

Best Practice with Farm Forestry Timber Species

No. 3: REDWOODS



Ian Nicholas (Editor)

NZFFA Electronic Handbook Series



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FOREWORD

Following the success of the publication *Blackwood - a handbook for growers and end users*, several New Zealand Farm Forestry Association (NZFFA) action groups expressed an interest in the production of handbooks for other tree species.

This publication is the third in a series designed to present up-to-date information about cypresses, eucalypts, redwoods and blackwood. Support for the project has been received from the MAF Sustainable Farming Fund with additional assistance from NZFFA, Scion (FRST new species CO4X0304), Proseed NZ Ltd, Environment Bay of Plenty, Horizons Regional Council, Rarefind Timbers, the Plantation Management Cooperative and relevant NZFFA action groups.

It was agreed that an electronic format would be the most appropriate method for publication. The advantage of this format is the potential for relevant details to be updated as new research results come to hand. Management techniques for many tree species are still being evaluated and recommendations are likely to be modified over the space of a few years.

These handbooks have been independently reviewed and are offered as a summary of the best available knowledge about tree species and their suitability for forestry, shelter, and amenity planting. Information gathered from farm foresters and research scientists has been collated and presented under specific topic headings for ease of reference.

Visit the NZ Farm Forestry Association website (www.nzffa.org.nz) for the most up-to-date information available.

In 2002 Wade Cornell published “The New Zealand Redwood Growers Handbook” as part of a promotional tour for a series of workshops. This provides an excellent overview of redwood as seen by the author at that time. A comprehensive summary of redwoods in New Zealand was also published by FRI in 1993 as No. 13 in its Bulletin No 124 series. Since these publications there has been an increasing amount of activity at both the research and operational levels on redwood. This new handbook does not attempt to repeat these previous publications but endeavours to capture the new information for farm foresters and place it in a form where it can be updated as required.

For ease of reading, the colloquial name of individual species has been used throughout the handbook in preference to full scientific names:

Redwood = *Sequoia sempervirens* [D. Don] Endl
Giant sequoia = *Sequoiadendron giganteum* (Lindley) J. Buchholz

Because most of the current forestry activities are based on redwood, this handbook concentrates on redwood, rather than giant sequoia.

Throughout the handbook text in boxes is used to highlight important information relevant to the chapter. At the end of each chapter, key points are used to summarise the information, along with any suggested reading. A full reference list and glossary are provided at the end of the handbook.

Grateful acknowledgement is given to the contributors who made this handbook possible, the reviewers for valuable additional input, Vivienne McLean and Margaret Richardson for editing contributions, Teresa McConchie for final formatting and Scion for web site preparation. In particular the assistance of NZ Forestry Ltd in allowing the use of website material is also appreciated.

Comments on this handbook and suggestions for revision should be sent to the NZFFA Sequoia Group (see the NZFFA web site for contact details).

Ian Nicholas

DISCLAIMER

In producing this publication, reasonable care has been taken to ensure that all statements represent the best information available. However the contents are not intended to be a substitute for specific specialist advice on any matter and should not be relied on for that purpose.

NZFFA and SCION and its employees shall not be liable on any ground for any loss, damage, or liability incurred as a direct or indirect result of any reliance by any person upon information contained or opinions expressed in this work.

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CHAPTER 1 - INTRODUCTION

Key points

Redwood is of increasing interest to the New Zealand forest industry as a potential plantation tree.

There is a long history of planting in New Zealand with mixed success.

Redwood offers opportunity for export, especially in the Californian market.

Giant sequoia is less well known but also has several positive features, warranting more evaluation.

CHAPTER 2 - TIMBER PROPERTIES AND MARKET

Key Points

There is considerable tree-to-tree variation in redwood wood properties, in both density and durability.

Redwood has a strong market niche in California, which has moved from predominantly old crop to younger, second-growth logs.

New Zealand-grown redwood has an opportunity to market logs in California in addition to New Zealand.

Clones or seedlots with acceptable durability ratings will be a key to securing market acceptance in both New Zealand and California.

CHAPTER 3 - SITE SELECTION

Key Points

Redwood is very site sensitive.

Avoid severe out-of-season frost sites.

Avoid exposed locations.

Avoid windy coastal situations.

Redwood does best in moist valley bottom locations.

Giant sequoia can tolerate cold, dry sites, but can remain in prolonged check after planting.

CHAPTER 4 - HEALTH

Key Points

Redwood is generally a healthy species in New Zealand situations.

Dead branches and extensive bark injuries can offer entry points to borers.

Possoms can cause some leader damage on young trees.

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CHAPTER 5 - SEED SOURCE AND BREEDING

Key Points

The Kuser collection is not a true range-wide provenance sample of seed sources.

The Kuser collection has provided material for a range of trials on 64 sites throughout New Zealand from 2002-2006.

Limited redwood provenance evaluation has been carried out, on one site, established in 1981.

Giant sequoia provenance trials were established on five sites in 1977-1978.

