‘Why should industry invest in Cypresses in FFR?’

Final draft to be distributed to the Cypress working group for review

Part A: Business Case
Part B: Background Analyses

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EXECUTIVE SUMMARY

The aim of this report is to give industry a status report on cypress forestry, including current knowledge and knowledge gaps, and present a business case for investment in cypress research.

Cypress species have been planted in NZ for over 150 years. The cypress group has desirable wood properties, with naturally durable heartwood, pleasant appearance, and, with good stand management, provides a high-value product. There is relatively low variation in wood properties from pith to bark and, therefore, no corewood problems as associated with radiata pine. There is already excellent market acceptance, with a substantial price advantage over radiata pine and a major premium for quality. There is limited economic data available, but initial economic analyses indicate comparable economic returns with radiata-pine forestry. Export prospects for eastern Asia are very promising, but currently the domestic market remains under supplied.

New Zealand's forestry industry is largely based on radiata-pine, resulting in a lack of market buffering associated with limited product diversity. Radiata pine provides for versatile timber products, but is not suitable for some demanding specialty end uses. Cypresses are better matched to many of these specialty end uses, allowing exploitation of market niches. The forestry industry can improve risk management and market buffering by diversifying and investing in high-value alternative species such as cypresses.

Cypress plantings are only a small percentage of the plantation forest estate in New Zealand. Nevertheless, there has been a slow but steady increase in plantings of cypresses over the last two decades, in spite of a recent decrease in overall forest plantings. Confidence in cypress forestry was set back when cypress canker became a serious problem in the mid 1990s in some parts of NZ, particularly with macrocarpa. Lusitanica has since become more prominent because of its much greater resistance to cypress canker. Although plantings are still at a low level compared with radiata pine, there is currently a good distribution of cypress plantings in all age classes, providing a continuity of resource.

Apart from the farm forestry sector and a few corporate growers, there tends to be a lack of confidence in growing cypress species. This is largely due to significant knowledge gaps regarding establishing and managing cypress stands, limited information on economic returns, market uncertainty, and an overall lack of infrastructure in the supply chain. There are also concerns about the currently higher silvicultural costs in cypress forestry compared with radiata-pine forestry. A recent market survey identified that a major concern for those processing and utilising cypress was a lack of available resource, yet ironically, a survey of growers indicated that a major impediment to more planting was market uncertainty.

Significant knowledge gaps have been identified by researchers in consultation with industry – a comprehensive list of knowledge gaps is presented in Part B of this report. This list needs to be prioritized and pruned down by industry in consultation with research providers. Many of the identified knowledge gaps can be remedied by obtaining and analysing existing data. There is already a considerable body of knowledge regarding growing cypress species and utilising cypress timber products, but this is somewhat fragmented. Transfer of technology has been good within the farm forestry sector, but somewhat lacking within the wider industry. The Cypress Action Group, of the New Zealand Farm Forestry Association, has been instrumental in encouraging the transfer of knowledge and technology within the farm forestry sector, but this group does not speak for the industry as a whole. Some of the information that the wider industry has indicated it needs to know before increasing investment into cypresses is already in existence, but obviously is not easily accessible or in a form that can be readily received. This has been improved in part by the recent publication of the cypress handbook in the NZFFA electronic handbook series, which is freely available on-line.

Investment in research will directly benefit the forestry industry with improved knowledge and technology transfer resulting in increased returns to growers, processors and end users. Increased knowledge on siting, establishment and management of cypress stands would help reduce the perceived higher risks currently associated with growing cypresses. Market research is needed to quantify current and potential future demand in local and international cypress consumer markets; including how much of the imported western-red-cedar market can be substituted for locally grown cypress. The market for imported western-red-cedar is both an opportunity and a threat, depending on whether it is either substituted by, or substituted for, NZ-grown cypress timber. Also, carbon sequestration, plus pressure for species biodiversity and FSC compliance, may create opportunities and positively impact the economics of cypress forestry.

The diversified species section of the newly formed Future Forests Research Ltd (FFR) is ideally positioned to provide the needed infrastructure for investment in research to benefit the cypress industry. Development of a co-funding relationship between government and industry for research initiatives, improvement in technology transfer, and lobbying of government would all be better facilitated by the diverse species group in FFR, particularly if there is a strong cypress sub-theme. FFR would allow a more direct partnership between industry and researchers, and subsequently, ensure that research is strongly focussed on industry needs.

A cypress industry workshop was held in Rotorua, 28th August 2007, and a cypress working group formed. There was unanimous support for the formation of a cypress sub-theme within FFR. The cypress working group will bring a very pertinent perspective on the development of the industry as a whole, and provide a mechanism for industry consultation regarding research priorities. It was recognised that success of the cypress sub theme would be dependent on industry investment. It was subsequently recommended that a report be prepared to encourage wider industry support for cypress research and development.

ACKNOWLEDGMENTS

This report is largely based on a compilation of disparate information sources, which have been identified where possible. However, it is difficult to acknowledge the source of some of the information because it is gleaned from conversations with colleagues across a broad spectrum of the forestry industry. Also, some of the information sources could not be divulged due confidentiality.

Grateful acknowledgement is given to Ian Nicholas (particularly for reviewing this report and providing information on the market survey, current knowledge and knowledge gaps), Patrick Milne (for assistance with the business plan), and Barry Poole (economic information and grower's survey). Charlie Low, Ensis Genetics, is gratefully acknowledged for providing Appendices 1 and 2. Acknowledgement is also given to members of the cypress industry who contributed to the report, particularly Kent Chalmers (Dunedin City Forests Limited).

INTRODUCTION

A cypress industry workshop was held in Rotorua, 28th August 2007, and a working group formed. There was unanimous support for the formation of a cypress sub-theme within FFR (Future Forests Research Ltd). FFR is a research partnership between industry and forest research providers, which replaces the industry co-operatives that have operated for radiata pine, Douglas-fir and eucalypts.

Financial support from industry is critical to the formation of a cypress sub-theme. With this in mind, the workshop identified some disparate information sources on the cypress industry that could be utilised to develop a business case.

Following discussions, the working group agreed that the following key information was required:

1. A summary of current and potential markets for cypress timbers (including the potential value of these markets).
2. A summary of the current NZ cypress resource and is potential value.
3. A summary of current knowledge applicable to growing, managing and utilising cypresses.
4. A summary of the gaps in this knowledge.
5. An insight into the economics of growing cypresses.

Participants at the workshop had a strong desire to move forward. It was recommended that funding be sought from FIDA (Forestry Industry Development Assistance) for a report on the status of the industry. The aim of this report is to provide the focus and background material necessary to attract and encourage wider industry support for cypress research and development.

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The brief for this contract is to: develop an overview of the current status of the cypress industry, identify the potential for growth and subsequently develop a business case for investment in cypresses.

For ease of reading, the colloquial name of individual species has been used throughout this report in preference to full scientific names, i.e.:

- macrocarpa = *Cupressus macrocarpa* Gordon.
- lusitanica = *Cupressus lusitanica* Mill.
- Leyland cypress = x *Cupressocyparis leylandii (*Jacks. & Dall.) Dall.
- Ovensii = x *Cupressocyparis ovensii* (A.F.Mitchell)

Because of their importance to New Zealand forestry, this report concentrates on macrocarpa and lusitanica along with the main hybrids Leyland and ovensii.

This report is in two parts. Part A is the business case for investing in cypress forestry and in the FFR diversified species, cypress sub-theme. Part B is the background analyses providing a status report for the cypress industry and information for the business case. In the business case, part A of this report, links are provided to background information in part B, plus key references.

PART A: BUSINESS PLAN

1. Why should the Forestry Industry invest in Alternative Species such as Cypresses?

- There is currently a lack of market buffering associated with limited product diversity, because New Zealand's forestry industry is largely based on growing and processing radiata pine.
- Alternative species such as cypresses can complement the main New Zealand forestry option of radiata-pine. Growth in the radiata-pine market is limited by a saturated NZ market and high freight costs for export.
- There is increasing concern over the unrealistic expectations for one species (radiata pine) to fit all market niches (Poole and others 2007). Although radiata pine is well recognised for producing highly versatile timber products, it is increasingly apparent that it is not suitable for some demanding specialty end uses. There are alternative species, such as cypresses, which provide profitable alternatives that are better matched to these specialty end uses and exploitation of market niches.
- This is increasing concern that economic reliance on one species is very risky - radiata-pine is 89% of the national plantation resource (Poole and others 2007). Forestry growers and processors are now more aware of the need for risk management in terms of species diversity in plantations, plus product diversity in the market place; i.e., a portfolio approach.
- The Forest Stewardship Council (FSC) has initiated certification of sustainably managed forests and most forestry organisations in NZ have sought and gained FSC certification to allow easier access to certain overseas markets. FSC certification does not dictate species diversity, but does encourage it and some NZ companies have shown initiative by planting different species to mitigate risk.
- Expansion of the national plantation area is currently constrained by the gap between land price and the return that radiata pine can produce on that land. In order to expand the national forest estate, the industry needs to produce higher value products and alternative species, such as cypress, may offer that (Kent Chalmers, CFL, pers. comm.).

2. Strengths of Cypresses – Why are they a good investment?

- Cypresses offer a profitable, alternative softwood industry. Currently demand for cypress timber in NZ exceeds supply.
- Economic returns are comparable with that of radiata pine. A recent economic analysis, of the expected returns from the current crop of well-tended cypress stands, gave a total estimated revenue of $52,000 per ha. With a rotation length of 35 years, this economic analysis estimates an IRR of 8 %. *(Insights into economics, page 23).*
- Cypresses are an integral part of New Zealand's exotic tree landscape – there are about 150 years of experience in growing and processing cypresses in NZ. There is a good distribution of cypress plantings in all age classes, providing a continuity of resource. *(Refer to current resource, page 11 for more info).*
- Cypresses offer a good alternative for plantation diversification and risk mitigation, as opposed to reliance on a radiata-pine monoculture.
- Once established, cypresses are relatively straightforward to grow and tend, they respond well to silviculture, and there is flexibility in rotation length. *(Siting and establishment, pages 17; and management, page 18).*
- Cypresses have desirable wood properties and, with good stand management, provide a high-value product. They tend to have a relatively low variation in wood properties from

pith to bark and, therefore, do not have the corewood problems associated with radiata pine. Subsequently, there is potentially good revenue in production thinnings or the harvesting of young stands. *(Timber properties, page 18; utilisation, page 19)*

- There are no major utilisation problems. Cypresses can generally be processed in mills geared for processing radiata pine, with little or no problems. This is one of the reasons why cypresses are ideal contingency species if the radiata-pine industry becomes threatened.
- Cypress heartwood is naturally durable. There is a growing domestic demand for naturally durable timbers, such as cypresses, with demand currently exceeding supply. *(Current NZ market, page 20).*
- Cypresses are well suited to high-value specialty end-uses and exploitation of market niches *(Utilisation knowledge page 19; current and potential markets, pages 20-22).* This would provide product diversity and subsequent market buffering, as opposed to reliance on radiata-pine products.
- There is already excellent market acceptance for cypress timber. There is room for considerable growth in the domestic market, plus a substantial price advantage over radiata pine and a major premium for quality. Currently the domestic market is under-supplied. *(Current NZ market, page 20).*
- Up to date information on growing and utilising cypress timber is now readily available with the recent publication of the cypress handbook in the NZFFA electronic handbook series, which is available on-line.

