorporated into Forest Practices Plans to cater for the identified values, but in some circumstances substantial changes to operational plans are required.

The Tasmanian forest practices system (see Appendix 2) places a lot of emphasis on providing Forest Practices Officers with information on regulatory and technical requirements, and developing technical skills, through: accreditation courses; biennial refresher courses; specialist courses in natural and cultural values, silviculture, forest health etc; and targeted dissemination of information (e.g. through newsletters and other information developed for Forest Practices Officers). My discussions with Forest Engineers, CONAF staff and others suggested that Forest Engineers do not receive this level of ongoing training and information transfer. Compared to Chile, training and dissemination of information in Tasmania is facilitated by the State's dimensions (small and compact) and the relative accessibility of its production forests.

I explained aspects of the Tasmanian forest practices system at several forums (discussions and presentations at research centres, government offices and on field trips) and with a wide range of people with an interest in native forest management. There was a lot of interest in processes used to develop and evaluate Forest Practices Plans, and the role of the Tasmanian Forest Practices Code and other planning tools. I took several copies of the Code, and CD versions of the Tasmanian Forest Botany Manual (the main flora-based planning tool for Tasmanian Forest Practices Officers), which I had no trouble dispensing. The Forest Practices Code, with its comprehensive and practical guidelines, and useful diagrams, was of particular interest to Forest Engineers and staff of government agencies, including people

developing Codes of Practice and certification systems through CONAF, INFOR and Foundation Chile.

In Tasmania, the Forest Practices Regulations require that a minimum of 15% of Forest Practices Plans (randomly selected) are comprehensively audited each year. Reports of potential breaches of the regulations or conditions in Forest Practices Plans are investigated. I did not get a good grasp on the enforcement or post-logging auditing processes used in Chile, though it was clear that there were differing opinions on their rigour and effectiveness. From my limited discussions (in Villarrica, Chiloé and Punta Arenas) it seems that about 20-30% of completed operations may be evaluated. It is likely that the figure, and the choice of operations to assess, varies between regions and will depend on a range of factors including: type of operation (e.g. plantation or native forest); degree of concern about adequacy or implementation of prescriptions in different forest types or by different landowners or operators; and potential environmental, silvicultural or regeneration issues.

Critics of the current process in Chile regularly commented that insufficient operations were audited on completion. However, my discussions with CONAF Forest Engineers and Technical foresters from CONAF offices at Castro (Island of Chiloé), Villarrica and Punta Arenas suggested that some form of inspection was often undertaken before, during or after the operation. Conservation organisations claim that enforcement and prosecution of infractions are poor, and that penalties are inadequate (the same criticisms are levelled at the Tasmanian forest practices system). Neira *et al*. (2002) points out that lack of effective enforcement or prosecutions in Chile is also a function of insufficient resources and tools, and problems within the jurisdiction system, resulting in many violations being unpunished by the courts or receiving much lower fines than those recommended by CONAF.

The regulation and processes relating to transport of forest products do not have close correlates in Tasmania, though transport or storage of illegally obtained forest products have been detected occasionally by police or offices of Forestry Tasmania or the Forest Practices Authority, resulting in offenders being fined or prosecuted.

Forestry operations: Top – Technical group from INFOR, CONAF and Foundation Chile inspecting logging in a Mapuche community near Melapeuco, where a Management Plan is prepared by a community forester; Middle – logging operations in lenga forest under a Management Plan on Tierra del Fuego and logs from operation; Bottom – Tree felling without Management Plans on Tierra del Fuego, where activities of introduced beavers have destroyed about 3% of the island's forests.

8. Discussion: Comparisons of forest practices, management and conservation in Chile and Tasmania

Most people with some knowledge of forest policies and management in Tasmania (and Australia generally) would feel at home if they visited Chile and experienced the current processes and debates about use and conservation of its native forests. This section of the report discusses some of the similarities and differences in forest practices, management and conservation in Chile and Tasmania. The nature of my study means that some of these are considered in depth, whereas others are treated superficially. It is clear that there are many opportunities for useful dialogue and exchange of information.

8.1 Forest vegetation and its use

Native forest covers about 16 million ha in southern South America – over 13 million ha are in Chile and the remainder in Argentina. The temperate forests of South America and Tasmania share a flora with Gondwanan origins, with species of *Nothofagus* being widespread in humid environments, and conifers of venerable age forming iconic images in the landscape. The structure, composition and distribution of the forests reflect similar environmental influences, including the effects of fire and different forms of land use. Forests in both places have a similar number of vascular plant species (about 1000), and similar plant species diversity at comparable latitudes (40°S to 44°S), though diversity is substantially lower in the southern latitudes of Patagonia (55°S in the case of Tierra del Fuego).

Native forests currently cover about 13.4 million ha of Chile – about 18% of its land area. Non-native forests, primarily plantations of *Pinus radiata* or eucalypts, cover an additional 2.2 million ha (3% of the land area). Native forests cover 3.2 million ha (45%) of Tasmania's land area and plantations cover 220,000 ha (3%). About half of Chile's pre-European (pre-1550) forest area remains, compared to about two-thirds of Tasmania's pre-1750 forest area.

In Chile, plantations are the main suppliers of pulpwood, sawlogs and other timber products, which provide 13% of the country's export income. Native forests typically supply timber for local use (and some export), woodchips (also exported) and firewood – they are also important for many other reasons, including the protection and maintenance of biodiversity and soil and water values, their role in indigenous culture and their contribution to tourism. Once again, there are many similarities with the situation in Tasmania, though in Tasmania logging operations in native forest supply a much greater proportion of timber products for domestic use and export.

Both Chile and Tasmania have a great deal of attention directed at their forest management and conservation. Both have a relatively high proportion of their forests in formal reserves on public land: about 3.9 million ha (29%) of the current area of Chile's native forest and 1.45 million ha (45%) of the current area of Tasmania's native forest. The reserve systems are not representative – this is a function of the distribution of public land, the economic value of different forest types, and the history of clearance for agriculture and settlement. In both places, important areas of forest are also contained in private reserves. Processes to achieve better protection of the range of forest communities and species have been initiated in Chile and Tasmania, but their implementation is considerably more advanced in Tasmania.

8.2 Forest legislation and policies

Laws designed to control forest clearance and burning, and to encourage regeneration and better forestry standards, were introduced in Tasmania and Chile in the 1870s. In Chile, the 1974 Forest Law (Law 701) encouraged a massive expansion in the area of plantations by

providing incentives for reforestation of degraded farmland and conversion of native forest. This law also forms the basis for management and regulation of native forest operations.

Chile has a centralised government, which devolves little autonomy to the country's 13 regions. A single agency, the National Forest Corporation (CONAF), is primarily responsible for developing and implementing policies on forest use and conservation: the National Commission for the Environment (CONAMA) also has a role in this sphere. Regional offices of CONAF undertake much of the on-ground management and regulation of forest practices and conservation.

In Australia's federal system of government, the states are largely responsible for their own forestry and land use legislation, under the over-arching umbrella of national policies. In Tasmania, forest and conservation planning is undertaken by several departments (including Forestry Tasmania – the manager of most of the State's production forest on public land), but the Forest Practices Authority (through the 1985 Forest Practices Act) is responsible for regulating forestry operations on all tenures. Conservation legislation, including the 1995 Tasmanian Threatened Species Protection Act, is also an important consideration in forest planning and on-ground management.

In both countries, national and regional policies have been influenced by responsibilities under international agreements and protocols (e.g. UN Convention on Biological Diversity and the Montreal Agreement).

A National Biodiversity Strategy was developed for Chile in 2005, partly as a result of these protocols, as well as national and international pressure from conservation organisations. There is also strong support for industry certification (which imposes conservation requirements) from the Chilean government and the influential (exporting) sector of the forest industry, to ensure access to foreign markets. Analyses of the extent and reservation status of vegetation types have identified priorities for conservation, and Chile's out-dated threatened species legislation is being reviewed using IUCN guidelines. The conservation implications of the National Biodiversity Strategy are discussed in the following section.

A law to encourage rehabilitation of native forest and provide greater controls on clearing (the Native Forest Law) was first introduced to the Chilean Parliament in 1992, but remains unratified, in large part because of opposition by agricultural interests to controls on further conversion of the sclerophyll forests and woodlands in central Chile. These dry forests and woodlands often occupy terrain that (with irrigation) is suitable for establishment of orchards and vineyards, which are also important contributors to Chile's thriving economy.

Chile seems to be at a point, as was Tasmania in 1997 (when the Tasmanian Regional Forest Agreement was signed), when forest management and conservation is about to become much more complex. One leading ecologist suggested to me that the period of conversation was over (referring to prolonged dialogue prior to approval of the National Biodiversity Strategy) and the period of conservation was about to begin. As with Tasmania, this is likely to involve a combination of reservation and off-reserve management, including refining processes for planning and conducting logging operations in native forest.