Progeny from the Long Mile Grove redwoods and Raincliff giant sequoia trees perform poorly compared with other provenance seedlots.

Future selections of redwood and giant sequoia should be based on a wide genetic base and take account of wood properties.

CHAPTER 6 - ESTABLISHMENT

Key Points

Correct siting, robust seedlings and weed control will ensure successful establishment.

Redwood requires weed control for at least 18 months, and possibly fertiliser, to promote early growth.

Giant sequoia is a slow starter, and will often require prolonged weed control.

CHAPTER 7 - PRUNING AND THINNING

Key Points

Redwood requires pruning to produce clearwood.

Over-pruning can result in epicormic shoots.

Pruning in autumn reduces epicormic sprouting.

CHAPTER 8 - GROWTH MODEL AND REGIME EXAMPLE

Key Points

Well-sited redwood grows very well with high volume production figures.

A regime is suggested, with 800 stems/ha, up to 3 pruning lifts, one thinning to final crop stocking of 350 stems/ha for a rotation length of 35 years.

CHAPTER 9 - ECONOMIC ANALYSIS

Key Points

Analysis of redwood forestry in New Zealand shows a positive return (based on Californian prices), with an estimated Internal Rate of Return (IRR) of 9.3%.

Seek professional input before making large investment in redwood forestry

Insufficient information is available to analyse giant sequoia forestry

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CHAPTER 10 - UTILISATION

Key Points

New Zealand-grown redwood has been successfully utilised in New Zealand.

A sawing study currently in progress will extend knowledge on utilisation of managed redwood.

CHAPTER 11 - SUMMARY

Key Points

New Zealand redwood is a developing industry in New Zealand.

Experience suggests that redwood plantations can be well grown and utilised in New Zealand.

Little information exists to evaluate the potential of giant sequoia for plantation forestry.

As new information is obtained, key results will be updated through the Farm Forestry Association via this handbook.

CHAPTER 12 - REFERENCES AND WEB LINKS

CHAPTER 13 - GLOSSARY



CHAPTER 1 - INTRODUCTION

**Ian Brown (NZFFA), Charlie Low and Ian Nicholas (Scion),
Rob Webster (NZ Forestry)**

Redwood in California

Redwood has iconic status in California, similar to that of Kauri in New Zealand. Redwood is a long-lived tree that can live over 2,000 years, and the reputation of giant sequoia being the largest trees in the world enhances the redwood image.

The image of redwood is reflected in the poem by engineer Joseph Strauss, who also designed the Golden Gate Bridge.



The Redwoods

*“Here, sown by the Creator’s hand
In serried ranks, the Redwoods stand:
No other clime is honored so,
No other lands their glory know.*

*The greatest of Earth’s living forms,
Tall conquerors that laugh at storms;
Their challenge still unanswered rings,
Through fifty centuries of kings.*

*The nations that with them were young,
Rich empires, with their forts far-flung,
Lie buried now - their splendour gone:
But these proud monarchs still live on.*

*So shall they live, when ends our days,
When our crude citadels decay;
For brief the years allotted man,
But infinite perennials’ span.*

*This is their temple, vaulted high,
And here, we pause with reverent eye,
With silent tongue and awestruck soul;
For here we sense life’s proper goal:*

*To be like these, straight, true and fine,
to make our world like theirs, a shrine;
Sink down, Oh, traveller, on your knees,
God stands before you in these trees.”*

Joseph B Strauss



Figure 1: The redwood grove, Whakarewarewa Forest, Rotorua

HISTORY IN NEW ZEALAND

Early Planting

By the mid-19th century, the plant hunters had moved into the American West, collecting seeds from the spectacular forests on the Pacific seaboard. Redwood seeds were among those of many forest tree species that were introduced to the young colony from the 1860s. They were planted in private estates and gardens, and by civic authorities. The legacy of these early plantings is a scattering of trees of impressive size. The early plantings were no doubt prompted by nostalgia for the familiar, the pursuit of novelty and prestige, and a need for shelter on exposed farm sites.

By 1900, Government recognised the need for afforestation to substitute for declining native-timber resources, and a number of forest nurseries were established. Among tree species

redwood was a contender – the leading contenders included Corsican pine and larch, but certainly not radiata pine at the time. Extensive areas were planted in redwood in the Rotorua district, but most failed to establish satisfactorily. The reasons are likely to have included poor site selection (too cold), poor site preparation and lack of weed control, and an absence of suitable mycorrhizae. The trees which did survive and eventually form the Long Mile Redwood Grove, New Zealand's most admired exotic forest stand, nearly succumbed to frosts. They struggled for several years until they were unexpectedly rescued when subsequently interplanted in larch, which gave them shelter.

Between 1920 and the 1940s further plantations were made by both government agencies and private companies, some run by entrepreneurs of dubious reputation. Except in a few small pockets, they all failed to get away, again through ignorance of site requirements and of establishment needs.