3. Opportunities in Cypress Forestry

- There is potential for significant economic gains from the establishment of plantations with improved planting stock from the cypress breeding programmes. Cypress breeding is still in the early stages - significant gains have already been made, but there is the potential for considerable further gains with continued breeding of pure species and from hybridisations between species. Cypresses are highly inter-fertile and there is good anecdotal evidence for hybrid vigour, plus there is the potential to combine desirable characteristics from different cypress species. Hybrid planting stock could become available from the breeding programmes within the next 5 years, depending on research funding. *(Seed source, breeding and propagation, page 16,* Milne 2006*).*
- Currently demand for cypress timber in NZ exceeds supply, which indicates the potential for considerable growth in the domestic market. *(Current NZ market, page 20).* Subsequently, much of the cypress timber can be processed and sold domestically. Many forest owners currently want increased exposure to the domestic market and the potential to add value without massive capital expenditure.
- There is also potential for capturing some of the market for imported softwoods. Trends in the volume of softwood timber imports over the last six years have shown a steady increase. In 2005, approximately 29,999 m^3 of softwood sawn timber was imported into New Zealand, with a value of $28,692,000. The majority of imports were western-red-cedar from Canada. According to most cypress end-users, NZ-grown cypress timber could substitute for at least some of this imported softwood in the domestic market. *(Imported softwoods, page 22)*.
- There is potential for a good export market for NZ-grown cypress in the Pacific Rim – as a substitute for a group of timbers that include yellow cedar, Port Orford cedar, incense cedar, sitka spruce, western-red-cedar and redwood. Export prospects for eastern Asia are particularly promising. *(Potential export markets, page 22).*
- There is industry support for developing a national cypress brand, which would raise the profile of NZ-grown cypress and provide some unity and infrastructure for the cypress industry.
- The ability of cypress stands to carry higher stockings than many other species means that more carbon can be captured over time. Carbon sequestration could, therefore,

become a major co-product in cypress forestry. *(Carbon sequestration, page 25).*

- Pressure for species biodiversity and FSC compliance, may create opportunities and positively impact the economics of cypress forestry. *(Carbon sequestration and other government policy influencing the economics of cypress forestry, page 26).*
- The government has recently announced support for afforestation of eroding hill country. Cypresses could play a prominent role in this afforestation. *(Carbon sequestration and other government policy influencing the economics of cypress forestry, page 26).*
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4. Weaknesses and Threats in Cypress Forestry

- Cypresses are site specific and more care is needed in matching species or clones to sites. This is in contrast with radiata-pine, which is highly adaptable over a wide range of sites. *(Siting and establishment, page 17)*
- Initially macrocarpa was the main cypress species planted in NZ, but it has. proved susceptible to cypress canker in warmer parts of NZ. *(Cypress forestry in NZ – an overview, page 8; Health, page 17)*
- Lusitanica planting stock has tended to be highly variable in the past, though this is no longer an issue with new planting stock available from the tree improvement programme.
- Apart from the farm forestry sector and a few corporate growers, there tends to be a lack of confidence in growing cypress species, partly due to limited technology transfer in the wider industry. *(Resolving knowledge gaps and technology transfer, pages 32-33).*
- There are significant knowledge gaps regarding establishing and managing cypress stands, particularly a limited availability of management models. *(Siting and establishment, page 17; management, page 18).*
- Silvicultural costs are currently higher in cypress forestry, mostly due to the need for more pruning, compared with radiata-pine forestry *(Insights into economics, page 23-25)*.
- There is currently limited information on economic returns in cypress forestry, which has proved to be a disincentive to investment *(Insights into economics, page 23)*.
- Higher land prices are currently a major factor influencing expansion of the cypress industry, particularly as cypress species require better sites with higher fertility. *(Impediments for investment, page 26-27)*.
- There is an overall lack of infrastructure in the supply chain for cypress forestry. This contrasts with radiata-pine forestry, which has a tremendous body of knowledge regarding silvicultural management and processing of timber - there is a well established infrastructure, from breeding through to harvesting and marketing processed timber and value-added products. This contributes to radiata-pine being seen as 'the safe bet' compared with cypress forestry, which is regarded as more high risk by the wider industry. *(Impediments for investment, page 26-27)*.
- The import market for softwoods from North America, particularly western-red-cedar, is potentially a threat because it could encroach on the domestic market for NZ-grown cypress timber.
- It is possible that the very newly initiated redwood industry in NZ could become a threat – potentially encroaching on growth in the domestic market for NZ-grown cypress, and also providing a substitute to imported western-red-cedar (Cooke and Satchell 2007).

5. Why should Industry Invest in Cypress Research?

- Research will directly benefit the forestry industry with improved knowledge and technology transfer resulting in increased returns to growers, processors and end users. Increased knowledge on siting, establishment and management of cypress stands would help reduce the perceived higher risks currently associated with growing cypresses.
- There is already a considerable knowledge base to build on regarding growing cypress species and utilising cypress timber products. This knowledge is based on many years of

experience in growing cypresses and a solid foundation of scientific research.

- Past research has, unfortunately, been somewhat fragmented due to funding constraints. Many of the identified knowledge gaps can be remedied by obtaining and analysing data from the existing extensive network of cypress trials, or from the network of growers and processors in the industry, rather than requiring the establishment of many new research trials *(Knowledge gaps, page 28)*.
- There are still unanswered questions regarding cypress forestry. For example:
  - ► What potential economic gains will cypress hybrids give us? There is good anecdotal evidence for hybrid vigour, plus there is the potential to combine desirable characteristics from different species.
  - ► There is limited research into the economics of growing cypresses, which has been identified as an impediment to investment.
  - ► Could carbon sequestration become a profitable co-product to cypress timber production?
  - ► How much of the imported western-red-cedar market can be substituted for locally grown cypress? Also, what is the potential market share for NZ-grown cypress in the Pacific Rim?
  - ► There are many other unanswered questions that have a direct relationship to profitability in cypress forestry.

6. Opportunities within FFR – Why should Industry Invest in the FFR?

Future Forests Research Ltd (FFR) is a research partnership between industry and forest research providers, which replaces the industry co-operatives that have operated for radiata pine, Douglas-fir and eucalypts. Knowledge gaps that have impeded growth in the cypress forestry have been identified by researchers in consultation with industry, as summarized below (pages 28-32). The opportunity is for FFR to review these knowledge gaps; then amend and prioritize them with industry input and consultation with research providers and funding agencies, such as FRST (Foundation for Research, Science and Technology). A cypress industry workshop was held in Rotorua, 28th August 2007, and a working group formed. There was unanimous support for the formation of a cypress sub-theme within the FFR diversified species group. There are very good reasons for cypress growers and processors, and the forestry industry in general, to invest in FFR. These reasons include:

- There is strength in numbers. A unified group of industry partners can achieve far more with pooled resources than individual growers and companies acting on their own. This includes lobbying government for decisions and policy that benefit the industry, and providing better leverage for government co-funding of research. The diverse species group in FFR would more effectively facilitate government lobbying and the development of a co-funding relationship between government and industry.
- It appears that a lack of unity and communication within the industry is a major impediment to growth of cypress forestry. This is probably due to a lack of infrastructure, which is impeding the transfer of knowledge and technology and contributing to a lack of confidence in the industry. The disjointed nature of the industry could be remedied, at least in part, by investment in cypress research within the diverse species group in FFR.
- There are already good indications for industry support of FFR, including support from those involved in the cypress industry.
- The radiata pine, Douglas-fir and eucalypt co-operatives are good examples of industry/research partnerships, which will be carried over into FFR. This history of co-operative work in other species will provide a good model for cypress industry/research partnerships. The potential role of the NZFFA cypress action group within FFR needs to be explored.
- FFR would ensure that there is a more direct partnership between industry and researchers, and subsequently, research is strongly focused on industry needs.

7. Potential Threats and Weaknesses of FFR

- FFR was recently established – in October 2007 – and is, as yet, an untried formula.
- Funding for FFR diversified species is still uncertain. FRST bids are currently being written. The current government funding system for research has been described as flawed, largely due to the three-year funding cycles of FRST, which results in a lack of continuity in research, with peripheral issues tending to be addressed rather than major step changes. *(Resolving knowledge gaps and technology transfer, page 32)*.
- Industry co-funding for FFR could be negatively impacted by a downturn in forestry.
- Alternative species industries could potentially be overshadowed by the dominant radiata-pine industry in FFR politics, resulting in a very small 'slice of the pie' going to the cypress sub-theme. There needs to be strong leadership in the diversified species sub-themes.
- As with any industry group, there is the potential for divisions and a lack of consensus between different factions of the cypress industry (though there is currently no indication of this). There is a need for strong leadership in the diversified species cypress sub-theme so as to maintain strong unity.

PART B: BACKGROUND ANALYSES FOR BUSINESS PLAN

1. Cypress Forestry In New Zealand – An Overview

Cypresses are an integral part of New Zealand's exotic tree landscape. Settlers began planting cypress species from the 1860's. By the late 1800s, at least 18 different species of *Cupressus* and *Chamaecyparis* had been introduced into New Zealand from various sources, many of which proved highly inter-fertile, i.e., they readily hybridised. The cypresses, particularly macrocarpa, were traditionally planted on farms for shelter, farm timber, ornamental use, and hedging, and generally were not intensively managed in plantations until the early 1990s. This resulted in a high proportion of inferior knotty timber initially being marketed.

In the mid 1980's, tree improvement programmes were initiated for macrocarpa and lusitanica (Aimers-Halliday *et al.* 2004; Low *et al.* 2007). The area planted in cypresses steadily increased with demand for superior planting stock exceeding supply. In the last decade, timber from intensively managed plantations has become more readily available. The most important species for local industry are lusitanica and macrocarpa. The timber has good stability and natural durability and is suitable for exterior and interior joinery, boat building, weatherboards, interior and outdoor furniture, and farm utilities. However, commercial success depends on good siting, good silviculture, and continuity of supply to the sawn timber industry.

Macrocarpa was initially the main species planted. Unfortunately, macrocarpa has proved susceptible to cypress canker, a virulent fungal disease. Cypress canker has been present in New Zealand since cypress species were first introduced; but it did not become a serious problem until the mid 1990's, after an increase in the planting of macrocarpa. Some macrocarpa growers suffered considerable losses, particularly in warmer parts of the country. This was a major blow to the developing cypress industry and some confidence was lost in the future of cypress forestry in New Zealand.

Currently cypress canker is still regarded as a problem with growing cypresses in New Zealand. But this reflects, in large part, our insistence on growing macrocarpa in preference to other cypresses, and putting it on inappropriate warm, exposed sites. Macrocarpa in its natural range is restricted to small stands on either side of Carmel Bay, California. It is, therefore, very much a coastal species. In cooler, sheltered coastal stands in New Zealand, macrocarpa is still largely disease free.

In contrast to macrocarpa, lusitanica is a species with a very wide natural range from Mexico through to Central America. It is largely an inland species. In the last decade, lusitanica has become more prominent because of its much greater resistance to cypress canker. However, aside from farm foresters, much of the wider forestry industry and end-users tend to lack knowledge on (and confidence in) the attributes of this species. Lawson cypress is another cypress species that was been widely planted in New Zealand by the NZ Forest Service. It has a small natural distribution in the northwest of USA. Lawson cypress grows well in New Zealand and produces superb timber. However, it grows significantly slower than macrocarpa and lusitanica, so has been largely supplanted by those species (Low and others 2007)

Cypress species are highly inter-fertile, with great potential for hybridisation. There is good anecdotal evidence of hybrid vigour in cypresses, i.e., the hybrids may be superior and faster-growing than either parent. Leyland cypress is a hybrid between macrocarpa and *Chamaecyparis nootkatensis*, which has been planted throughput New Zealand. The Leyland clones have been tested on a number of sites and form healthy stands of well-formed trees,

with slightly slower growth than lusitanica or macrocarpa, but better wood properties. The slower growth may be due accumulated maturation during the many cycles of vegetative propagation of these clones, rather than being typical of the true hybrid genotype, per se. There has been speculation that controlled hybridisations between the two parent species (macrocarpa and *Ch. nootkatensis*) may result in superior, faster growing hybrid genotypes. More recently, there has been great interest in the Ovensii clone (an accidental hybrid between lusitanica and *Ch. nootkatensis*), which appears to be performing well, though is yet to be well tested.