8.3 Forest conservation

About 23% of the land area of continental Chile is reserved. This includes 3.9 million ha (29%) of the current area of native forest on public land, much of it in relatively inhospitable upland areas and in the south of the country. There are also substantial areas of private land which are reserved, in some cases through government-accredited systems. Many of these reserves have been established with funds from outside Chile, and are being managed or co-managed by conservation organisations and research groups.

In scenarios very reminiscent of those in Tasmania, there are three main focuses for further conservation of forests:

- Forests that have been extensively cleared and are poorly reserved (e.g. the sclerophyll forests of central Chile);
- Forests that have high biodiversity (e.g. Valdivian rainforest);
- Frontier forests: large tracts of relatively undisturbed forest, mainly in remote areas (e.g. forests of Tierra del Fuego).

There has been a great amount of attention focussed on management and conservation of Chile's forest vegetation. The wetter forests with high biodiversity and the frontier forests have most captured the interest of international environmental organisations. These forest types are contained in the larger private reserves (in some cases they were acquired to prevent logging or other development activities). Forests in remote areas are also relatively well-reserved in National Parks and other reserves on public land.

Recent analyses of the distribution and conservation status of Chile's forest types (with some similarity to analyses associated with the Tasmanian Regional Forest Agreement) quantified the non-representative nature of its reserve system, and the desperate state (in extent and conservation status) of some communities – particularly the less charismatic communities, such as the sclerophyll forests and woodlands, which are generally under more immediate threat of continued clearance and modification. Priorities for conservation have been established (not without rancour), and are being pursued through a National Biodiversity Strategy. The Strategy was approved in 2005 after several years of development and contains goals for the period 2005–2015. One of the main challenges to government will be to engage successfully with private landowners, and to develop incentives and agreements to protect areas that are important for conservation – particularly as funds are also needed for other pressing social and educational priorities. Maintenance and protection of the sclerophyll forests in central Chile probably represents the biggest conservation challenge.

The goals of the National Biodiversity Strategy include a review of the conservation status of Chile's flora and fauna species – this commenced in 2005 and is being conducted by an expert panel using IUCN guidelines. Chile's current lists of threatened species are clearly out-dated, comprising only 93 species of animals and 40 species of vascular plants (less than 1% of Chile's native vascular flora). The revision will lead to a substantial increase in the number of listed species; it will also be important to develop planning tools and management systems that allow threatened species to be taken into account in forest planning and operations.

In May 2005, Tasmania had about 1.45 million ha of forest formally reserved on public land, and about 45,000 ha of forest reserved on private land (totalling 46% of its extant native forest area). Tasmania is more advanced than Chile in its efforts to protect threatened communities and species, on public and private land. However, the large number of Tasmania's species that are listed on its Threatened Species Protection Act (186 animal species and 466 plant species, including 23% of the native vascular flora) has the potential to drain limited resources – a review of distributions and threats may allow resources to be used more effectively.

Much of the policy direction and financial support for forest conservation in Tasmania has resulted from agreements between the Tasmanian and Commonwealth governments. These have been influenced or informed by social and stakeholder attitudes, the activities of researchers and political considerations.

There are parallels with Chile in the ongoing debate about forest management in Tasmania, with local, national and international conservation campaigns (and political responses) also focusing on old-growth stages of relatively well-reserved and widespread forest types

(rainforest and wet eucalypt forest) in remote (wilderness) areas. There has been scientific and some policy support for conservation of Tasmania's more poorly-reserved or threatened communities, including drier forest and woodland communities that have been substantially modified, occur mainly on private land, and are often associated with occurrence of threatened species. Such support has been relatively muted, has not captured the popular imagination and has not been embraced by some private forest owners. However, several initiatives have been taken to avoid further attrition of threatened communities – they include constraints on clearance (exercised through Tasmania's forest practices system) and various programs which have provided financial incentives, information, technical assistance and material support for landowners to reserve such vegetation, or undertake conservation-oriented management.

8.4 Forest research

Ecological and silvicultural researchers in Chile have been influential in shaping opinion on forest management and conservation, and developing policies and practices. There is a great range of forest-related research being undertaken in Chilean universities, and in government research institutions (notably Instituto Forestal – INFOR) where the research is more directed towards applied forest management. There are active scientific societies, and complex networks and partnerships connecting Chilean research institutions (universities and government) and other stakeholders. The latter include: local, national and international conservation organisations (mainly linking with university-based researchers); forest industry groups and companies; foreign research institutions (mainly located in Argentina, Europe and North America); and foreign funding bodies (government and non-government). Ecological researchers seem to act as intermediaries between government agencies and conservation groups (some of whom have a deep mistrust of government).

There is a lot of liaison between Chilean and Argentinean researchers and research centres – increased collaboration with researchers from Tasmanian (and other parts of Australia) would also be useful, because of common issues and research interests. They include management of demonstration sites; and assessments of the wood production, silvicultural and biodiversity outcomes of alternative silvicultural systems in wetter forest types (e.g. shelterwood, aggregated retention, dispersed retention, clear-cut). Many other fields of investigation being undertaken in South America's temperate forests are also relevant to research being undertaken in Tasmania and other parts of Australia (e.g. forest ecology; threatened species; dendrochronological studies into long-lived conifers; nutrient cycling and hydrology in forests; use of forests by invertebrates; landscape-level planning). Improved communication between Australian and Chilean researchers working on native forest silviculture and ecology is highly desirable.

Despite the calibre of much of the research, there was a perception, amongst most of the ecologists I talked with, that their results and recommendations were largely ignored by government departments (CONAF and CONAMA), which had more interest in maintaining the status quo and supporting the forest industry. However, from my (limited) observations and discussions, and my visits to forests and forest operations in central and southern Chile, staff of government agencies involved in forest management, regulation and research had a commitment to good forest management and conservation practices. At the same time, some fields of biodiversity research that are regularly incorporated into forest practices planning in Tasmania, are not included in the process of preparing typical Management Plans for native forest operations in Chile.

8.5 On-ground regulation of forestry operations

The processes for regulating forestry operations in Chile are specified in the 1974 Forest Law – these processes have similarities to those used in Tasmania. In Chile, Management Plans are required prior to logging or clearing forest on public and private land, and must be prepared by accredited Forest Engineers (in most cases graduate foresters) employed by the proponent. The plans must be assessed and approved by Forest Engineers employed by CONAF before operations commence, and the operation may be audited on completion (possibly about 20–30% of operations). Management Plans fulfil a similar function to Tasmanian Forest Practices Plans, which are also required for logging or forest clearing on all tenures, and are prepared by Forest Practices Officers who are trained and accredited by the Tasmanian regulator (the Forest Practices Authority). As with Tasmania's forest practices system, a fee may be charged by CONAF, depending on the size and type of operation.

Chilean Management Plans for native forest logging contain more silvicultural information than is required in Tasmanian Forest Practices Plans – in part because the logging treatments specified by CONAF will be dictated by forest form and composition (often related to previous logging history) and attributes of the regeneration. Silvicultural research is important in determining logging prescriptions, and in this respect studies by universities and research agencies in Chile and Argentina have provided information that is incorporated into standard silvicultural prescriptions.

The main environmental focus in Chilean Management Plans is on soil and water values, including requirements for roading standards and streamside reserves that are comparable to those required in Tasmanian operations. Treatment of other natural and cultural values tends to be cursory. There is a requirement that some biodiversity values are considered – notably the occurrence of threatened flora or fauna. However, the processes used to cater for the presence of threatened species and other biodiversity values (e.g. threatened vegetation communities, habitat retention, dispersal of logging) are less rigorous than those specified in Tasmania through the Tasmanian Forest Practices Code and other legislation and policies (state and national).

CONAF's operational requirements for different types of native forest are specified in Management Plan templates. In Tasmania, guidelines and prescriptions are supplied to Tasmanian Forest Practices Officers by an all-encompassing Forest Practices Code, supported by specialist advice and planning tools relating to natural and cultural values (e.g. Forest Botany Manual and Threatened Fauna Advisory Program – produced by the Forest Practices Authority) and silviculture or forest management (e.g. silvicultural technical bulletins and forest health leaflets – produced by Forestry Tasmania).

My observations and discussions in South America, although limited, suggest that in Tasmania there is more efficient transfer of information on forest biodiversity issues than is the case in Chile (and Argentina). This includes sharing of data and results (e.g. threatened species locations and management) between research scientists and specialists from different organisations (e.g. University of Tasmania, Forest Practices Authority, Dept of Primary Industries and Water, Forestry Tasmania). It also includes the transfer of information and prescriptions from specialists and researchers to Forest Practices Officers (through newsletters, databases and web-based sources and training courses).

