Best Practice with Farm Forestry Timber Species

No. 2: EUCALYPTS

NZFFA Electronic Handbook Series

Ian Nicholas (Editor)

Best Practice with Farm Forestry Timber Species

No. 2: EUCALYPTS

NZFFA Electronic Handbook Series

Ian Nicholas *(Editor)*

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 producing handbooks for other tree species.

This publication is the second in a series designed to present up-to-date information about cypresses, eucalypts, blackwood and redwood. 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 of publication. Management techniques for many tree species are still being evaluated and recommendations are likely to be modified in the space of a few years. The advantage of an electronic publication is that relevant details can be updated as new research results come to hand.

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.

Please note, recent changes in the taxonomic classification of eucalypts have placed some species in the genus *Corymbia*. The relationship with the genus *Eucalyptus* is still close, and both genera are commonly referred to as “eucalypts”.

Throughout the handbook eucalypt species are referred to by their species name. No common names are used, as in Australia these sometimes vary between states, which can lead to confusion.

Boxes have been used to highlight important information relating to the chapter topic. At the end of each chapter, key points are summarised and suggestions are made for further reading. A full reference list and a 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, Ruth Gadgil, Vivienne McLean and Margaret Richardson for editing contributions, Teresa McConchie for final formatting and Scion for website preparation.

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

Ian Nicholas

TABLE OF CONTENTS

Visit www.nzffa.org.nz for the most up-to-date information available.

TABLE OF CONTENTS

CHAPTER 1 - INTRODUCTION

Key Points

New Zealand has considerable experience in growing and processing eucalypt wood.

Eucalypt species respond differently to site, climate and the presence of pests.

Site/species matching is vital to minimise risk.

We have considerable knowledge about the eucalypt species that are appropriate for New Zealand conditions.

Demand for hardwood is likely to increase in the future.

CHAPTER 2 - TIMBER PROPERTIES AND MARKETING HISTORY

Key Points

Over the years several specialist eucalypt processing operations have been set up, but have not survived in their original form.

New Zealand-grown eucalypt has similar wood properties to Australian-grown material.

New Zealand imports Australian eucalypts and tropical hardwoods.

There is a growing market for eucalypt timber.

New Zealand has a small dedicated pulp/short fibre resource.

CHAPTER 3 - SITE SELECTION

Key Points

Individual eucalypt species have specific cold tolerance characteristics.

Some eucalypts can tolerate cold sites.

Some eucalypts are very sensitive to frost.

Different eucalypt subgenera and species vary in their requirements for fertility.

Different eucalypt species vary in their tolerances for wet and very dry sites.

Micro-environmental influences can be very important in supporting or hindering eucalypts.

It is important to match species to site conditions.

CHAPTER 4 - HEALTH

Key Points

Some eucalypt species are more resistant to insect pests than others.

Insect resistance should be considered during species selection and is as important as growth rate, tree form and wood properties.

The planting of stringybark and ash eucalypts in preference to *Symphyomyrtus* species may reduce the risk of serious damage from insect attack.

Leaf spot diseases can be reduced by species selection and careful siting.

TABLE OF CONTENTS

CHAPTER 5 - SPECIES SELECTION, SEED SOURCE AND BREEDING

Key Points

A great deal of testing and breeding research has been undertaken for a large number of species.

A considerable amount of trial work has provided information about the adaptation of different eucalypt species to specific site types.

Growth rates of a single species are often different at different sites.

Soundly-based recommendations about species choice can only be made if there is adequate knowledge about local conditions.

Recent research effort on genetic improvement has concentrated on *E. nitens* and *E. fastigata* which have been grown on a large scale for fibre.

Opportunities exist for the improvement of planting material derived from seed stands.

CHAPTER 6 - ESTABLISHMENT AND NUTRITION

Key Points

Eucalypt species vary in their fertility requirements, several eucalypt species require fertile soil for optimum growth, while others can grow well on infertile sites.