Success with cypresses needs good matching of species and sites, good establishment and timely and appropriate silviculture. Once established, cypresses are relatively straightforward to grow and tend, and there is flexibility in rotation length. Cypresses tend to have a relatively low variation in wood properties from pith to bark, and therefore do not have the corewood problems associated with radiata pine. Well managed stands of cypresses produce high quality timbers that are, highly valued.

2. A Summary of the Current NZ Cypress Resource and Its Potential Value

Cypresses are poised to be the third most important genus in New Zealand plantation forestry. They already have excellent market acceptance, with a substantial price advantage over radiata pine and a major premium for quality. Export prospects for eastern Asia are very promising, but currently the domestic market remains under supplied (Nicholas 2007, Nicholas and Garner 2007).

In spite of the growing demand for cypress timber, planting rates for cypress species remain low. On 1st April 2005, the National Exotic Forest Description (NEFD) records that cypress production forests totalled 6000 ha in New Zealand. This was a very small proportion of the 1,811,000 ha of total plantation forest. Radiata-pine was 89% and Douglas-fir 6% of the forest estate (Figure 1). By 1st April 2006, after better inclusion of small woodlots, the NEFD records 7000 ha of cypress, still well below 1% of the forest estate. It is interesting to note, however, that although total planting rates have dramatically declined in recent years, planting rates for alternative species such as cypresses, have remained steady (MAF 2007, Poole and others 2007).

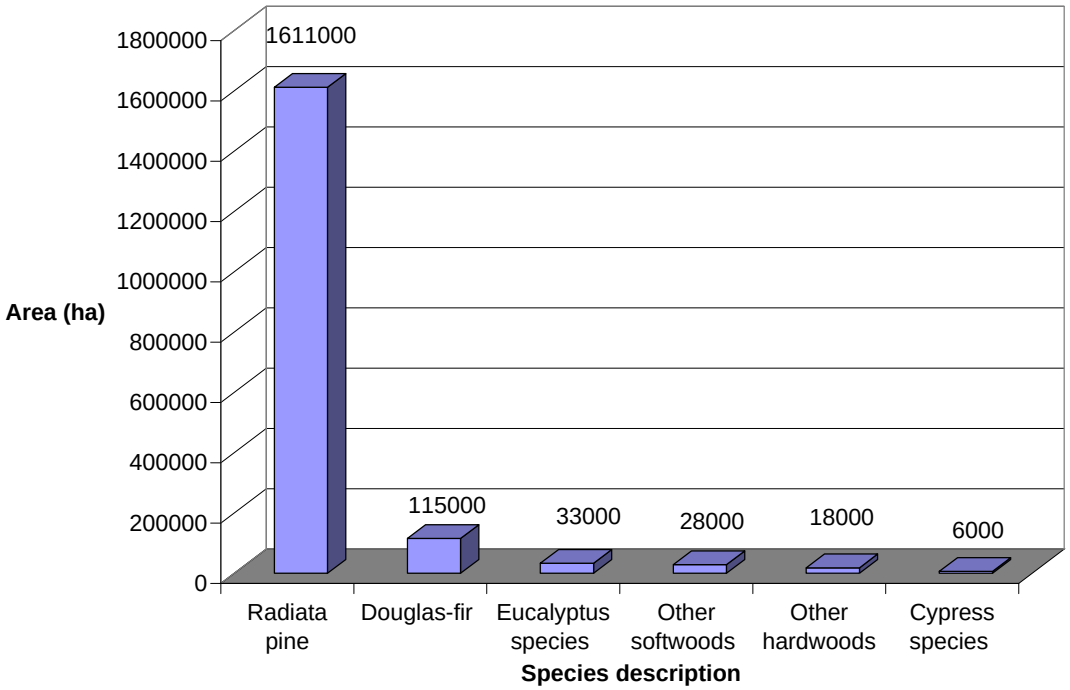

Figure 1: Area in hectares for different species in the NZ National Forest Estate, NEFD, April 2005.

Although there have been recent improvements, the NEFD may not capture all alternative species grown in smaller farm forestry estates (Poole and others 2007). Data collected from the cypress royalty scheme (where a proportion of revenue from nursery sales is levied for research purposes) suggests that, in the last 5 years, on average there has been between 500,000 and 750,000 seedlings planted per year. Based on 1000 stems per hectare, this equates to between 500 -750 ha per year, with more than 2,500 ha established under the royalty scheme during the last 5 years. The NEFD survey records the total area of cypresses aged 1-5 years as 2,300 ha. This suggests that the cypress resource as reported in the NEFD and Agriquality Survey of Small Forest Growers is slightly underestimated (Poole and others 2007).

NEFD statistics show that there is more cypress currently growing in the South Island than in the North Island (Table 1). NEFD statistics also show that there are more hectares in the younger age classes in both the North and South Islands, as compared to older age classes, which bodes well for the future continuity of supply for timber processors and other end users.

Table 1: Area planted in cypress species as at 1 April 2005 (NEFD)

	1-5 Years (ha)	6-10 Years (ha)	11-15 Years (ha)	16-20 Years (ha)	21-25 Years (ha)	>25 Years (ha)	Total (Ha)
North Island Total	609	318	117	152	149	123	**1468**
South Island Total	1695	1331	579	338	476	162	**4581**
New Zealand Total	2304	1649	696	490	625	285	**6049**

A recent industry survey indicated that the major impediments to more planting of alternative species were lack of economic justification and market uncertainty (Poole and others 2007). A questionnaire was sent to approximately 100 individuals and organisations in the forest industry to determine the factors that influenced planting alternative species. The species of most interest for new planting and focused research was clearly the cypresses.

It is predicted that planting rates for cypress species will increase as species biodiversity and FSC compliance become more important (Poole and others 2007). The Forest Stewardship Council (FSC) initiated certification of sustainably managed forests a few years ago and many forestry organisations in New Zealand have sought and gained FSC certification to allow easier access to certain overseas markets. FSC certification does not dictate species diversity, but does encourage it and some NZ companies have shown initiative by planting different species to mitigate risk (Poole and others 2007).

Members of the New Zealand Farm Forestry Association who were particularly interested in growing cypresses formed the Cypress Action Group in 1999. The Cypress Action Group currently has 280 members (Benjamin Lee, NZFFA pers. comm.), which indicates the farm forestry commitment to cypresses. However, the bulk of cypress grown in New Zealand is owned by corporates (92% of the total, Poole and others 2007), although the area of cypress grown by farm foresters is probably underestimated (Benjamin Lee, NZFFA pers. comm.). Several corporates have made the commitment to grow cypress species, including Dunedin City Forests Limited and Timberlands West Coast.

Timberlands West Coast (TWC) currently has 4714 ha in cypress species in Westland in the age range of 1 to 12 years. The predominant species is lusitanica (3536 ha), plus 417 ha of macrocarpa, with the balance a mixture of cypress species. These plantings are part of the Crown's Special Purpose Species establishment plan designed to compensate the region for the transference of indigenous forests to National Park. The commercial viability of these species is unknown in this area as very limited numbers of older plantings are available for assessment. The sites are mostly poorly drained and nutrient deficient; subsequently, the final crop is not likely to be comparable to cypress crops in other parts of New Zealand. However, many micro-sites within the total are demonstrating very good early growth and have been pruned to 4 m. Continued fertilizer application will probably be required. TWC is currently restructuring and is unlikely to continue planting cypress species (Mike Craw, TWC pers. comm.)

Dunedin City Forests Limited (CFL) was one of the first major NZ forest owners to demonstrate confidence in cypress (Palmer 2006). CFL is mainly a radiata-pine grower, but just under 2% of its 15,500 hectares is in cypresses (290 ha). CFL began planting cypresses in the 1980s. The strategy is to produce 5,000 cubic metres of high quality logs per year, on a sustainable basis. This quantity of production is deemed to be the critical mass needed to generate viable marketing opportunities. This means that CFL needs to plant 30 to 60 hectares of cypress every 2 years. Their main cypress species is macrocarpa and site selection is considered to be critical for success (Palmer 2006). CFL has anticipated other landowners in Otago and Southland following their example in planting cypress, thus ensuring sufficient local resource for processing and marketing sawn timber. CFL see their cypress programme as providing diversification and a degree of risk mitigation in their plantation resource (Kent Chalmers, CFL, pers. comm.).

MAF statistics provide data on the sawn timber production of alternative species. The MAF figure for sawn production of cypresses in 2006 was close to 20,000 m^3. The volume of rough sawn timber production of alternative species grown in New Zealand plantations is shown in Table 2. It is clear that cypress timber production is just a small fraction of the yearly total timber production in NZ production of sawn timber, with approximately 4.2 million

m^3 of radiata-pine and 164,000 m^3 of Douglas-fir timber being processed per year (MAF 2006). A total of about 18,744 m^3 of cypress timber was sawn in New Zealand in 2006

Table 2: Sawn timber production of alternative species in New Zealand for the year ended March 31, 2006 **(Forestry Statistics Section, Policy Innovation & Research Group, MAF, 2007)**

	North Island m^3	South Island m^3	Total m^3
Cypresses	12, 625	6, 119	18, 744
Minor softwoods	263	527	790
Eucalyptus	3, 234	1, 289	4, 523
Minor hardwoods	151	-	151

The regional distribution of cypress sawn timber production is presented in Figure 2. A comparison of Table 1 with Figure 2 shows that there is a different regional distribution for sawn timber production compared to hectares of cypress currently being grown. The three main regions for cypress timber production are currently Auckland, southern North Island and Otago/Southland. These regions each process about 26 to 27% of the national volume. More cypress timber is currently being milled in the North Island, according to MAF statistics, but the South Island has a greater number of hectares of cypress plantations in all age classes. It is possible that the MAF statistics for sawn timber production are not capturing some of the timber production and one-site harvesting by farm foresters. Sawn timber production would also include farm shelterbelts, which are not likely to be included in plantation statistics.

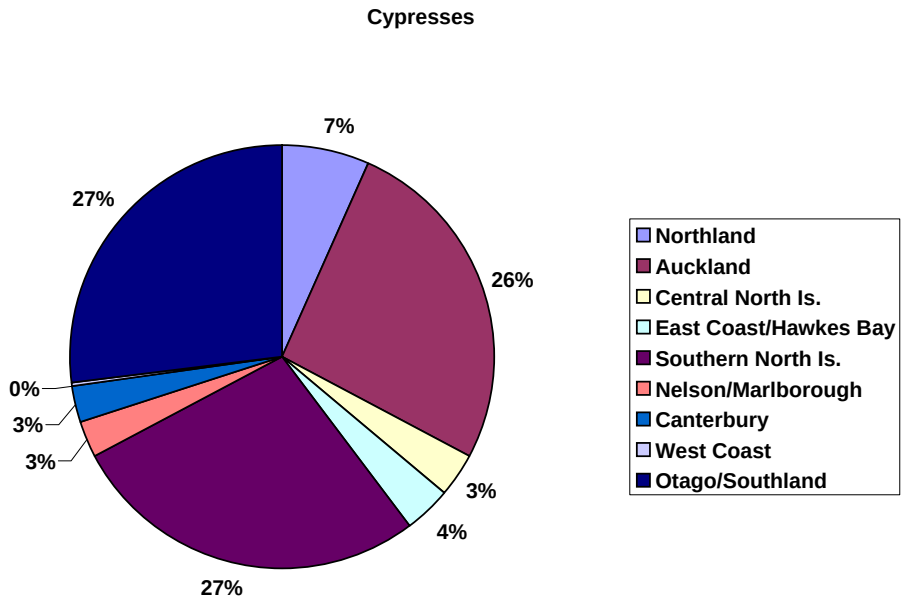

Figure 2: Regional distribution of cypress sawn timber production for 2006 (MAF 2007)

Much of the macrocarpa that has been harvested to date has come from farm shelterbelts, with limited plantation macrocarpa becoming available more recently. The nature of shelterbelt resource means that the timber is of relatively poor quality; nevertheless, macrocarpa has become widely recognised and sought after as a high quality softwood. The wood is often compared to kauri. Heartwood is rated as class 3 for durability, higher than most exotic softwoods (Hocking and Nicholas 2007; Turner and others 2007).