The combination of the Forest Practices Code, planning tools and specialist advice, supported by information transfer and training, is a strength of the Tasmanian forest practices system and contributes to an adaptive management approach to biodiversity values. There was a great deal of interest in Chile (and Argentina) about Tasmania's forest practices system, including the Forest Practices Code and associated planning tools.

8.6 Possibilities for collaboration and liaison

There are many possibilities for collaboration and exchange of information on management, regulation and conservation in native forests used for wood production in South America (Chile and Argentina) and Australia (particularly Tasmania). Closer links could be established through study tours; placement of students and staff in research institutions, industry and government agencies; and better contact through symposia and working groups. Possibilities for collaboration on management and conservation of biodiversity in native forests include:

- Flora, fauna and ecological processes (including nutrient cycling) in temperate forests and woodlands;
- Effect of forestry operations and different silvicultural systems on flora, fauna and other aspects of biodiversity, including mitigation of adverse effects;
- Prescriptions and practices to enhance and maintain biodiversity in production forests, including habitat retention, threatened species management, and planning at a landscape level;
- Development of indicators and monitoring procedures to ensure implementation and effectiveness of biodiversity prescriptions;
- Processes to address conservation priorities on private land;
- Processes to disseminate information to forest planners and managers.

I am grateful for the opportunity to experience the temperate forests of South America, and to discuss forest management, conservation and regulation with a great range of people. It reinforced my feeling for the strength of the ecological connections, and the importance of achieving sustainable management, of our shared Gondwanan inheritance. The words of Chile's beloved poet, Pablo Neruda, could apply equally to Tasmania when he wrote of the forest of southern Chile…

"…Beside the snow-capped mountains, among the huge lakes, the fragrant, the silent, the tangled Chilean forest…My feet sink down into the dead leaves, a fragile twig crackles, the giant rauli trees rise in all their bristling height, a bird from the cold jungle passes over, flaps its wings, and stops in the sunless branches…Going on, I pass through a forest of ferns much taller than I am: from their cold green eyes sixty tears splash down on my face and, behind me, their fans go on quivering for a long time…Further along, each tree stands away from its fellows. They soar up over the carpet of the secretive forest, and the foliage of each has its own style, linear, bristling, ramulose, lanceolate, as if cut by shears moving in infinite ways…Anyone who hasn't been in the Chilean forest doesn't know this planet."

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Appendix 1: Itinerary and key contacts for study tour examining ecology, management and forest practices in temperate forest in Chile and Argentina. Affiliation of contacts has been translated into English. Further details are available from Fred Duncan. Contacts who have degrees as Forest Engineers are indicated by an asterisk (*). Some recreational activities are not shown.

Date	Location	Activity	Contact	Affiliation
31 October	Hobart – Santiago	Flight to Chile		
1 November	Santiago – Los Andes	Bus trip and tour of dry (sclerophyll) forest and agricultural landscapes north of Santiago (Region V & Metropolitan Region)		
2–4 November	Santiago	Discussions about forest ecology and biodiversity with researchers. Discussions about integration of research results with forest managers and government agencies.	Dr Javier Simonetti	Senior Researcher, Dept of Ecological Science, University of Chile
			Dr Juan Armesto	Principal Investigator, Centre of Advanced Studies in Ecology and Biodiversity (CASEB), Catholic Univ. of Chile President, Board of Directors and Research Program Coordinator (Conservation Management) Senda Darwin Foundation
			Dr Iván Diaz Dr Sharon Reid Pablo Necochea	Researchers, Centre of Advanced Studies in Ecology and Biodiversity (CASEB), Catholic Univ. of Chile
3 November	Santiago	Discussions about native forest silviculture with researchers	Dr. Gustavo Cruz*	Director, Dept of Silviculture, Faculty of Forest Science, Univ. of Chile
			Dr Harald Schmidt*	Senior Researcher, Dept of Silviculture, Faculty of Forest Science, Univ. of Chile
			Dr Juan Caldentey* Dr Alexis Federico*	Researchers, Dept of Silviculture, Faculty of Forest Science, Univ. of Chile
3–4 November	Santiago	Discussions about regulations and processes relating to forestry operations; threatened species and conservation planning with government officers	Dr Iván Benoit	Botanist, Natural Heritage Section National Forest Corporation (CONAF)
			Mariá Eugenia Saavedra*	Director of Forest Regulations, CONAF
			Diego Flores*	Conservation Planner, Natural Resources Section, National Environment Commission (CONAMA)

5 November	Santiago – Concepción – Los Angeles	Flight and bus trip across agricultural and forested landscapes, giving appreciation of distribution of native forest and plantations, and scale of harvesting, particularly in Concepción and Los Angeles areas (Region VI – VIII)		
6 November	Nahuelbuta National Park (Region VIII)	Visit outlying area of *Araucaria* and *Nothofagus* forest, discuss management	Guillermo Astudillo	Tech. Engineer, BASF Chile, Los Angeles
			Jaime Carcamo	Ranger, Nahuelbuta National Park
7–10 November	Temuco – Melapeuco – Villarrica – Curarreheu – Temuco (Region IX)	Field trip with researchers and regulators, discussing and assessing: – management of native forest on small to medium-size properties; – use and effectiveness of different silvicultural systems; – research sites; – certification and incentive schemes to encourage native forest regeneration; – implementation of Plans of Management and role of regional CONAF staff; – forest management and use of non-wood forest products in indigenous (Mapuche) communities – sawmill operations (small and medium-size mills) Presentation given to group on Tasmania's forests, management and forest practices	Alvaro Sotomayer*	Director of Research and Development, Forest Institute of Chile (INFOR)
			Victor Vargas*	Director of Good Forest Practices Project; Technical Director, Certification Standards Project, INFOR
			Dr. Oscar Larrain* Karina Luengo*	Researcher, Sustainable Native Forest and Plantation Management, INFOR
			Mariá Inés Miranda*	Coordinator, Forest Certification Systems for Native Forests, Foundation Chile
			Lucia Vilches* Pamela Reyes*	Forest Certification and Management Practice Technical Group, Foundation Chile
			Luis Corrales	President, Network of Native Forest owners of La Araucania Region
			Omar Rebellado	Consultant, community and social values
			Agosto Fuentes*	Forest Engineer, Melapeuco Municipality (through Program for Rural Development)
			Thomas Menzel*	Manager, CONAF, Villarrica area
			Oscar Painen	Forester, CONAF, Villarrica area
			Landowners in the Melapeuco, Huechilefun, Curarreheu & Villarrica areas	
11 November	Temuco – Valdivia	Bus trip across agricultural and forested landscapes; appreciation of distribution of native forest and plantations		

14–16 November	Valdivia (Region IX)	Discussions about forest ecology and biodiversity with researchers. Discussions about integration of research results with forest managers and government agencies. Presentation given to staff and students on Tasmania's forests, management and forest practices	Dr. Antonio Lara	Professor, Institute of Silviculture, Principal Investigator, Forest Ecosystem Services (FORECOS), Univ. Austral de Chile
			Dr. Carlos Le Quesne Eduardo Neira	Researchers, Institute of Silviculture, University Austral de Chile
			Francisco Morey	Journalist, Forest Ecosystem Services (FORECOS), University Austral de Chile
15 November	Rio de Cruces Wildlife Sanctuary	Tour of Rio de Cruces including wetlands and riparian forests. The Wildlife Sanctuary was affected by a chemical release from the ACELCO cellulose plant upstream in September 2005, resulting in death of threatened black-necked swans and other species.		
15–17 November	Valdivia	Discussions with Conservation Groups (NGOs), including priorities, processes and relationships with researchers and government agencies.	Christian Frei	Coalition for the Conservation of the Coastal Range
			Mark J. Gerrits	Institutional Development Specialist, Southern Andes Program, The Nature Conservancy
			Alexia Wolodarsky-Franke	Conservation Planner, World Wildlife Fund Chile
17 November	Valdivia – Chiloé (Region IX – X)	Bus and ferry trip from Valdivia through Puerto Montt to Castro (Chiloé Island)		
18 November	Castro, Chiloé Island	Survey of rainforest on private property	Carlos and Angeles Grimalt	Forest owners, Castro
18 November	Castro, Chiloé Island	Discussion on forest distribution, Plans of Management, interaction with conservation and research organisations	Rodrigo Rojas*	Forest Engineer, CONAF, Castro
20 November	Foundation Darwin Research Station, Ancud, Chiloé	Discussions about forest ecology, biodiversity, conservation and forest management with researchers. Discussions about conservation and management of Alerce (*Fitzroya cupressoides*) forests.	Dr. Celia Smith-Ramirez	Forest Ecology Laboratory, Faculty of Sciences, University of Chile Research Program Coordinator (Biodiversity), Senda Darwin Foundation Associate Researcher, Centre of Advanced Studies in Ecology and Biodiversity (CASEB), Catholic Univ. of Chile
			Dr Iván Diaz	Researcher, CASEB, Catholic Univ. of Chile