For some years after that time, redwood languished in the planting figures, dogged by a reputation for being difficult to establish. There were also concerns about timber quality, when the local product was compared with the timber still under harvest from the old growth forests in California. There was no corporate interest, and a lack of research funding. A number of farm foresters kept the faith, establishing small plantations, more for amenity interest than in the hope of a commercial return. With attention to site selection and weed control, most of these have thrived, and grown into impressive stands. One of the best of these stands is on the Brann's property in the Bay of Plenty.

The redwood revival

The recent renewal of interest in redwood can be clearly dated to a Farm Forestry conference in 1995. While the group sheltered under the Brann's redwood stand, Bill Libby presented a case for reconsidering the place of redwood in New Zealand. As Professor of Forestry at the University of California, Bill Libby has studied and researched redwood for many years, and had a deep knowledge of the New Zealand scene. From his observations of farm forestry plantations he was convinced that with proper site selection and management redwood could be easily established and grow well in New Zealand, and expressed the view that our conditions are probably better suited to growing redwood than anywhere else. Moreover, the quality of locally grown timber is likely to match that of the second growth currently harvested in California, and therefore likely to attract a high price in a market where demand is high and supply is dwindling.

His comments fell on fertile ground, and when a decision was made in 1999 to form a special-interest group, the Sequoia Group within Farm Forestry, there was an enthusiastic response.

We decided to start with a simple trial, in which members would be involved. As no research funding was available, it had to be self-funding. The aim of the trial was to examine the growth of a set of clones across a range of New Zealand sites. In 1993, Bill Libby had introduced some clonal material from the Kuser collection in California. The parent trees were unexceptional, but covered the main geographical zone occupied by redwood in California. A selection of clones were bulked up at the Fletcher Challenge tissue culture laboratory at Te Teko, and made available for the trial. Bill Libby provided a planting plan. The participants bought the trees at cost price, planted on their own property, and carried out the silvicultural work. Preliminary results are reported on page 20.

In the absence of research funding, we assumed that this would be the first of a series of small scale trials that would be conducted through the Sequoia Group. However events took a new turn when the Americans arrived.

The big players get involved

In 2000, a group, comprising the owners and chief foresters of the Soper-Wheeler Company, arrived in New Zealand from California to look at the potential for redwood establishment. Bill Libby was the catalyst, and much of their itinerary was arranged by members of Farm Forestry. They were impressed by our growth rates and timber quality, and keen to be free from the entanglement of regulations that govern forestry practice in California. They returned, as the New Zealand Redwood Company, and have established plantations in Canterbury, and near Hunterville in the North Island. They have an active research program, which includes growth modelling and silvicultural trials. They have introduced seed-orchard and improved clonal material from California, and have selected plus trees in New Zealand for propagation.

Significant plantations are being established by local growers, and will expand as new clonal and seed orchard stock becomes available. These will be selected for form and growth rate, and there is now growing acceptance that selection for wood properties



Figure 2: Giant sequoia, Mariposa grove

is equally important if we are to succeed in the American market.

Rob Webster and his group, the New Zealand Forestry Company, have been active in research and establishment.

Bill Libby maintains an active interest, and continues to provide support and advice.

Wade Cornell has played a major role in research and education, and has pursued a dogged campaign promoting the quality of the species' wood.

Redwood is a demanding species, and in New Zealand we are privileged to have some of the world's best sites for growing it. Redwood forestry is on a roll, and has a momentum that will result in substantial forests. These have the potential to transform much of the rural landscape, and provide a strong economic resource. The next challenge is to prepare for the future markets. This requires us to capture the genetic variability in redwood, and deliver timber of high and consistent quality.

Giant Sequoia

The world's largest tree has a patchy distribution along the western flanks of the Sierra Nevada Range in California. Not surprisingly, it is well suited to the high country of the South Island. Giant sequoia was introduced in about 1860, and has been planted mainly as an ornamental species on large South Island estates and parks. Limited trials were planted on five South Island sites in 1977.

Its timber has traditionally been regarded as inferior to that of coast redwood but is in fact similar, and accepted in the Californian markets. Trials in California and New Zealand have shown very respectable growth rates. It is likely to be more widely planted in the South Island.

Giant sequoia is highly tolerant of gale force winds, an advantage worth bearing in mind as we enter a period when extreme weather events will become more common.



Notable tree, Waikato



Giant sequoia, Rotorua Boys' High School



Giant sequoia planted by Charles Haines at Camp Hill between Glenorchy and Paradise, Otago



Notable tree, Waikato

Figure 3: Notable trees planted in New Zealand

Key Points

- Redwood is of increasing interest to the New Zealand forest industry as a potential plantation tree.
- There is a long history of planting in New Zealand, but with mixed success.
- Redwood offers opportunities for export to the Californian market.
- Giant sequoia is less well known but also has several positive features warranting further evaluation.

Suggested reading:

Brown 2007

Cornell 2002

Knowles and Miller 1993

Libby 1999

Mortimer and Mortimer 1984

NZ Tree Grower 27 (1) 2007

Poole 2007

Webster 2008

Weston 1957