Lusitanica is becoming more important in the market place, and many growers are planting it now in preference to macrocarpa because of its greater resistance to cypress canker. Lusitanica timber is similar to macrocarpa in most respects, but generally somewhat lighter in colour and often with a much wider sapwood band (up to 14 growth rings in some cases). The heartwood is commonly regarded as less durable (Hocking and Nicholas 2007). Lusitanica timber can be extremely variable, which is probably a reflection of the variable planting stock that was initially available to growers. Variability is no longer a problem with the genetically improved planting stock now available to growers.

Leyland cypress has not been utilised to the same extent as lusitanica and macrocarpa, but is likely to become more widely available. Leyland cypress is a series of clones that originated from accidental hybrids of macrocarpa and *Chamaecyparis nootkatensis*. Wood properties are similar to the other cypresses, but Leyland is slower growing than macrocarpa and lusitanica. This is probably due to accumulated maturation, during repeated cycles of propagation, rather than genetics. Based on the characteristics of the *Chamaecyparis nootkatensis* parent, Leyland heartwood durability may exceed that of macrocarpa, although this has not been tested (Hocking and Nicholas 2007). The Ovensii clone (an accidental hybrid between lusitanica and *Chamaecyparis nootkatensis*) is becoming very popular with farm foresters. It is performing well, and though its wood properties are as yet largely unknown, it is expected to have good wood quality based on the combination of parental traits.

The cypresses are used for a very wide range of end uses including: top quality clearwood, decorative veneer, furniture, joinery, weather boards, sarking, mouldings, panelling, boat building, etc. Timber with tight green inter-grown knots is used for some of the above uses, also flooring, decking and structural uses, while poorer quality wood with dead encased knots goes into structural uses, especially “on farm” or “garden pagoda” uses. The poorest quality timber is often used for garden sleepers. Note that though these end uses will tolerate large knots, all external uses need heartwood, or preservative-treated sapwood. Interior uses put little premium on heartwood over sapwood (Hocking and Nicholas 2007).

Aside from timber production, cypress forests in New Zealand provide other important resources. One important function of forests that is becoming much more recognised is carbon sequestration. The ability of cypress stands to carry high stockings means they could have an important role in carbon sequestration. The highest macrocarpa volumes are from a 60-year-old stand with 2230.5 m^3/ha, but there are other cypress genera that can carry even higher volumes (Nicholas 2008).

2.1 Potential Value of the Cypress Resource

The potential value of the cypress resource in New Zealand is difficult to estimate because there is little information available on recoverable yields. However, Ian Nicholas has collected data on revenues, based on recoverable yields from well-tended cypress stands, which provides data for an up-to-date economic analysis (Cawston and Nicholas 2007). Using the recommended regime discussed in Chapter 8 of the cypress handbook (Berrill 2007) and the range of log types from the MARVL analysis, an estimate of revenue from cypress forestry was calculated. With a rotation length of 35 years, IRR was estimated at 8 %. The total revenue was estimated at $52,000 per ha (Cawston and Nicholas 2007). More information is provided on this in the section below titled ‘An Insight into the Economics of Growing Cypresses’.

Collection of more data and full details of revenue and costs from harvested, well-tended cypress stands, are required to validate these estimates. However, a very approximate estimate of the potential value of the cypress resource in New Zealand, based on the total revenue estimated at $52,000 per ha, and the NEFD estimate of 6049 hectares in cypress, is estimated to be $315 million at rotation, based on current costs and returns. This is approximately an average of $8.9 to $10.5 million a year on a sustained yield basis, based on an average rotation of 30 to 35 years, respectively. Please note that this is an average figure, which does not take into account the variation in number of hectares planted per age class (Table 1), i.e. less will be milled and returns will be smaller in the near future, compared with more hectares milled and higher returns when current plantings reach rotation age in approximately 30 to 35 year. This is a very approximate estimate and should be validated by more substantial databases. Also, the NEFD figures are believed to slightly underestimate the area growing in cypress, and the estimated total revenue per hectare is based on recoverable yield from well-tended stands only.

3. Summary of Current Knowledge on Growing, Managing and Utilising Cypresses

There tends to be a 'catch-22' situation with alternative species. Our current knowledge generally does not provide the confidence for large-scale estate, but there is not the scale of resource to provide the required operational experience or financial support for necessary research knowledge (Manly 2005). However, among the softwood alternative species, cypresses are somewhat the exception to this generality. There is a considerable body of knowledge regarding growing cypress species and utilising cypress timber products. This knowledge is based on many years of sound scientific research and extensive growing experience.

The wealth of research is demonstrated by the number of progeny trials from the cypress tree improvement programmes (Appendix 1); the more recently planted cypress clonal trials (Appendix 2) and the number of permanent sampling plots (PSPs) for cypresses (Appendix 3 shows the stocking by age distribution for lusitanica). A considerable amount of data is being collected in a wide variety of cypress stands throughout the country, building on a wealth of existing knowledge. There are 463 PSPs for cypresses throughout the country, covering a broad forestry spectrum. About 63% of the PSPs are macrocarpa and 34% lusitanica. The red star in the PSP graph (Appendix 3) indicates the current recommended regime for lusitanica. It is obvious that there are a limited number of PSPs which are close to the current recommended stocking, i.e. with a spacing of 300 stems per hectare at age 35.

The transfer of technology has been good within the farm forestry sector, but somewhat lacking within wider industry. This has been improved in part by the recent publication of the cypress handbook in the NZFFA electronic handbook series. Most of the following information is summarized from the key points in the NZFFA cypress handbook (Nicholas 2007).

3.1 Seed Source, Breeding and Propagation

Breeding programs for both lusitanica and macrocarpa were begun by the Forest Research Institute in the early 1980s – initially aimed at improving growth, form, and health (for details, see chapter 5 in Nicholas 2007). Breeding for wood density and resistance to cypress canker have been now been incorporated. More recently, clonal programmes have been initiated, including a canker screening programme. Current knowledge is summarised below:

- Improved seed is currently available for macrocarpa and lusitanica, but is in short supply.
- Lusitanica has become more important in the last couple of decades due to its greater

resistance to cypress canker.

- Growers should ensure they plant quality planting stock, which is appropriate for the site. Guidelines are available.
- There have been some big disappointments from earlier released clones that were susceptible to cypress canker or whose growth was disappointing.
- Breeding for canker resistance continues, with some good gains already made. Screening of cypress clones for resistance to cypress canker began in 2002.
- Growers should be aware of the risks associated with extensive planting of single clones, versus less risk if planting a number of unrelated clones. There is less risk if clones originate from a breeding programme and are well tested in clonal field trials.
- Growers need to ensure that clonal planting stock has a juvenile state, i.e., is vigorous and has an appearance similar to seedlings or juvenile cuttings.
- Cypresses are highly inter-fertile and there is good anecdotal evidence for hybrid vigour (hybrids outperforming parent species), plus there is the potential to combine desirable characteristics from different species. The breeding of new hybrid genotypes for New Zealand conditions has been initiated.

3.2 Siting and Establishment

Cypresses require care in siting and establishment (for details, see chapters 2 and 6 in Nicholas 2007; Milne 2006). The recommendations given below should be regarded as guides, not limits, as cypresses are being successfully grown outside these recommendations:

- Generally cypresses prefer well drained sites with moderate to good fertility and rainfall greater than 800 mm.
- Macrocarpa and Leyland cypresses are better suited to colder sites. Macrocarpa in particular is very susceptible to cypress canker on warm exposed sites.
- Lusitanica and Ovensii prefer sheltered sites with lusitanica thriving on warmer sites. Lusitanica does not tolerate salt laden winds.
- Lusitanica is preferred where cypress canker is a risk. This generally means that macrocarpa should be restricted to cooler sites in the South Island, or should be sited on cool, southern facing slopes elsewhere.
- Farmers need to be aware of the risk of abortion in cattle when foliage is consumed.
- Cypress species can be vulnerable to animal damage. Damaged trees are subsequently vulnerable to disease and insect damage.
- Toppling can be a problem in young cypress plantations, particularly with lusitanica.
- Prevention of toppling is far more effective than undertaking remedial measures after toppling has occurred.
- To avoid toppling, choose suitable sites - well drained and reasonably sheltered. Don’t use extra fertiliser on fertile farm sites, unless on expert advice. Windproof prune on topple-prone sites.
- If toppling is severe, replanting should be considered.

3.3 Health

Cypress canker is the most important disease of cypresses in New Zealand, causing growth loss, mortality, and malformation. Cypress canker is a fungal pathogen that has been a serious problem since the mid 1990’s, and it caused some confidence to be lost in cypress species. Currently cypress canker is still regarded as a serious problem, but its impact can be minimised or eliminated with careful management (for details see chapter 4 in Nicholas 2007). A summary of health in cypresses is given below:

- Cypress canker is present in most of NZ, but the incidence and impact is greatest in the warmer northern parts of the North Island.
- There is variation between species for resistance: macrocarpa and Lawson cypress are

particularly affected; Leyland cypress is also susceptible, but not to the same degree. Lusitanica is notably resistant and the Ovensii hybrid appears to have some resistance.

- Breeding for resistance to cypress canker has been a priority in the tree improvement programme for some time. Screening of cypress clones for resistance to cypress canker began in 2002.
- Management decisions that can help reduce the impact of cypress canker are:
  1. Establishing stands on sheltered sites with a southerly aspect can help reduce the risk of cypress canker developing.
  2. If establishing cypresses on potentially disease-prone sites (e.g. warmer, exposed, north-facing slopes) choose a more resistant species.
  3. Plant healthy vigorous stock (from disease-free nurseries) away from diseased trees, shelterbelts, or woodlots that may provide a spore source.
  4. Protect plants from undue stress such as wind exposure, stock damage, excessive pruning, especially in stands in which the disease is present.
  5. Remove any trees or branches with symptoms of cypress canker as soon as possible during silvicultural operations, to prevent a rapid and unmanageable build-up of infestation within the stand.

There are fungal pathogens, other than cypress canker, which are associated with minor dieback in cypresses, but none of them are regarded as major pathogens. There are also insects that can cause damage to cypress species:

- Larvae of the huhu beetle and the two-toothed longhorn beetle can cause damage to standing trees, but only where access to the heartwood can be gained through mechanical wounds.

3.4 Management Options – Pruning and Thinning

Well managed stands of cypresses produce high quality timbers that are highly valued. Pruning and thinning of cypresses have been debated for years and cypress regimes are still evolving (see chapters 7 and 8 in Nicholas 2007), but current research recommends the following:

- Early pruning can help reduce toppling, which can be a problem with young cypress plantations, particularly lusitanica on exposed, fertile sites.
- Plantations require pruning and thinning to produce the best logs.
- Cypresses need pruning for clearwood production, which is highly valued. The main shortfall in supply is perceived to be in clear timber or the better dressing grades; therefore, growers should fully prune their cypresses and thin to ensure adequate diameters for clearwood recovery.
- Prune below 12 cm stem diameter.
- Leave 5 m green crown when pruning.
- Thin to 300 stems/ha by age 10 years.
- Mixtures of cypresses with other species can be successfully established, but need care in management.
- Cypresses can offer production thinning options.
- Current regimes suggest final crop stocking of 300 stems/ha, pruned to 6 m.
- The cypress growth model can be used to design regimes that match the owner's objectives, such as finding the optimal stocking for a given rotation length and target tree size.
- Final crop stocking has a major influence on volume production and average tree diameter development.
- Site quality also has a major influence on volume production and average tree diameter development.
- Only the heartwood of cypress is durable, therefore, substantial recovery of durable timber requires longer rotations.