21 November	Ancud – Puerto Montt – Bariloche (Argentina)	Bus and car trip through agricultural land, plantation, native production forest, then through *Nothofagus*-dominated forests of the Puyehue National Park in the Andes Mountains to the Chilean–Argentinean border, before continuing through rainforest and drier forest to Bariloche. Unfortunately, the weather was dismal, meaning that there was little chance to appreciate the relationships between the vegetation and the environment.		
22–23 November	Bariloche Rio Negro Province, Argentina	Discussions about forest ecology, biodiversity, conservation and forest management with researchers. Discussions about national and provincial forest legislation and policies. Presentation given to staff and students on Tasmania's forests, management and forest practices	Dr. Juan Gowda* Dr. Cecilia Nuñez Dr. María Ines Messuti Dr. Thomas Kitzberger Dr. Gernot Vebis Lucas Garibaldi	Researchers, Laboratorio Ecotono, University of Bariloche (National University of the Comahue)
23–24 November	Bariloche	Discussions about forest management research, sustainable management, threatened species, regulations, national and provincial forest policies. Presentation given to staff on Tasmania's forests, management and forest practices.	Dr. Tomás Schlicter*	Coordinator, National Forest Program, National Institute of Primary Industry Research (INTA)
			Dr. Verónica Rusch*	Researcher (Sustainable Forest Management), National Forest Program, National Institute of Primary Industry Research (INTA)
24 November	Bariloche	Discussions about provincial legislation and regeneration requirements/problems.	German Fritz	Technical Forester, Andean Forest Service, Department of Production, Province of Río Negro
24 November	Bariloche – Buenos Aires	Flight across barren grass and scrublands, salt lakes and scalds, cropland and sporadic forest towards the Platte Delta, and finally the huge metropolis of Buenos Aires.		
25 November	Buenos Aires	Discussions about forest management, current forest mapping program and conservation planning. Discussions about national forest legislation and policies. Presentation given to staff on Tasmania's forests, management and forest practices.	Sergio La Rocca*	Coordinator, Native Forest Program, National Dept of Environment and Sustainable Development
			Lucila Boffilissin	Native Forest Program, National Dept of Environment and Sustainable Development
			Eduardo Manghi* Gabriela Parmuchi* Marcelo Brouver	Forest Evaluation Unit, Forest Section, National Department of Environment and Sustainable Development
		Discussion about forest management and regulation – national perspectives. Planning for biodiversity in plantations.	Dr Jorge Trevin*	Coordinator, Forest Development Project, National Department of Agriculture, Livestock, Fisheries and Produce

1 December	Ushuaia (Tierra del Fuego, Argentine Sector)	Flight across barren grass and scrublands, Patagonian forests, snow-capped mountains and finally Tierra del Fuego and the Beagle Channel.		
2 December	Ushuaia	Discussion about research into forest ecology and silviculture on Tierra del Fuego. Presentation at public meeting given on Tasmania's forests, management and forest practices.	Guillermo Martinez Pastur* Dr. Guillermo Defarrari Dr Vanessa Lencinas Alicia Moretto	Researchers, Southern Centre of Scientific Investigations (CADIC), National Council of Scientific and Technical Research, Argentina
3-4 December	Ushuaia – Los Cerros – Río Grande (Tierra del Fuego, Argentinean Sector)	Field visits to silviculture and ecological research sites; assessment of relationships between forest and non-forest veg. and environment, including land degradation by grazing, fire and beaver activities. Visit to areas with Plans of Management and forestry operations. Visit to sawmill and discussions with manager/owner. Visit to peat harvesting operations.	Guillermo Martinez Pastur* Dr Vanessa Lencinas	Researchers, Southern Centre of Scientific Investigations (CADIC), National Council of Scientific and Technical Research, Argentina
			Ricardo Vukasovic*	Forest Engineer, *Servicios Forestales*
			Roberto Fernandez	Manager and owner, *ProDin Ltd.*, Kareken Sawmill, Los Cerros
5 December	Río Grande – Ushuaia	Return from Río Grande to Ushuaia through spectacular snowstorm. Discussions about forest management and planning; conservation planning; preparation and evaluation of Management Plans.	Nora Loekemeyer Ricardo Hlopec*	Protected Areas Planners, Dept of Planning, Province of Tierra del Fuego, Argentina
			Néstor Urquía*	Director of Forests, Dept of Natural Resources, Province of Tierra del Fuego, Argentina
			Leonardo Collado*	Forest Engineer, Dept of Natural Resources, Province of Tierra del Fuego, Argentina
5 December	Ushuaia – Punta Arenas (Chile)	Flight across Tierra del Fuego to southern Chile, with Beagle Channel shining in the sun, mountains plastered with snow, contrasting with *Nothofagus* forest and recently logged coupes in Tierra del Fuego (Chilean Sector).		
6 December	Punta Arenas – Puerto Natales	Bus trip through landscape of grasslands and degraded forest (mainly *Nothofagus*), showing effects of fire and grazing by stock.		
7–9 December	Torres del Paine National Park	Recreational walk through this World Heritage Area landscape featuring soaring peaks, glaciers and lakes, wildlife, flora (much in flower), *Nothofagus* forests and relationships between vegetation and environment (including fire).		

10 December	Puerto Natales – Río Rubens – Punta Arenas	Field visit to Monte Alto property, to assess silvicultural research sites (Univ. of Chile) and examine and discuss areas being currently harvested under Plans of Management.	Dr. Gustavo Cruz*	Director, Dept of Silviculture, Faculty of Forest Science, Univ. of Chile
			Federico Hechenleitner*	Forest Engineer and Manager, Monte Alto property, Rio Rubens
11 December	Punta Arenas area	Visit Lago Parilla Nature Reserve – discuss research projects; examine relations between forest and non-forest vegetation, drainage and fire. Discuss land and forest degradation, and conservation planning.	Dr. Gustavo Cruz*	Director, Dept of Silviculture, Faculty of Forest Science, Univ. of Chile
12 December	Punta Arenas	Discussion on regulation of forest management, and Plans of Management.	Patricio Salinas*	Forest Engineer, CONAF, Magellanes Region (Region XII), Punta Arenas
12 December	Punta Arenas – Santiago	Flight along the length of the Andes, allowing spectacular views of the coastline, fjords, ice fields, glaciers and mountains of southern Chile, before the landscape becomes increasingly dominated by forests and agricultural land.		
13 December	Santiago	Discussion about forest certification for native forest management and development of technical guidelines. Presentation given to staff on Tasmania's forests, management and forest practices.	Mariá Inés Miranda*	Coordinator, Forest Certification Systems for Native Forests, Foundation Chile
			Lucia Vilches* Pamela Reyes*	Forest Certification and Management Practice Technical Group, Foundation Chile
14 December	Santiago	Discussion on forest management, conservation planning, problems with lack of government action (by CONAF and CONAMA) on infractions and responsibilities under Chilean legislation and international agreements.	Adriana Hoffman	President, Defenders of the Chilean Forest (NGO) Vegetation ecologist and prolific writer and botanical illustrator
15–16 December	Santiago – Valparaiso – Los Andes	Recreational activities, including visiting urban forest reserves in Santiago, and touring through dry (sclerophyll) forest and agricultural landscapes to the north of Santiago (Region V & Metropolitan Region).		
17 December	Santiago – Hobart	Return flight to Australia		

Appendix 2: The Tasmanian Forest Practices System

Tasmania has 3.3 million hectares of forest, which cover half the island. These forests are amongst Tasmania's greatest environmental, economic and cultural assets. The Tasmanian forest practices system is legislated by the Forest Practices Act 1985 and administered by the Forest Practices Authority (FPA), an independent statutory body. The FPA is responsible for ensuring that forest practices on all tenures provide reasonable protection for the natural and cultural values of the forest.

Forest practices include:

- Harvesting and regenerating native forest
- Harvesting and establishing plantations
- Clearing forests for other purposes
- Constructing roads and quarries for the above purposes
- Harvesting tree ferns

The Tasmanian forest practices system is based on a co-regulatory approach, involving responsible self-management by the industry, with independent monitoring and enforcement by the FPA. Self-management is delivered by Forest Practices Officers, who are employed within the industry to plan, supervise and monitor forest practices. The FPA trains and authorises them to carry out these functions and provides advice and monitors forest practices to ensure that standards are being met. Corrective action is taken where required and penalties are imposed for serious breaches.

The emphasis of the forest practices system is to foster co-operation amongst all stakeholders, including the government, landowners, the forest industry and the broader community, with an emphasis on training, education and continuing improvement. Tasmania's

The Elements of the Tasmanian Forest Practices System

Forest Practices Officers (FPOs)

The Forest Practices Authority trains and appoints foresters as Forest Practices Officers (FPOs), who are either employed by the forest industry or work as private consultants. FPOs prepare Forest Practices Plans (FPPs), which must be in accordance with the *Forest Practices Code* . The FPA delegates authority to selected FPOs to certify Forest Practices Plans. FPOs supervise the implementation of the plan and take corrective action where necessary. They have the authority to issue notices to cease operations, repair damage or carry out other work.

Upon completion of the operation, they lodge a Certificate of Compliance with the FPA that details the way in which the operation has complied with the *Forest Practices Code*. The FPA closely monitors Forest Practices Officers' performance and takes action through regular training and auditing to ensure uniformly high standards.

The Forest Practices Code (FPC)

The *Forest Practices Code* (FPC) provides a set of guidelines and standards to ensure protection of the natural and cultural values of the forest. The guidelines and standards in the FPC cover:

- Building access into the forest: (roads, bridges, quarries etc.)
- Harvesting timber

- Conservation of natural and cultural values (soil and water, geomorphology, visual landscape, flora, fauna and cultural heritage)
- Establishing and maintaining forests

The FPA developed the FPC through extensive consultation and public comment. It is reviewed periodically, incorporating suggestions from scientists, government, the forestry industry and the public. As part of this process it has been refined and expanded twice, most recently in 2000. The Code is legally enforceable under the *Forest Practices Act 1985* for both public and private forests. There are also other legislation and policy requirements that also need to be considered when preparing a Forest Practices Plan, such as the *Threatened Species Protection Act* (1995) and the Regional Forest Agreement.

Forest Practices Plans (FPPs)

Forest Practices Plans (FPPs) are required for all forest practices on public and private land, except for a few exemptions detailed in the Forest Practices Regulations (available at www.fpa.tas.gov.au).

FPPs must be prepared in accordance with the *Forest Practices Code* and be certified by a Forest Practices Officer before work starts. Applicants for FPPs must notify their neighbours and local government before operations begin.

FPPs provide details of the operation area, boundaries, roads, snig tracks, landings, bridges, streams and retained forest areas for conservation. They also include prescriptions for protection of natural and cultural values of the forest, planned harvest systems, and reforestation or regeneration of the site.

During the preparation of the plan, FPOs are required to identify natural or cultural values of the forest, and must seek advice from a relevant specialist on protecting those values. This may result in restrictions, such as harvesting being modified or areas being reserved for conservation reasons.

Approval for the activity associated with the plan is then sought from the local Council as the statutory planning authority (if required under the planning scheme and if the land is not a Private Timber Reserve or State forest). The Council may impose additional conditions on the proposed operations.

Private Timber Reserves (PTRs)

Private Timber Reserves (PTRs) provide long-term planning certainty to private landowners wishing to grow or harvest trees on their land. A FPP is mandatory on a PTR but additional local government approval is not required for forestry operations. Land declared as a PTR must satisfy the criteria outlined in the *Forest Practices Act 1985*. For example, it must be contrary to the public interest or local government planning and the land must be suitable for forestry. Local government and neighbouring landowners may object to the declaration of a private Timber Reserve through the Forest Practices Tribunal.

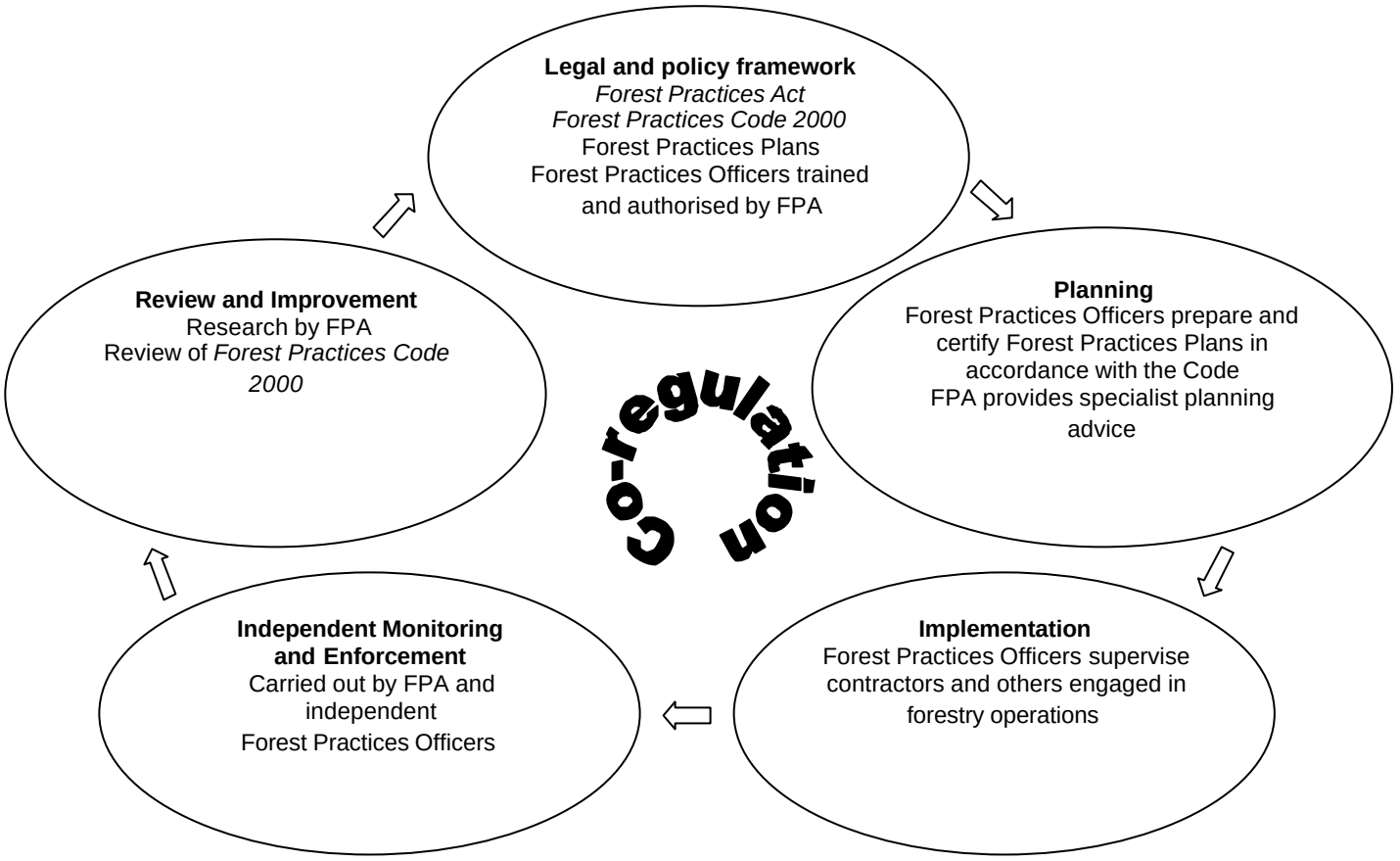
The Forest Practices Tribunal

The Forest Practices Tribunal is an independent body composed of experts in forestry and conservation science and is chaired by a legal practitioner. It hears appeals lodged in relation to decisions of the Forest Practices Authority.

FPA Research and Advisory Program
Employs specialists whose research and monitoring underpins the *Forest Practices Code 2000* and its review
Trains Forest Practices Officers and provides practical advice
Monitors management of the natural and cultural values of forests

The Forest Practices Code 2000
Outlines legally enforceable guidelines and standards for forest practices.

Forest Practices Plans
Are mandatory for all forest practices on both State and private land, including Private Timber Reserves
Must be in accordance with the *Forest Practices Code 2000*
Must be certified by a Forest Practices Officer



FPA Independent Regulation Program
Annually audits Forest Practices Plans
Monitors forest practices throughout the year
Corrective action is taken and penalties are used where necessary

Forest Industry self-management
The forest industry and landowners employ Forest Practices Officers who prepare, certify and supervise the implementation of Forest Practices Plans. They take corrective action where necessary and issue a Certificate of Compliance on completion of operations.

Co-regulation = industry self-management + Government regulation

The Forest Practices Authority (FPA)

The Forest Practices Authority has statutory responsibilities to monitor the operation of the *Forest Practices Act* and report to Parliament.

The FPA has a board of governance and a management team that comprises scientists, advisors, compliance officers and administrative staff. The Chief Forest Practices Officer is the head of the FPA and is responsible for the day to day administration of the forest practices system.