3.5 Timber Properties

Cypresses have desirable wood properties and, with good stand management, provide a high-value product (see chapters 2 in Nicholas 2007). Key points are:

- Cypress timbers from old untended stands/shelterbelts have generated a strong market for the timber, although much of this resource is inferior compared to plantation-grown cypress.
- There is no generally superior cypress for timber properties - the different taxons have their good and bad points.
- Unlike radiata pine, cypress species have relatively uniform wood properties from pith to cambium.
- Macrocarpa is a medium to lower density softwood of moderate strength and stiffness, but relatively low surface hardness with good working and finishing characteristics. Macrocarpa wood has often been compared to kauri. The sapwood is light brown and typically occupies five growth rings. The heartwood is a darker yellow. The timber is attractively scented.
- Lusitanica timber is similar to macrocarpa in most respects, but generally somewhat lighter in colour and often with a much wider sapwood band.
- Timber from Lawson cypress is similar to that of the other cypress species, but it is notably stronger and stiffer.
- Macrocarpa, lusitanica and Lawson cypress all have heartwood in Australasian durability class 3, which is higher than most exotic softwoods.
- In Table 2A of NZS 3602:2003 “Timber and wood-based products for use in building”, dressing heart-grade macrocarpa, Mexican cypress (lusitanica) are listed as suitable for external weatherboards without preservative treatment.

3.6 Utilisation Knowledge

Considerable experience has been gained in processing cypress logs. Commercial experience has shown all cypress taxons are easy to saw. Saws and cutting patterns normally that used for cutting radiata pine are satisfactory for use with cypress. Information on utilization of cypresses is found in chapter 10 of the NZFFA cypress handbook (Nicholas 2007). Key points on utilisation are:

- There are no major utilisation problems.
- Only the heartwood of cypress is durable - the heartwood percentage in logs increases with the age of trees.
- Sawing conversions range from 40-60%.
- Macrocarpa is a very stable wood, easily sawn with minimal reaction wood, meaning that even small diameter logs of 15-20 cm can be sawn.
- Young stands, approximately 20 years old, and production thinnings can be successfully utilised.
- Drying schedules are available.
- Cypress wood has low shrinkage on drying, but can suffer some collapse when kiln dried.
- The cypresses are used for a very wide range of end uses including: top quality clearwood, decorative veneer, furniture, joinery, weather boards, sarking, mouldings, paneling, boat building, etc.

4. Summary of Current and Potential Markets for Cypress Timbers

Cypress timbers from old untended stands and shelterbelts have generated a strong market for the timber, although much of this resource is inferior compared to plantation-grown cypress. Plantation cypress timber is now being sought after. It appears that most grades of cypress timber have good markets – from inferior knotty timber, to high-grade, plantation-grown clearwood. Cypress timber is developing a strong market profile locally and there is potentially a good export market (Nicholas 2007). However, there is a lack of overall consistency in the market, which has resulted in variable returns to growers.

There have been appeals for a more cohesive industry for alternative species suggesting targeted publications, better marketing and even a government overarching body (Nicholas and Garner 2007, Poole and others 2007). Processors and architects have repeatedly made requests for more information on the resource and where timbers can be sourced. There is a growing demand for naturally durable timbers, such as cypresses, with demand currently exceeding supply.

4.1 The Current NZ Market for Cypress

In 2005, a survey was made of the current New Zealand market for alternative species (Nicholas and Garner 2007). The survey solicited information from people involved in handling 21,000 m^3 of cypress timber and 7000 m^3 of eucalypt timber per year. These figures, when compared with MAF figures of sawn timber production, indicate that the processors of cypress timbers were well captured by the survey. The major issues among those surveyed were concerns regarding the lack of resource of cypresses and eucalypts for future processing, and a requirement for information on species choice and log/timber quality (Figure 3). A growing demand for naturally durable (treatment-free) timbers was identified, with the demand currently exceeding supply.

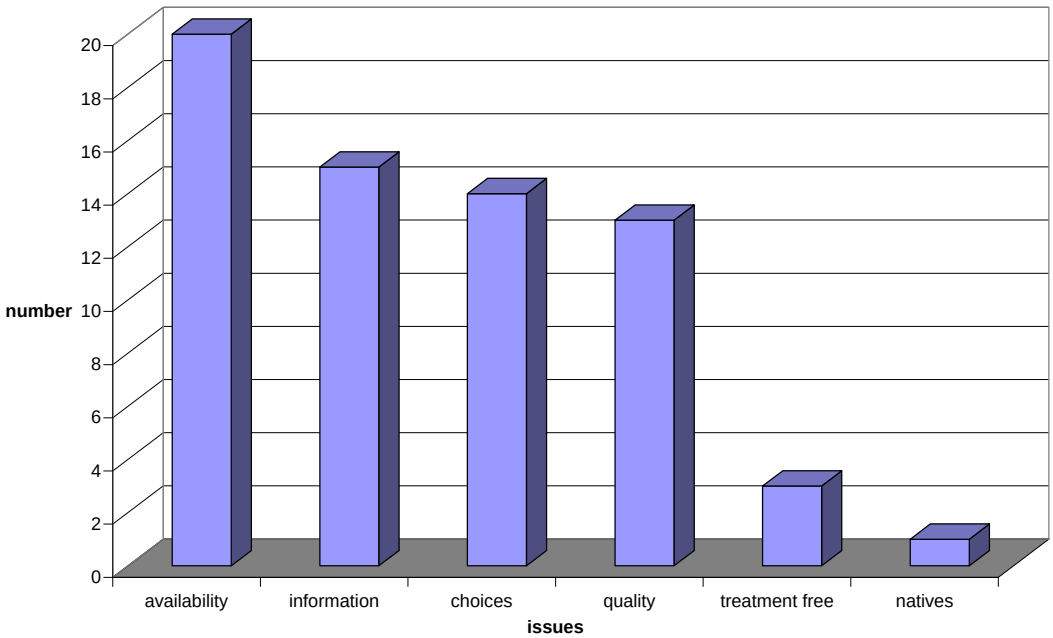

Figure 3: Major issues identified by respondents in an alternative species market survey (Nicholas and Garner 2007).

The 2005 market survey shows that cypress growers can have confidence in future markets especially if marketing is improved (Nicholas and Garner 2007). Cypress sawmillers have expressed some concern, often great concern, about future supplies of sawlogs. They have

expressed confidence in the future demand for the timber, especially the better quality grades, and all those surveyed stated that they would like to expand their cypress processing operations, but felt restricted by log supplies. Several made the point that larger end-users such as joinery and furniture manufacturers would like to use locally-grown cypress, but are not confident of future supplies of good quality timber. At present it is easier to use radiata pine or imported softwoods such as western red cedar or Fijian kauri (Hocking and Nicholas 2007).

Both macrocarpa and lusitanica have good market acceptance, with a normally substantial price advantage over radiata pine and a major premium for quality. The main shortfall is perceived to be in clear timber or the better dressing grades and this means that growers would be well advised to fully prune their cypresses and thin to ensure adequate diameters for clearwood recovery. From the end users point of view, the species grown is not critical and should be the species or hybrid best suited to the site. Cypress timber is often marketed as one line and not treated as individual species in the market (Hocking and Nicholas 2007).

Widely varying prices are currently paid for cypress timber. One well-known cypress farm forester recently quoted prices for green timber 'off saw' varying from $280 a cubic metre for box grade, up to $1200 a cubic metre for large diameter clears, with logs from $15 to $500 cubic metre (Tantrum 2006). The same farm forester recently commented that he only managed to secure about $50 per cubic metre for production thinnings (equivalent to radiata-pine pulp-wood prices) and, after harvesting and transport costs, he made very little profit (Don Tantrum, pers. comm.).

In contrast, another grower is milling his own production thinnings from well-managed 15-20 year-old stands and is marketing the seasoned timber himself – selling a tight knotty grade for an average of $1000 per cubic metre for highly decorative panelling, for which currently there is a very good market (Paul Millen, pers comm.). Unlike radiata pine, cypress species have relatively uniform wood properties from pith to cambium, therefore, do not have corewood problems. Subsequently, there is potentially good revenue in production thinnings. Unfortunately, the value of young cypress is often underestimated in a processing industry dominated by radiata pine, a species with significant corewood problems.

The lack of overall consistency in the market has resulted in variable returns for growers and the call for development of a national cypress brand. It is hoped that a cypress brand would raise the profile of NZ cypress, provide some unity and marketing infrastructure for the cypress industry, and some consistency in returns to growers.

There are processors that pay well for cypress timber. Ashburton-based Macrocraft, the South Island's biggest user of macrocarpa for furniture, pays $320 a cubic metre for the best-quality wood. Gunn's Veneers, a Christchurch company that peels 0.6-millimetre-thick veneers off the highest grade of pruned plantation macrocarpa logs, pays about $350 a tonne (about the same as a cubic metre). The veneers end up mainly on doors and kitchen joinery, though some were recently used on wall panels in the Beehive's refurbishing.

Steve Renall, who runs a mill near Christchurch specialising in macrocarpa, cuts up to 300 tonnes a year. Almost all his supply comes from old farm trees; 60 per cent goes to furniture makers, to garden centres for outdoor furniture and sleepers, and the rest for firewood. He looks forward to local plantations of pruned macrocarpa coming on stream in about five years (Dominion Post, December 21, 2006, reported in its farming page by Jon Morgan). Currently macDirect, a sawmilling and timber merchant company that specialises in cypresses, sells sarking dressing grade at $38 per m^2, tongue and groove flooring at $41 per m^2 and cladding/weatherboarding at $51 per m^2 (www.macdirect.co.nz).

4.2 Imported Softwoods

Trends in the volume of imports over the last six years have shown a steady increase. In 2005, it was estimated that a total of 29,999 m^3 of softwood sawn timber/sleepers was imported into New Zealand, with a value of $28,692,000 (MAF statistical data, 2007). Total softwood imports included Oregon pine, redwood, western red cedar and other softwoods. The majority of imports were western red cedar from Canada, with 21, 320 m^3 at a value of $23, 936,000. According to most cypress end-users, NZ-grown cypress timber could substitute for at least some of this material, for both redwood and western red cedar, provided it met grade specifications (Nicholas and Garner 2007).

4.3 Potential Domestic Market for NZ Grown Cypresses

A total of about 18,744 m^3 of cypress timber was sawn in New Zealand in 2006 and the domestic market is currently undersupplied. This plus the imported softwoods market (above), suggests that the potential domestic market for NZ-grown cypress is approximately 40,000 m^3 in size. This could be substantially increased with a better infrastructure ensuring a continuity of supply to processors, plus a concerted marketing effort.

4.4 Potential Export Market for NZ Grown Cypresses

Export prospects are also regarded as very promising for NZ-grown cypress. A study by a Masters of Science student, at Waikato University, looked at international trade of softwoods in the Pacific Rim. It was concluded that New Zealand-grown cypresses could substitute for a group of timbers that include yellow cedar, Port Orford cedar, incense cedar, sitka spruce, western red cedar and redwood (Di Maio 1997). All of these timbers are traded as high-value softwoods suggesting a potential high-value export opportunity for New Zealand-grown-cypresses (Hocking and Nicholas 2007).