The FPA's Annual Report makes publicly available the work carried out by the Research and Advisory Program and the results of the Independent Regulation Program (compliance reports, the annual audit, investigations and enforcement action).

Research and Advice

The FPA employs specialists in archaeology, botany, geoscience, soil and water, visual landscape, zoology and forest operations. They liaise and collaborate with other scientists. Research and monitoring in these subjects underpins the FPC and aids its development. The specialists also monitor the effectiveness of the forest practices system and suggest improvements to it.

The specialists play a key role in training FPOs. They have developed a variety of management tools to assist FPOs identify and manage the natural and cultural values of forests when preparing FPPs. The specialists also provide a consultancy service when special values are identified.

Independent Regulation

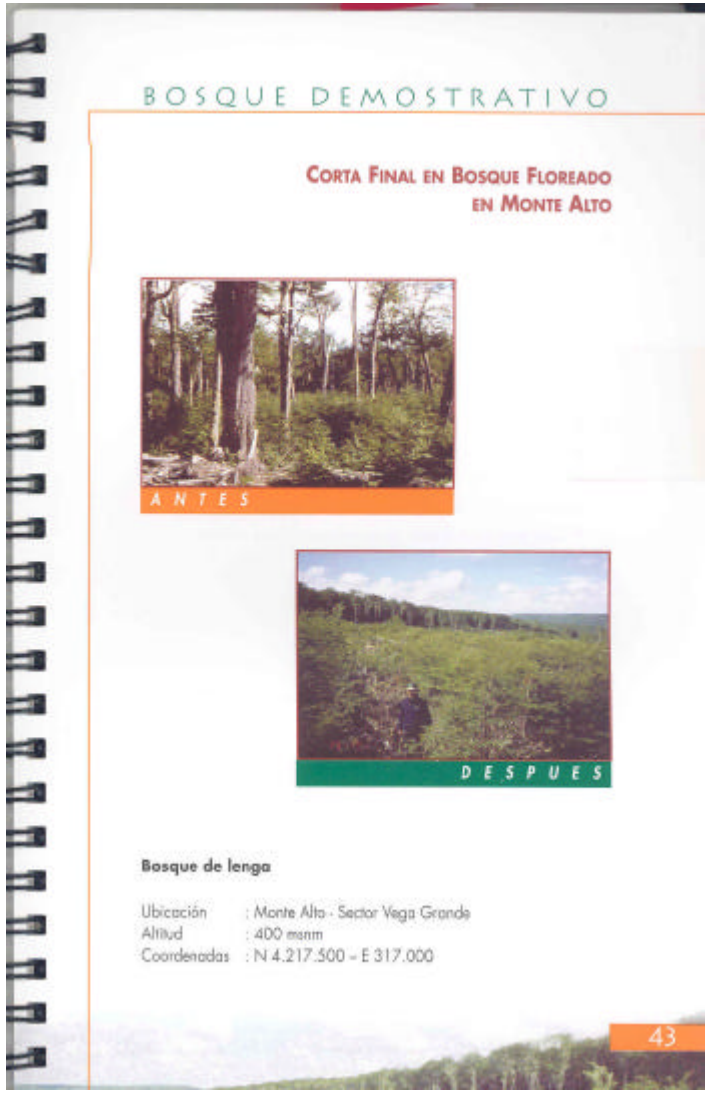
The Independent Regulation Program of the FPA annually audits a random sample of about 15 per cent of all FPPs on private and public land. Independent FPOs and the FPA specialist staff conduct the audits which sample the standard of forest practices. The performance of each sector - Forestry Tasmania, large private companies and small operators – is assessed and the results published in the FPA's annual report. The program also investigates all alleged breaches of the FPC and takes appropriate enforcement action. It has powers to issue notices, impose fines or take legal action to ensure Code compliance, and to revoke the authority of FPOs.

The focus of the Tasmanian forest practices system is on co-operation and continuing improvement through training, research and development. This leaflet is part of a series which includes leaflets on the Forest Practices Code, Forest Practices Plans, the role of the Forest Practices Authority specialists and compliance monitoring. More information about the Forest Practices Authority can also be found on the web at www.fpa.tas.gov.au.

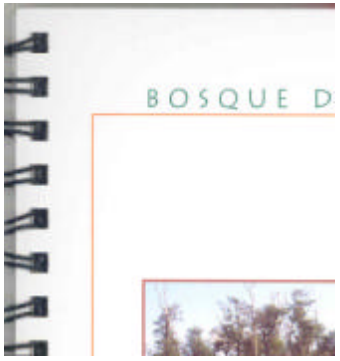
For more information contact…

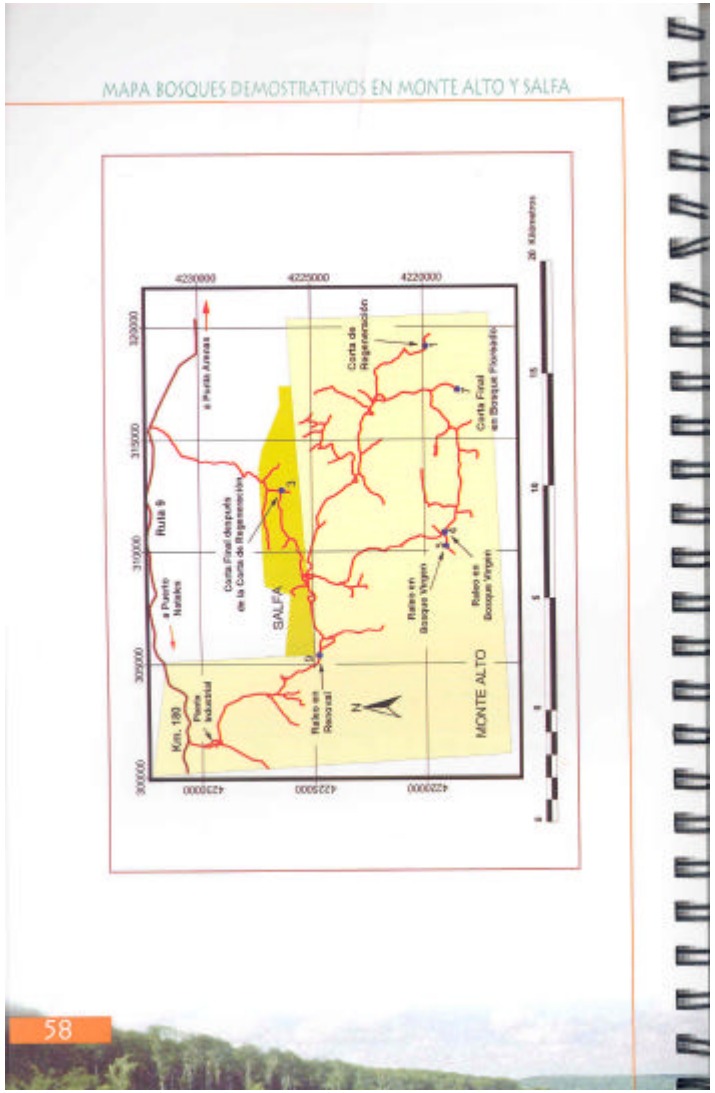
Forest Practices Authority
30 Patrick Street Hobart 7000
Tel: (03) 6233 7966
Fax: (03) 6233 7954
Email: info @fpa.tas.gov.au

Appendix 3: Excerpts from guide book on silvicultural management of demonstration forests in southern Chile. The excerpts illustrate operations in lenga (*Nothofagus pumilio*) forest on Monte Alto property, near Punta Arenas. The guidebook (Schmidt *et al*. 2003) was produced by the Department of Forest Sciences, University of Chile.



Gottstein Report (2005)





Gottstein Report (2005)

Appendix 4: Management Plan template for logging in lenga (*Nothofagus pumilio*) forest

corporación nacional forestal

GIS

FECHA DE INGRESO		
DIA	MES	AÑO

(Uso exclusivo CONAF)

Nº 01228
Solicitud Nº
Fecha de Ingreso .....

Normas de Manejo Aplicables a cortas de Protección en el tipo Forestal Lenga

Nombre o Razón Social del Propietario.....

Nombre del Representante Legal .....

Domicilio.....

R.U.T. del Propietario.....

Solicito acoger el predio que más adelante se individualiza a las Normas de Manejo establecidas por la Corparación, para ejecutar Cortas de Protección en bosques del Tipo Forestal Lenga, de acuerdo a las especificaciones técnicas y administrativas que en ellas se indican, dentro de un plazo máximo de dos años contados desde la fecha de emisión del respectivo certificado aprobatorio de estas normas por parte de CONAF.

Declaro bajo juramento que los datos proporcionados son verdaderos y que conozco las Normas de Manejo que se señalan al reverso a las cuales me acojo, me comprometo a cumplirlas cabalmente y a otorgar a CONAF las facilidades necesarias para que proceda a su fiscalización.