In 1997, Alan Sommerville went on a ten day study tour through central and southern Japan to obtain an overview of the current supply, quality and utilisation of Hinoki (*Chamaecyparis obtusa*). He also gauged the response of the Japanese cypress industry to New Zealand-grown cypress timber (Sommerville 1997). The impression gained by Alan Sommerville was that New Zealand-grown cypress timber would be well received in the Japanese market, though not at the extremely high prices reserved for locally-grown, Japanese Hinoki (*Chamaecyparis obtusa*). The overall impressions were of a potentially strong market for clear timber and veneer from New Zealand-grown cypress. Success would be helped by an already existing large market with a strong preference for cypress species, and cost competitiveness with domestically-grown Hinoki. The success of such a trade would also depend on a sustainable supply of a clear and even quality product and on developing good and trusting long-term client relations in the industry as opposed to the trading houses.

There are also good export prospects in Taiwan and South Korea (Hocking and Nicholas 2007) that need to be thoroughly explored.

5. The Economics of Growing Cypresses

A common type of statement repeated many times during industry consultation can be summed up as: ***"If a good economic argument for alternative species can be presented, then our investors would consider investing more in alternative species"*** (Poole and others 2007).

An economic evaluation of alternative species by Maclaren (2005) indicated that the best alternative to radiata pine, based on IRR (Internal Rate of Return) figures, was Douglas-fir, but cypresses were not evaluated because of a lack of information on recoverable yields. Limited information has, however, been published on yields and revenue for cypress forestry, giving a range of IRR values from 4 to 8%. In comparison, the same studies calculated radiata-pine IRR

figures as ranging from 4 to 9.9% (Cavana and Glass 1985). The cypress forestry is not as refined as radiata-pine forestry and because little information available on recoverable yields, more assumptions are used in economic analyses; therefore, calculated returns often tend to err on the conservative side (Cawston and Nicholas 2007).

Improved log prices and a better continuity of supply for cypress will mean a significant improvement in IRR figures. This is already occurring with the shift in processing of cypress timbers from old untended stands and shelterbelts, to higher value, plantation-grown cypress. Until recently, revenue figures from well-tended stands have been largely unavailable for analyses. Denis Hocking, a prominent farm forester, has published an economic analysis of costs and returns from a small pruned macrocarpa block (Hocking 2006). The returns from this block, net of harvest costs, but excluding establishment and silvicultural costs, as well as significant grazing credits, were around $63,000 per hectare at 40 years. This is close to $1,600 per hectare per year. This return would excite most investors, but is this typical of the returns from cypress forestry in New Zealand?

In an effort to provide a better idea of the expected returns from current crop, data has been collected on revenues from the harvesting of well-tended stands (Cawston and Nicholas 2007). Using the recommended regime discussed in Chapter 8 of the cypress handbook (Berrill 2007) and the range of log types from MARVL analysis, an estimate of revenue was calculated. With a rotation length of 35 years, an IRR of 8 % was estimated. More details are presented in the economic analysis below.

5.1 Economic Analysis

This analysis is taken from Chapter 9 of the NZFFA Cypress Handbook (Cawston and Nicholas 2007).

As the figures used in this analysis are of a general nature, more detailed site-specific figures should be used before decisions are made on investing in cypress forestry. Professional advice and a case-by-case evaluation are recommended.

5.1.1

5.1.1 Estimated Costs

The estimated costs shown in Table 3 were obtained from limited data provided by tree growers. More data is needed to obtain better information on costs. The actual costs for any individual operation will depend on the species or cypress clone being grown, the type of site, and on management practices. Other costs include management (15% of costs) plus roading, log, load and fees at $47 per m^3. **Note that land values have not been included in these calculations.**

Table 3: Estimated costs used in the economic analysis

Operation	Stand age	Cost ($/ha)
Land cost		0
Land prep	0	40
Tree stocks	0	375
Planting	0	250
Releasing etc	0	235
First prune	6	825
First thin	6	350
Second prune	8	300
Third prune	10	650
Second thin	10	350
Annual costs		60

5.1.2 Yields

Evaluation of MARVL (method of assessment for recoverable volume) analyses, actual recoverable volumes from recent harvests, data from the national PSP data base, and growth model predictions, were all used to estimate recoverable yields.

Total standing volume was estimated as 600 m^3/ha. Of this it was estimated that 92% was recoverable volume, resulting in 550 m^3 being available for utilisation. This was estimated to be made up of 250 m^3 of pruned and 250 m^3 of branched sawlog material. Within the pruned component it was estimated that 80% was high-quality pruned logs and 20% was lower-grade pruned logs. Within the branched sawlogs, it was estimated that 60% was small-branched logs and 40% was large-branched material. It was estimated that 10 % of the branched material was non-sawlog or firewood material.

5.1.3 Revenues

Revenues were based on 250 m^3 of prime pruned sawlogs, 150 m^3 of second-grade pruned sawlogs, 150 m^3 of small-branched logs, 100 m^3 of large branched sawlogs and 50 m^3 of firewood; with log values of $240, $160, $90, and $60 per m^3 and $0 m^3, respectively; which provided a total estimated revenue of $52,000 per ha (Cawston and Nicholas 2007). With a rotation length of 35 years, this economic analysis estimates an IRR of 8 %. More data collection and full details of revenue and costs well-tended cypress stands are required to validate these estimates.

5.1.4 Sensitivity

The base case estimates an IRR of 8%. Sensitivity to changed variables, but keeping everything else consistent, provides an indication of important aspects of the economic analysis. Revenue needs to lift to $72,000 per ha, for this evaluation, before IRR reaches 9 %. If yield is reduced by 25%, IRR drops from 8% to 7%. If land cost at $4,000/ha is included, IRR drops to 5.6 %. If planting stock costs are doubled, IRR is reduced to 7.7%.

5.2 Comparing Economics of Cypress with Other Species

Based on information recently provided by industry, a snapshot on costs and returns provides a comparison of the economics of cypress forestry relative to radiata-pine and several other alternative species (Table 4, information provided by Barry Poole). These figures are based on current recommended silvicultural regimes for each species, and are

comparative estimates of actual costs and returns, with the assumption of each species having the same rotation length of 30 years. This information indicates that although the costs are higher for cypress timber production (due largely to higher pruning costs), compared with radiata pine, returns are also higher due to better log prices. The IRR for the radiata-pine sawlog regime is 5.28% compared with 5.88% for cypress sawlogs. The NPV was calculated using a 7% value and so everything except Redwood sawlog and Eucalypt carbon fell below this (Barry Poole, pers. comm.).

Table 4: Estimated costs and returns for timber production in radiata pine, cypress, eucalypt and redwood stands; plus estimated cost/benefit figures for carbon sequestration in redwood and eucalypt stands.

Year	Radiata Sawlog Cost/ha	Cypress Sawlog Cost/ha	Radiata Carbon Cost/ha	Eucalypt Sawlog Cost/ha	Redwood Sawlog Cost/ha	Eucalypt Carbon Cost/ha
0	$723	$544	$814	$736	$544	$827
1	$774	$1,152	$840	$1,117	$2,116	$1,117
2	$248	$222	$248	$146	$222	$146
3	$38		$38	$405		$405
4	$1,175					
5			$83		$919	$83
6	$775	$1,166		$350	$840	
7					$835	
8	$795	$775				
9	$350				$400	
10		$1,134	$83			$83
15	$50	$50	$83	$50	$50	$83
20			$83			$83
25			$83			$83
29	$80	$80		$80	$80	
30			$83			$83
Annual						
Maintenance	$45	$35	$45	$35	$35	$35
Rental	$240	$240	$240	$240	$240	$240
Rates	$15	$15	$15	$15	$15	$15
Management	$25	$25	$25	$25	$25	$25
Rotation (yrs)	30	30	30	30	30	30
Yld/ha	720	600	854	614	600	0
Ave Log Price $/m3	104	129	0	120	200	0
Harvesting $/m3	25	25	0	25	25	0
Transport$/m3	18	18	0	18	18	0
Pre Tax IRR %	5.28%	5.88%	6.29%	6.54%	8.20%	12.18%
Pre Tax NPV/ha 7%	$2,481	$1,731	$463	$625	-$2,782	-$3,478

5.3 Carbon Sequestration and Other Government Policy Influencing the Economics of Cypress Forestry

Carbon sequestration could become a major co-product in cypress forestry. The government recently introduced the Climate Change Policy, with an emissions trading scheme and afforestation grants. While the policy statements are complex and currently difficult to decipher, it is clear that this is a major opportunity for the forestry industry. No carbon costs and returns are currently available for cypresses for comparisons (Table 4) but it has been suggested that estimates would be similar to that of radiata pine (Barry Poole, per. comm.). However, the ability of cypress stands to carry higher stockings than many other species, including radiata-pine, means that more carbon could potentially be captured over time (Nicholas 2008). The highest macrocarpa volumes recorded are from a 60-year-old stand with 2230.5 m^3/ha, but there may be other cypress taxons that have a higher productivity. The PSP database could be used to evaluate national cypress productivity – particularly biomass by age series for different cypress taxon (Nicholas 2008).

Debate is still ongoing whether cypress growers can maximise carbon credits and also achieve good log quality. There is the possibility in the near future that some cypress forests will be planted with carbon sequestration as the main objective for economic return rather than timber production; or possibly with the combined objective of afforestation of eroding hill country and carbon sequestration (Barry Poole and Ian Nicholas, pers. comm.). The government has recently announced it will give grants for afforestation of eroding hill country. Cypresses could play a prominent role in this afforestation (Poole and other 2007).

Planting rates for cypress are likely to be influenced as the ramifications of existing government policy on carbon become clearer, more policy is introduced, and the carbon trading market develops. Unfortunately, small growers may find it difficult to meet compliance costs for claiming carbon credits (Cooke 2007). MAF should address this issue and ensure that small growers reap the benefits of carbon sequestration as well as the larger corporates.

5.4 Impediments to Investment in Cypress Forestry

Economic uncertainty and insufficient market information were given as the major impediments to investment in alternative species, such as cypresses, in a recent industry survey regarding planting rates (Poole and others 2007). The survey indicated that having better economic information on the potential revenue from alternative species, and having a sufficient resource to give economies of scale, are the main priorities for both corporate and small growers.

Industry feedback has also indicated that higher land prices are currently a major factor influencing expansion of the cypress industry, particularly as cypress species require better sites with higher fertility. Unfortunately for the cypress industry, better sites that are most suited to cypress have been steadily converted to dairying over the last 5 years. However, the government's newly released climate change policy is likely to start a reversal in this trend. The government is now likely to penalise changes in land use away from forestry (Cooke 2007) but this will probably only occur with pre-1990 forests.

Another factor impeding investment is that cypress forestry is perceived to entail higher risks; therefore, industry needs to see higher returns before investing. Cypresses are more site specific than radiata pine and the wider industry generally lacks the knowledge and confidence in matching species or clones to sites and subsequent management of cypress, compared to the mainstay of radiata-pine. Radiata-pine is highly adaptable and grows well across a wide range of New Zealand sites, and there is a tremendous body of knowledge regarding its management and processing. Radiata-pine forestry has a well established infrastructure, from breeding through to marketing processed timber and value-added products.

There are very real knowledge gaps regarding cypress forestry that discourage further investment by industry. There are significant knowledge gaps, which are described below. This is one of the reasons why growers are advised to seek professional input before making a large investment in cypress forestry. However, once there is a good matching of species and sites, good establishment and timely and appropriate silviculture, cypresses are relatively straightforward to grow and tend, flexible in rotation length and produce highly regarded, high-quality and high-value timbers.

It is clear that the industry needs government support, particularly in terms of co-funding investment into research that will resolve critical knowledge gaps, before the wider industry will make a significant commitment to planting more cypress.

6. Knowledge Gaps in Cypress Forestry

Most of the information in this section is gleaned from a blueprint for cypress and redwood research, which is currently being put together by Ian Nicholas, with the help of other ENSIS staff. This blueprint is part of a Plantation Management Co-operative project (Nicholas 2008). Information for this blueprint was gathered from several sources: particularly from two recent industry surveys and also from background research for the cypress handbook in the NZFFA electronic handbook series (Nicholas 2007).