ANTECEDENTES DEL PREDIO

Nombre del Predio .....

Rol ..... Comuna ..... Provincia ..... Región .....

Superficie Predial .....

Superficie Total de Rodales a Intervenir .....

Vías de Acceso .....

.....

.....

.....

.....

.....

.....

.....

ORIGINAL : OF. REGIONAL

NORMAS DE MANEJO DE APLICABLES A CORTAS DE PROTECCION EN EL TIPO FORESTAL LENGA

1.- Clasificación de los bosques de Lenga:

Se podrán acoger a estas normas los rodales ubicados en bosques del Tipo Forestal Lenga de las siguientes características.

a) Rodales sin regeneración establecida; compuestos por uno o más estratos, generalmente un solo estrato superior; en ellos la cobertura no es adecuada para el establecimiento de la regeneración, o ésta última es incipiente y/o se encuentra irregularmente distribuida, o aún no alcanza una altura superior a 0,5 metros.

b) Rodales con regeneración establecida; compuestos por uno o más estratos, con una cobertura tal que ha permitido el establecimiento de regeneración homogéneamente distribuida, alcanzando ésta una altura igual o mayor a 0,5 metros.

c) Rodales con renoval sin posibilidad de mejoramiento mediante manejo; formados por un dosel superior con árboles sobremaduros y un dosel inferior constituido por un renoval de mala calidad que no asegura la formación de un bosque comercial. Se considera que este dosel inferior no tiene la posibilidad de mejoramiento mediante manejo cuando la combinación del número de árboles por hectárea y diámetro medio no alcanza los valores presentados en el siguiente cuadro:

CUADRO Nº 3 : Parámetros de rodal mínimos necesarios para constituir renovales manejables

Estado de Desarrollo	Densidad (Nº árboles/ha)	Diámetro Medio Cuadrático (cm)
Monte Bravo	5.000	2 - 3 *
Latizal	2.000	8
Fustal	1.000	15

* altura media (metros)

d) Rodales considerados como enclaves; cuando el renoval alcanza o supera los valores mínimos presentados en el cuadro Nº 3 se considera manejable. Su manejo dependerá de su tamaño, definiéndose dos categorías de superficie:

i) 0,00 - 0,50 ha: se considera que estos tamaños no alcanzan a constituir enclaves y, si el propietario lo desea, puede integrar dicha superficie a la aplicación de cortas de protección. Cuando se integren dichas superficies se entenderá que deben quedar bien manejadas y realmente incorporadas a cortas de protección, respetando la regeneración ya establecida.

ii) Mayores a 0,50 ha: se considera que estas superficies ya constituyen enclaves y su manejo o exclusión es voluntario.

e) Rodales con Bosque Mosaico; son rodales que, a niveles de superficie iguales o inferiores a 1 ha, presentan una elevada heterogeneidad de estados de desarrollo o de clases diamétricas.

2.- Identificación y caracterización de rodales

Los rodales acogidos a estas normas deberán cumplir con las siguientes exigencias:

a) Tener una sumatoria total de rodales menor o igual a 500 ha por predio. En el caso que el predio tenga una superficie boscosa mayor a 500 hectáreas, el propietario sólo podrá acceder a este procedimiento especial por una superficie máxima de 500 héctareas y, una vez efectuadas correctamente las actividades especificadas en esta norma, podrá ingresar una nueva solicitud hasta 500 hectáreas adicionales, y asi sucesivamente hasta completar la superficie boscosa del predio que interesa manejar.

b) Señalar en el Cuadro Nº 1: número del rodal, superficie (ha), pendiente del terreno (%), situación tipo, año de ejecución de la corta, Diámetro Medio Cuadrático (cm), densidad inicial (Nº árb./ha) y rango de cobertura a dejar (%).

c) Señalar en el Cuadro Nº 2: número de rodal y densidad (Nº pl/ha), altura (cm) y distribución de la regeneración.

d) La ubicación de estos rodales deberá mostrarse en una plano a escala 1:20.000, 1:10 000 o 1:5.000, el que deberá indicar a lo menos lo siguiente: antecedentes administrativos del predio, roles vecinos, nombre del autor del estudio técnico, mapa de ubicación predial a escala 1:500.000 0 1:250.000, escala (gráfica y nominal), Norte, límite de los rodales a intervenir señalados con el mismo número usado en el Cuadro Nº 1, presencia de enclaves, cursos de agua, curvas de nivel, áreas de protección, red de caminos (actuales y planificados a futuro), senderos cercos y otros elementos que ayuden a localizar los rodales en terreno.

II.- IDENTIFICACION Y CARACTERIZACION DE LOS RODALES

2.1.- Cuadro Nº 1 ; Caracterización de los Rodales

Nº RODAL	SUPERFICIE (ha)	PENDIENTE RANGO MEDIO (%)	SITUACION *	AÑO EJECUCION **	DMC (cm) ***	ALTURA MEDIA (m)	DENSIDAD INICIAL (Nº arb/ha)			RANGO COBERTURA A DEJAR ****
							LENGA	COIHUE	TOTAL	
SUPERFICIE TOTAL										

* : **Situación Tipo :** Se presenta con las letras **a**, **b**, **c**, **d**, o **e**, de acuerdo a lo definido en el Punto 1: Clasificación de los bosques de Lenga.

** : **Año de ejecución de la Corta :** Corresponde al año en que se realizan las actividades de corta, las que tendrán vigencia por un periodo de 2 años, contados desde la fecha de emisión del respectivo certificado aprobatorio por parte de CONAF.

*** : **DMC** = Diámetro Medio Cuadrático

$$DMC = \sqrt{(AB * 4000 / \pi * Nº \text{ árboles / ha})}$$

**** : **Rango de cobertura a dejar:** Se representa de acuerdo a lo señalado en el Cuadro Nº 4: Coberturas a dejar por situación tipo

Observaciones: .....

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2.2.- Cuadro Nº 2: Caracterización de la regeneración presente antes de iniciar el programa de corta.

Nº RODAL	REGENERACION		
	DENSIDAD (Nºpl/ha)	ALTURA (cm)	DISTRIBUCION

Observaciones .....

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III.- ANTECEDENTES DEL AUTOR DEL ESTUDIO TECNICO

Nombre del Autor .....

Profesión .....

Dirección y Teléfono .....

Firma .....

IV.- ANTECEDENTES DEL PROPIETARIO

Nombre del Propietario del Predio .....

Dirección y Teléfono .....

Fecha .....

Firma .....

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3.- Método de Corta:

3.1.- Método de Cortas de Protección

Para los fines de esta norma se entenderá como Cortas de Protección aquéllas consistentes en la extracción gradual de la masa completa del rodal en una serie de cortas parciales que se extienden durante una parte del turno. Esquemáticamente se trata de dos tipos de corta:

a) Corta de Siembra: se aplica en rodales en que no haya regeneración establecida y se considera como una única corta.

b) Corta de Extracción: se aplica en rodales con regeneración establecida y para el caso de esta norma se considera sólo la primera corta de extracción.

La forma predominante que toma el método, es la de una corta semillera intensa distribuida mas o menos uniformemente en todo el bosque, cuyo objetivo final es el establecimiento de la regeneración y su posterior desarrollo.

Por tratarse de un método dirigido al establecimiento o a la liberación de la regeneración, este tipo de manejo es aplicable a rodales adultos y en etapa de regeneración y a renovales que presenten deficiencias serias de sanidad, forma y/o densidad que les impidan constituirse en rodales aprovechables en el futuro.

En casos de rodales con regeneración establecida de hasta 2,5 metros de altura, el movimiento provocado por la explotación debe dejar vías de saca claramente establecidas o planificadas.

En el caso de rodales que tenga regeneración de hasta 2,5 metros de altura, deberá dejarse una cobertura entre 10 a 30 % y, para los que tengan regeneración de una altura superior a 2,5 metros deberá dejarse una cobertura entre 0 y 30%.

No obstante en situaciones de mosaicos en que no hubiera suficientes árboles a dejar de buenas características, se podrán dejar árboles de otras características pero la cobertura a dejar será de 40 a 55%. Estos sectores deben ser previamente marcados en la cartografía.

Para los rodales en que se deba dejar dosel de protección, éste debe ser de los estratos superiores, por lo cual se deben eliminar aquellos individuos del dosel intermedio que dificulten el establecimiento de la regeneración.

En las mediciones de cobertura y densidad se aceptará un rango de error total no superior al 10% de los valores extremos establecidos en el Cuadro Nº 4.