In 2005, a survey was made of the current New Zealand market for alternative species, i.e. species other than radiata pine and Douglas-fir (Nicholas and Garner 2007). Most of the timber handled by those surveyed was cypress timber. A requirement for more information on species choice and log/timber quality was clearly indicated by processors and end users. Another recent industry survey identified factors influencing the planting of alternative species (Poole and others 2007). The specific areas of research priority indicated by industry in this survey were alternative species products and utilisation, and the development of a robust business case around alternative species plantations. The species of most interest for new planting and focused research was clearly the cypresses. The priority area for research was the identification of reliable markets for alternative species (Table 5). Forest management was an important research requirement for the corporate growers (more than 10,000 ha total estate) whereas tree improvement was rated as a more important requirement for the small growers (less than 10,000 ha total estate). Research into utilisation was important for both groups (Poole and others 2007).

Table 5: Priority research themes for alternative species
(Poole and others 2007)

Research Theme	Corporate %	Small growers %
Markets	46	37
Management	18	8
Utilisation	18	17
Tree Improvement	9	25

The blueprint for cypress and redwood research identified that the largest research gaps for cypresses are: a lack of information on hybrid clone wood quality, and the health of new planting stock (lusitanica and hybrids), plus the lack of a national nutrition data base. It also identified that further work is needed on hybrids, especially lusitanica and *Chamaecyparis nootkatensis* crosses, crown management, young log utilisation and the economics of growing cypresses. Other significant research gaps identified relate to siting, mixtures, thinning, genetics, provenance testing, propagation, continuous cover systems, growth, volumes, models, quality yields and utilisation of

tended trees. This information on knowledge gaps, identified from the blueprint, has been supplemented in this report by further discussions with members of the cypress industry - in the formation of the diversified species theme in FFR, and in industry consultation regarding the Diverse Species bid for FRST (Foundation for Research, Science and Technology). This information is presented below.

6.1 A compilation of Major Knowledge Gaps

This is an all inclusive list drawn from multiple sources, which needs to be prioritised and rigorously pruned down with industry input.

6.1.1 Seed Source, Breeding and Propagation

- Provenance evaluation of lusitanica. Only a small part of the genetic base of lusitanica is currently represented in New Zealand. Increasing awareness of the potential of this species and increased planting rates means that this project should have a high priority.
- Breeding for canker resistance. Cypress canker remains a major concern for growers. They want breeding for canker resistance to continue, and subsequently, planting stock with greater resistance made available. The inheritance of resistance needs to be better understood. Much of the data is already available, but needs to be analysed and interpreted.
- Clonal screening for cypress canker. Three years of data need to be analysed and interpreted, but there is currently a lack of resources to do this. To ensure durable resistance, cypress clones with multiple resistance mechanisms need to be identified, which can then be released to industry. This is complimentary to research for breeding for cypress canker, and must not be seen as a replacement for further breeding for resistance.
- Improvement of tree form. Growers have voiced particular concern over the higher costs of growing cypress, particularly with pruning. Breeding for lighter, more horizontal branching, which require less pruning is of interest to them. Are certain types of planting stock likely to have lower pruning costs?
- Heritability of heartwood development and heritability of durability in heartwood needs to be determined for all important cypress taxon in NZ.
- Breeding for wood quality. This is of particular interest to growers. Questions include: is it possible to breed for increased durability?
- Research on hybridisation should be a priority, especially crosses involving lusitanica, macrocarpa and *Chamaecyparis nootkatensis*. Industry feedback indicates a strong interest in this. There is good anecdotal evidence of hybrid vigour in cypresses, i.e., the hybrids may be superior and faster-growing than either parent, but this needs to be proven in field trials. There are opportunities to combine good traits such as canker resistance and superior wood properties. Cypress species are highly inter-fertile, but there are difficulties in synchronising flowering and pollen storage that require further research.
- Propagation of elite cypress genotypes requires further research. Inexpensive and effective methods are needed for technology transfer to industry partners. Research into control of maturation in propagation systems should be a priority, so as to maximise both propagation success and field performance in vegetatively propagated planting stock.

6.1.2 Siting and Establishment

- The ideal range of fertility for cypresses needs to be quantified. There is a lack of a national nutrition data base for cypresses.
- Siting of cypress: industry expansion has been impeded by a lack of knowledge and confidence in the siting of cypress. There have been repeated requests by industry for decision-making tools to aid decisions on siting.

- Site indices for cypresses need to be determined.
- Toppling problems with cypress. The problem with toppling in cypress appears to be more extensive on exposed sites than first thought and is a major concern for lusitanica growers. Very limited research has been done. The extent of the problem needs to be quantified, e.g. is toppling a problem limited to lusitanica, and are seedlings more susceptible to toppling than rooted cuttings? Some trials have been initiated, but there has been limited analysis of data due to lack of resources. Growers need better guidelines for prevention of toppling.
- Cost-effective weed control options are a major priority for some growers who find that releasing costs have a significant impact on discounted cash flow analyses (Kent Chalmers, CFL, pers. comm.).

6.1.3 Health

- Determine susceptibility to cypress canker in current planting stock. Feedback from industry indicates that this should be a priority. Questions include: how susceptible is lusitanica, and hybrids such as Ovensii?
- Interactions between thinning, pruning and canker infection need to be determined. Management practices, to reduce the impact of the disease, should subsequently be updated.
- Continue clonal screening programme for cypress canker. The existing data, from the current screening programme, needs to be analysed. Also, an effective, non-invasive testing technique needs to be developed to screen clones on a more operational scale - for example, spraying spores on to foliage, a standard technique used in other systems. Is it possible to obtain enough spores to enable to do this?
- Data from the clonal screening programme needs to be analysed – so as to quantify and interpret the complexity of the host-pathogen relationships.
- Determine the potential health threat from aphids. This is a major health problem in cypress stands overseas. Could it become a problem here - if so, what mitigation options are available?
- Heartwood attack by borers – what is the extent of the problem? What mitigation options are available?

6.1.4 Forest Management

- Pruning and thinning and production thinning options need more research – for maximising growth, volume and wood quality. Industry feedback indicates concern over managing stands so as to secure good second logs.
- Crown management, including crown and branch modelling, is of particular interest to industry. How can stands be managed to keep branches live and of acceptable size? A major concern is the high cost of pruning – can this be reduced – or satisfactory prices for products modelled/attained to justify the high cost?
- Cypress regimes/modelling tools. Industry wants a Douglas-fir or radiata-pine calculator approach to evaluation and forest management. They want stand-based models to aid management decisions, with modelling extending out 20 to 30 years, estimating wood flows and predicting volumes by log grade, and associated costs. The existing prototype growth model needs improvement
- Continuous cover systems in cypresses need to be researched, for maximising carbon credits.
- Carbon sequestration in cypress needs to be quantified. The PSP data base can be used to evaluate national cypress productivity - biomass by age series for different cypress taxon

6.1.5 Utilisation

- Young log utilisation – wood quality in young cypress logs and the economic viability of short rotation cypress forestry needs to be researched. To date there has only been preliminary research on this.
- There is no national log grading system for cypresses, which is a concern for industry. Is there a big enough cypress resource to get adequate data for this?
- NZ building regulation requirements need to be better understood, for better utilisation and marketing of cypress.
- Cypress kiln-drying regime – is a review needed?

6.1.6 Wood Quality/Timber Properties

- Wood quality of lusitanica and cypress hybrids, particularly Ovensii. Analysis of silviscan data.
- Quantify durability in all cypress taxon. How durable is the heartwood of lusitanica and the cypress hybrids compared with macrocarpa heartwood? There is currently no information on the durability of hybrids such as Leyland and Ovensii.
- Examine heartwood development and age/durability relationships

6.1.7 Economics and Policy

- Economic package - internal rates of return are difficult to calculate because there is not enough information on the economics of growing cypress species, including a lack of information on recoverable yields. This has hindered investment. An economic analysis has recently been completed, but more data collection is needed with full details of revenue and costs from harvested, well-tended cypress stands. This would allow for a more complete analysis to validate the preliminary estimates.
- Forest management options and subsequent economic returns need to be quantified. Discounted cash flow analyses for cypress need to be examined with the aim of decreasing costs and improving cash flow relative to radiata-pine forestry. Development of an economic evaluation tool?
- The economic viability of both production thinning and short rotation cypress forestry need to be researched. Limited preliminary research and first-hand grower experience have given promising results.
- Government policy on carbon sequestration – how will this impact the cypress industry? How efficient are the cypress species at fixing carbon compared with other species such as radiata pine, Douglas-fir, the eucalypts, and the redwoods? Will cypresses become a more profitable option?

6.1.8 Marketing

- Current markets need to be better described and quantified for cypress logs and timber products (housing, interior joinery, interior and outdoor furniture, landscape supplies, etc). Statistics for planting, harvesting, production, trade, consumption, and price trends need to be analysed.
- Drivers of change need to be identified in markets for cypress products, e.g. increased interest in naturally durable timbers as opposed to chemically-treated timber products, and increased preference for sustainably–grown timber products - are these sustainable market opportunities?
- Threats, risks, opportunities, and competitors need to be identified in cypress product markets (local and export). How much of the imported western red cedar market can be substituted for locally-grown cypress? What is the potential market share for NZ-grown cypress in the Pacific Rim – as a substitute for a group of timbers that include yellow

cedar, Port Orford cedar, incense cedar, sitka spruce, western red cedar and redwood?

- Analysis of potential Pacific Rim markets. Some preliminary work was done to assess the Japanese market for NZ-grown cypress – this research indicated that there was considerable market potential for NZ-grown cypress. Export prospects in Taiwan and South Korea also need to be explored.
- Explore the potential for a national cypress brand for raising the profile of NZ-grown cypress, providing some unity and infrastructure for the cypress industry, and some consistency in returns to growers.

6.2 Resolving Knowledge Gaps and Technology Transfer

Knowledge gaps that have impeded growth in the cypress forestry have been identified by researchers in consultation with industry, as summarized above. More consultation is needed - industry input is particularly important. The opportunity is for FFR to review these knowledge gaps; then amend and prioritize them with industry input and consultation with research providers and funding agencies, such as FRST (Foundation for Research, Science and Technology). The cypress working group will bring a very pertinent perspective on the development of the industry as a whole and provide a mechanism for industry consultation regarding research priorities.

Much of the work needed to resolve the knowledge gaps does not involve entirely new research programmes. There is already a considerable body of knowledge regarding growing cypress species and utilising cypress timber products. This knowledge is based on extensive growing experience, particularly in the farm forestry sector, and sound scientific research. Unfortunately research on cypress forestry has been somewhat fragmented due to funding issues. One major constraint is the three-year funding cycles of FRST, which results in a lack of continuity in research, with peripheral issues tending to be addressed rather than major step changes (Maclaren 2005). However, considerable past investment in cypress research has resulted in the planting of many research trials. Unfortunately, there is a current lack of funding for measuring these trials, analyzing the data and getting the research information out to industry. Many of the knowledge gaps identified above can be resolved by accessing and analyzing these data.

The transfer of technology and knowledge has been good within the farm forestry sector, but somewhat lacking within the wider industry. In 1999, members of the New Zealand Farm Forestry Association (NZFFA), who were particularly interested in growing cypresses, formed the Cypress Action Group. The members collectively acknowledged the wealth of knowledge and experience in growing cypresses among farm foresters and wanted to help ensure that this was transferred to future generations of tree farmers. The Cypress Action Group currently has 280 members (Benjamin Lee, NZFFA, pers. comm.) and has become a prominent means of technology transfer in the cypress industry. However, this group does not speak for the industry as a whole. It has been suggested that all the cypress industry would benefit from membership in the NZFFA Cypress Action Group (Ian Nicholas, pers. comm.).