3.2.- Características de las intervenciones:

En la regulación de las intervenciones se deben considerar dos variables: cobertura y tipo de árboles a dejar.
Las coberturas a dejar por situación tipo se presentan en el Cuadro Nº 4:

Cuadro Nº 4: Coberturas a dejar por situación tipo

Situación Tipo	Coberturas a dejar %
- Rodal sin regeneración establecida	30 - 50
- Rodal con regeneración establecida:	
altura menor o igual a 2,5 mts.	10 - 30
altura mayor a 2,5 mts.	0 - 30
- Rodal con renoval no manejable	30 - 50

Respecto de los árboles a dejar, lo más importante es que sean buenos semilleros y que se distribuyan en forma más o menos uniforme en el área, otorgando una protección adecuada para el establecimiento de la regeneración.

Las principales características de los árboles a dejar son las siguientes:

- que pertenezcan al dosel dominante o codominante
- que tengan copa frondosa
- que sean estables y vigorosos

Las siguientes características definen árboles que por ningún motivo debieran seleccionarse:

- pudrición evidente y generalizada
- fuste quebrado y/o copa rajada.

En todos los casos se deben extraer, aquellos individuos del dosel intermedio que dificulten el establecimiento de la regeneración.

3.3.- Marcación:

En terreno se deberán seleccionar los árboles a cortar y aquéllos a dejar en cada rodal de acuerdo a lo señalado en el punto 3.2.

Los árboles seleccionados para dejar, obligatoriamente deberán marcarse con una franja a nivel de DAP y una marca en forma de punto en la base del árbol (ver Figua 1).

3.4.- Comprobación de la marcación

Una vez efectuada la marcación, es recomendable que el propietario compruebe que el número y la calidad de los árboles seleccionados sea el adecuado para los objetivos planteados. En caso contrario deberá modificar el número de árboles marcados.

3.5.- Planificación y Ejecución de la corta:

La planificación de la corta debe contemplar los aspectos de:

a) Establecimiento de la regeneración: para la regeneración se exigirá un mínimo de 3.000 plantas por hectárea de buena calidad y homogéneamente distribuidas.

b) Volteo: en el volteo se controlará el daño causado a los árboles remanentes y a la regeneración. En el caso de los árboles remanentes se considerarán dañados cuando no puedan cumplir la función para la cual fueron dejados y este daño no debe superar un 5 % de los árboles que quedarán como protección. En consecuencia, estos árboles no serán contabilizados para la determinación de cobertura, la que de todas maneras debe cumplir con los valores señalados precedentemente.

Como norma general se recomienda no voltear a aquellos árboles que puedan causar demasiado daño, tanto a los árboles remanentes como a la regeneración; en caso de que sea necesario eliminar estos árboles u otros que no desde el punto de vista económico y que deben salir desde el punto de vista silvícola , se recomienda su anillamiento.

c) Madereo: para el madereo se tendrá en cuenta las mismas consideraciones anteriores, teniendo presente que estas actividades deben causar el mínimo daño tanto a la regeneración como al suelo. En todo caso no deberán quedar en el bosque, bajo ninguna circunstancia, trozos de los árboles cortados.

d) Tratamiento de desechos: respecto del tratamiento de desechos se establece solamente que los árboles que quedan en el interior del bosque no esten sostenidos ("colgados") por árboles en pie, sin lograr alcanzar totalmente el suelo y que las copas de los árboles cortados no sobrepasen los 1.5 metros de altura ("bajar las copas").

e) Construcción de campamentos, canteras, caminos y canchas de acopio: los campamentos, canteras, caminos y canchas de acopio que se construyan podrán cubrir un máximo de un 5% del área de los rodales acogidos a estas normas. El ancho de la faja para los caminos principales no debe superar los 20 metros.

3.6.- Casos particulares

Cualquier caso particular que no este dentro de estas normas deberá ser transmitido como un plan de manejo convencional.

4.- Medidas de Protección:

4.1.- Areas a excluir de intervención.

Las áreas que a continuación se señalan quedarán excluidas de cualquier corta y no deberán sufrir caida de árboles:

a) Areas alrededor de cursos de agua: los cursos de agua permanente tendrán en cada orilla una faja de protección de 30 metros de ancho, como mínimo. Los 30 metros se medirán horizontalmente desde donde empieza la vegetación arbórea que bordea el curso. La ubicación de estos cursos y su clasificación en permanentes y no permanentes se basará en las cartas regulares escalas 1: 50.000 del I.G.M. (ver Figura 2).

b) Area de pendiente elevada: aquellas áreas cuya pendiente es mayor o igual a 60% por más de 30 metros.

c) Areas con bosques que en estado adulto no superen los 8 metros de altura, pues esto es indicador de suelos delgados o sitios de mala calidad.

d) En el caso de turbas, vegas o mallines se debe dejar una franja de protección de 10 metros de ancho como mínimo.

e) Para todos los caminos públicos deberá dejarse una franja de protección, en ambas orillas, de a lo menos 30 metros, medida desde la parta exterior de la berma.

4.2.- Medidas de Protección en las áreas de intervención:

Los propietarios adheridos a estas normas, se comprometen a respetar las siguientes restricciones:

a) Los cursos de agua no permanentes contarán con una faja de protección de 15 metros de ancho como mínimo.

b) Excluir de ganado los rodales afectados a estas normas en las siguientes condiciones:

i) Hasta que la regeneración de los árboles intervenidos alcance una altura de 2,5 metros, o

ii) Hasta que la regeneración por su altura y densidad evite por sí sola el desplazamiento de los animales en el bosque.

c) Por la restricción señalada en b) se recomienda cercar los rodales a intervenir bajo estas normas, y preocuparse de la mantención y reparación de los cercos.

d) La construcción de campamentos, canteras, caminos, canchas de acopio y fajas de madereo deberá realizarse de acuerdo a lo señaldo en el punto 3.5 y causando el mínimo impacto al suelo y la vegetación.

e) Los propietarios adheridos a estas normas se comprometen a dejar en pie y no dañar durante las faenas de volteo y madereo a los individuos de cualquiera de las especies arbóreas o arbustivas incluidas en las categorías de: en peligro, vulnerable o raras.

f) Se prohibe el uso del fuego en las faenas forestales de los rodales adheridos a estas normas de manejo.

5.- PLazo y Cumplimiento de las Normas:

5.1.- Plazo para la ejecución de las actividades programadas:

El propietario quedará autorizado para realizar las intervenciones de corta por la superficie total alecta a estas normas, dentro de un máximo de dos años contados desde la fecha de emisión del certificado aprobatorio de CONAF.

Una vez que el propietario ejecute correctamente las actividades señaladas en estas normas de manejo, quedará facultado para presentar para el mismo predio, una nueva solicitud de adhesión a estas normas, y así sucesivamente, hasta completar la superficie total boscosa del predio que se desee manejar.

5.2.- Cumplimiento de las normas:

Si producto de la evaluación del grado de cumplimiento de las normas previamente autorizadas, se detecta o se prueba alguna de las situaciones que se indican seguidamente, se estará frente a un corta ilegal en los términos señalados en el artículo 21 del D.L. 701, o frente a un incumplimiento de plan de manejo en los términos señalados en el artículo 20 del D.L. 701, ante lo cual se notificará la Juzgado de la Policía Local este hecho.

5.2.1.- Se entenderá que existe corta ilegal de los bosques en los siguientes casos:

a) No respetar la prohibición de corta de árboles ubicados en algunos sectores de protección aledaños a cursos de agua e indicados en el punto Nº 4.

b) Corta de árboles ubicados en pendientes superiores al 60% por más de 30 metros.

c) Ejecución de las faenas de corta en fecha posterior a los dos años de vigencia de las normas.

d) No respetar la prohibición de corta a orillas de caminos públicos.

e) Corta de árboles que en estado adulto no superen los 8 metros de altura.

5.2.2.- Se entenderá que existe incumplimiento respecto a las normas aprobadas en las siguientes situaciones:

a) Información abiertamente errónea.

b) Extracción de un porcentaje de cobertura superior o inferior a lo indicado por la norma.

c) Extracción de los árboles marcados que implique una alteración tal, que la cobertura dejada se salga de los rangos fijados para situación tipo.

d) Extracción de los árboles de mejores características maderables mediante el sistema de floreo.

e) Extracción de árboles sin haber efectuado marcación previa

f) Comprobación en terreno de daños mayores efectuados al bosque cuando no se haya dado cumplimiento al Programa de Protección.

g) No respetar la exclusión de ganado para los rodales acogidos a estas normas.

CUADRO Nº 1

CUADRO Nº 2

INFORME TECNICO (Uso exclusivo de CONAF)

Analizados los antecedentes técnicos y administrativos contenidos en las presentes Normas de Manejo

procede ☐ **no procede** ☐ **su aprobación**

Observación .....

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Nombre del Informante .....

Firma del Informante .....

Fecha .....

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Appendix 5: CONAF guide to transport of native forest products