Aside from the NZFFA, there is clearly a concern about the effectiveness of current technology transfer. A common constraint to planting alternative species, including cypresses, is an apparent lack of knowledge about what species to plant on what site, which seedlots to use, which regimes to follow, plus overall investment economics (Poole and others 2007). Industry magazines, scientific journals, workshops, field days; these all provide information, however, they are not always proving effective for the wider industry (Poole and others 2007). In a survey of 480 land owners, Nicholas and others (1994) concluded that the NZ Tree Grower magazine and the NZFFA network were the main sources of information on alternative species such as cypresses. It also concluded that research outcomes need to be more readily published into public media forms.

There have been repeated requests for a more cohesive industry for alternative species, suggesting targeted publications and even a government overarching body (Nicholas and Garner 2007, Poole and others 2007). There is a belief that government should be more involved in helping develop an alternative species industry in New Zealand. There has been a recommendation for MAF to establish a special focus group committed to expanding the plantation resource with a broader range of species (Poole and others 2007).

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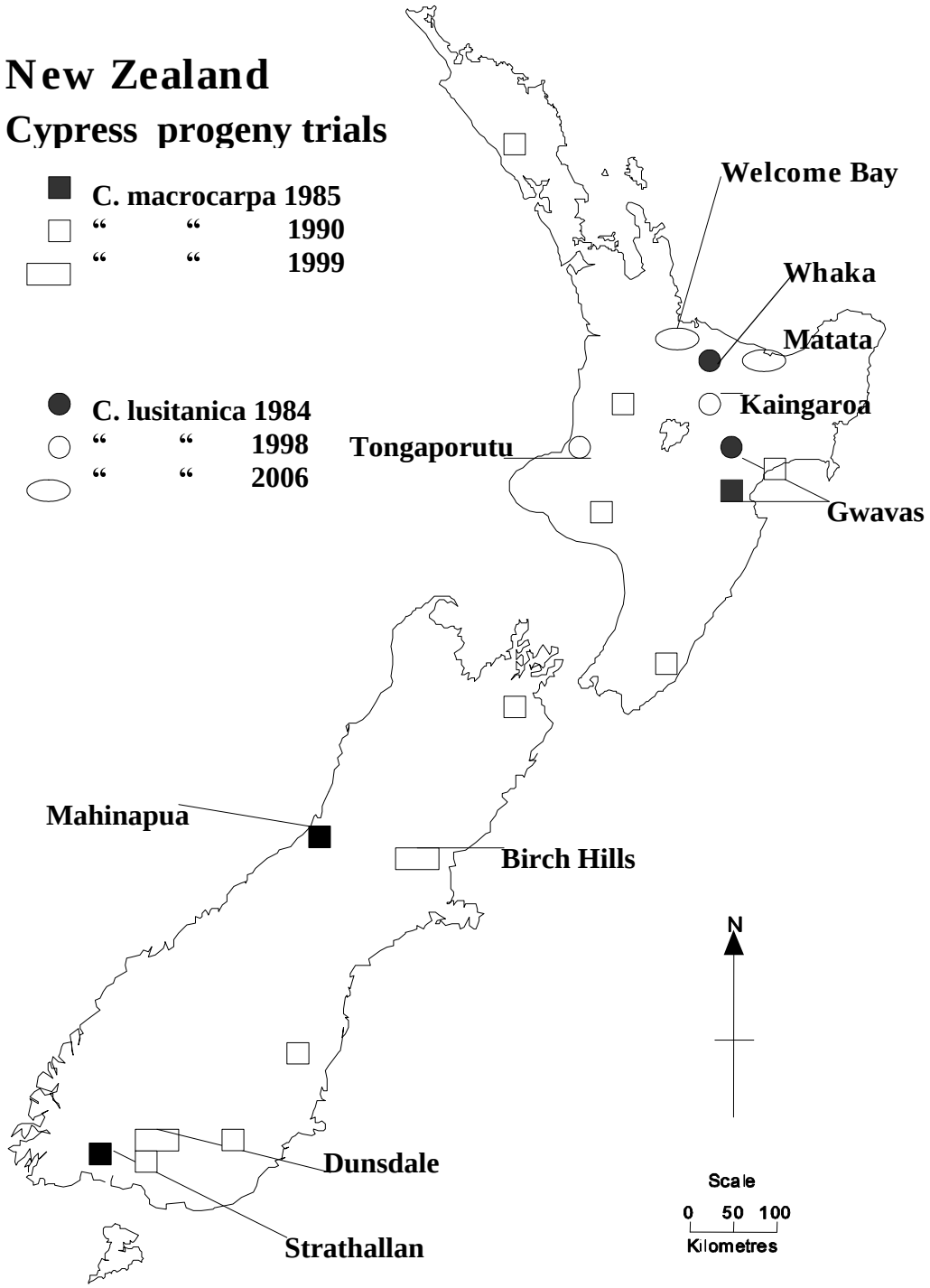
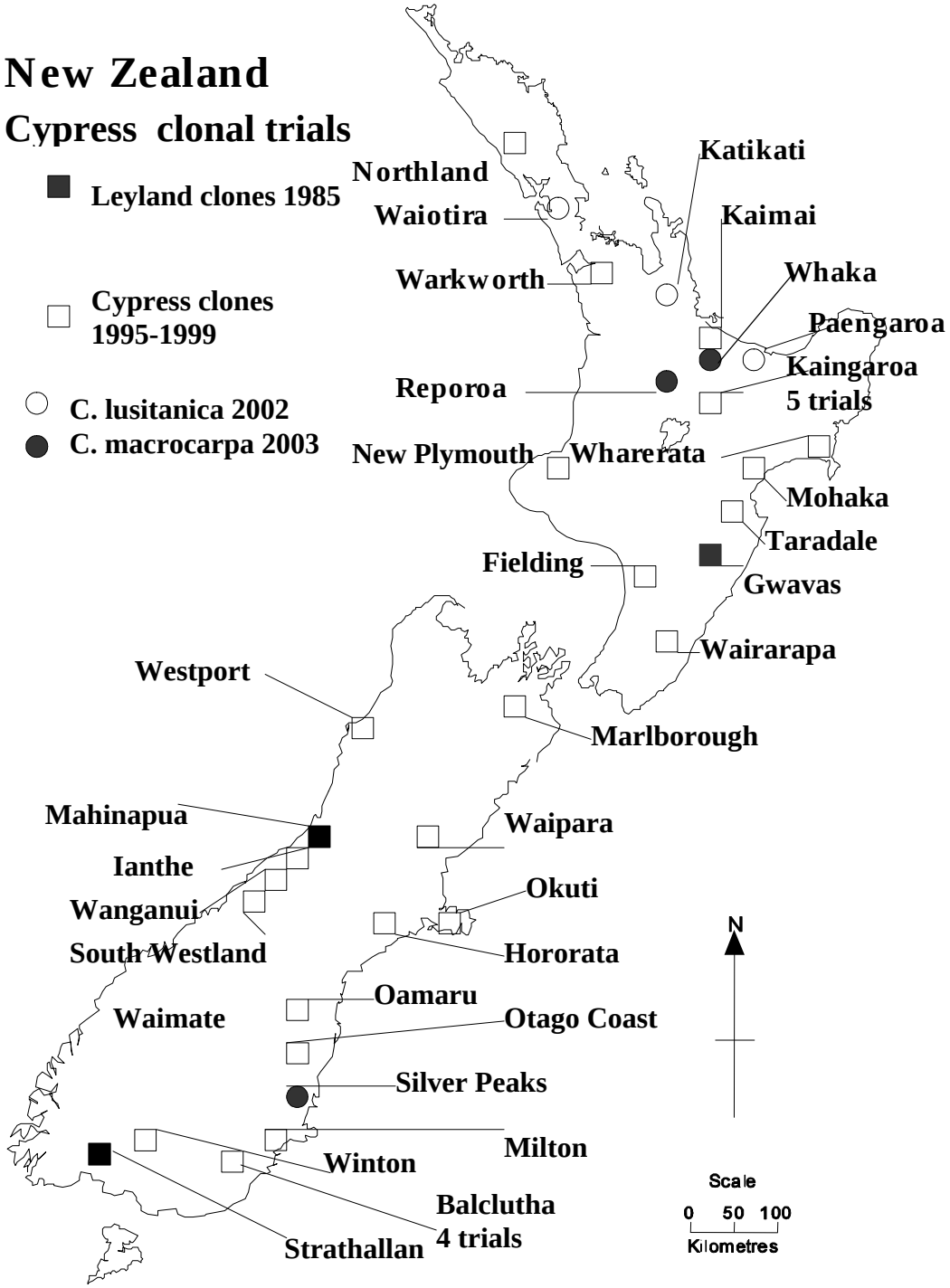
Appendix 1

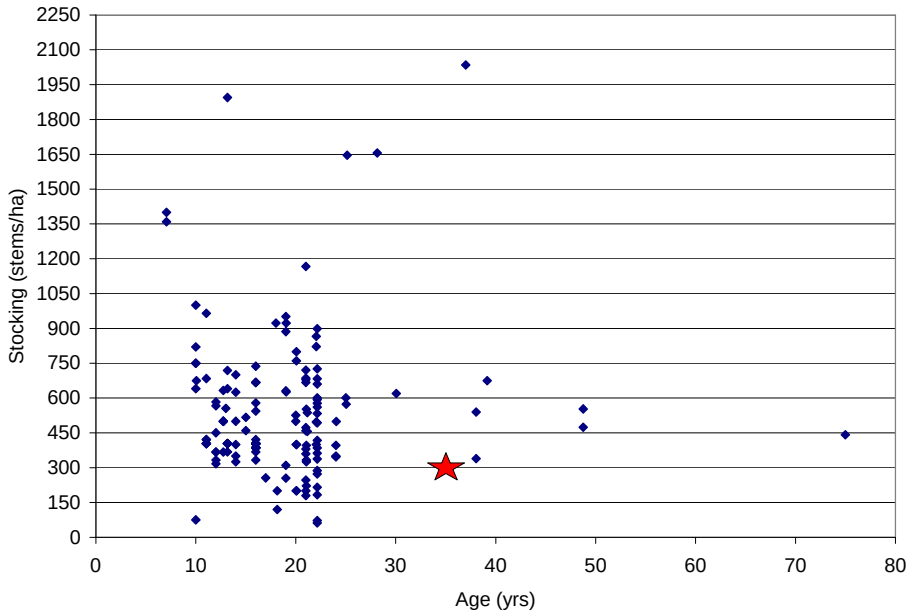

New Zealand
Cypress progeny trials
C. macrocarpa 1985
“ “ 1990
“ “ 1999
C. lusitanica 1984
“ “ 1998
“ “ 2006
Welcome Bay
Whaka
Matata
Kaingaroa
Tongaporutu
Gwavas
Mahinapua
Birch Hills
Dunsdale
Strathallan
N
Scale
0 50 100
Kilometres

Appendix 2


New Zealand
Cypress clonal trials
Leyland clones 1985
Cypress clones 1995-1999
C. lusitanica 2002
C. macrocarpa 2003
Northland
Katikati
Waiotira
Kaimai
Warkworth
Whaka
Paengaroa
Kaingaroa
5 trials
Reporoa
New Plymouth
Wharerata
Mohaka
Taradale
Fielding
Gwavas
Wairarapa
Westport
Marlborough
Mahinapua
Waipara
Ianthe
Okuti
Wanganui
South Westland
Hororata
Oamaru
Waimate
Otago Coast
Silver Peaks
Milton
Winton
Balclutha
4 trials
Strathallan
N
Scale
0 50 100
Kilometres

Appendix 3

Data from Permanent Sampling Plots for lusitanica in New Zealand



PLEASE NOTE: The red star indicates the current recommended regime for silvicultural management, with a spacing of 300 stems per hectare at age 35. Unfortunately, as evidenced by the distribution of data points, there are not many PSP plots managed at this stocking.