Establishment and early growth are improved by soil cultivation, weed control and fertiliser application.

Foliar analysis is not a good indicator of eucalypt growth performance.

CHAPTER 7 - PRUNING AND THINNING

Key Points

Eucalypts require pruning for clearwood production.

No more than 40% of the green crown should be removed during pruning.

Pruning should be done in dry weather to minimise entry of decay organisms.

Thinning regimes will vary with end-product (sawlogs, veneer, pulpwood).

Final crop stocking of 200 stems/ha is recommended to produce large diameter butt logs.

CHAPTER 8 - GROWTH MODELS

Key Points

Growth and yield models are available for *E. nitens* and *E. saligna.* Regional variation in growth patterns means that without validation datasets current *E. nitens* models need to be treated with caution.

Models have been developed for *E. fastigata* and for a group of stringybark species consisting of *E. eugenoides*, *E. globoidea*, *E. muelleriana* and *E. pilularis.* Current databases for these species do not cover the complete age range. Until the models can be refined, they indicate trends and are not reliable predictions of the effects of silvicultural procedures.

TABLE OF CONTENTS

CHAPTER 1 - INTRODUCTION

Ian Nicholas (Scion)

Plantation-grown eucalypts offer New Zealand forestry an exciting alternative to pine forestry. Eucalypts, with their strength and attractive appearance, as well as (for some species) natural durability, provide timber for a wide range of market opportunities, from high-quality furniture and outdoor uses, to fibre for high-quality papers.

While New Zealand does not have a recognised eucalypt forest industry, it imports over $33 million worth of hardwood sawn timber annually to meet markets that want a strong appearance grade or naturally durable timber. Eucalypt timber is also imported as furniture or veneer.

As consumers increasingly demand timber from plantations rather than from natural forests, New Zealand-grown eucalypts offer a local, genuinely sustainable option.

One of the strengths of eucalypts is their diversity, with over 600 species indigenous to Australia. However, at times this diversity can be a little overwhelming. With approximately 250 known species planted in New Zealand it is easy to understand why there can be some confusion as to what to grow where, how to select for growth rate, health and timber quality and then utilise the wood. Sometimes the whole genus is blamed for a bad experience with one species, where with correct selection from the other 250 species, the problem could have been avoided or minimised. Success has been achieved where the correct species have been well sited.

Even though some of the hundreds of species planted in New Zealand may not have been successful, where the correct species has been matched appropriately to its site, many others have been outstanding.

This handbook aims to help people make an informed choice on the best options to achieve their eucalypt planting objectives.

Choice of species

Trees belonging to the introduced genus *Eucalyptus* are an established feature of the New Zealand landscape. Approximately 25 species have been planted for amenity, shelter and commercial forestry. Present plantations are estimated to cover 33,000 ha, the majority having been established since 1990 as a source of short fibre for the pulp and paper industry.

Eucalypts are described in broad groupings. Some species are mixed together because of similar timber attributes.

Table 1: Example of most commonly discussed species by category

Ash Group	Stringybark	Gums	Peppermints	Boxes	Others	Corymbia
E. delegatensis	*E. agglomerata*	*E. botryoides*	*E. amygdalina*	*E. bosistoana*	*E. microcorys*	*C. maculata*
E. dendromorpha	*E. baxteri*	*E. globulus*	*E. coccifera*	*E. pilularis*		*C. calophylla*
E. fastigata	*E. blaxlandii*	*E. macarthurii*	*E. elata*			*C. ficifolia*
E. fraxinoides	*E. caliginosa*	*E.maidenii*	*E. nitida*			*C. gummifera*
E. obliqua	*E. cameronii*	*E. nitens*	*E. pulchella*			
E. oreades	*E. eugenoides*	*E. ovata*	*E. tenuiramis*			
E. pauciflora	*E. globoidea*	*E. saligna*				
E. paliformis	*E. laevopinea*	*E. gunnii*				
E. regnans	*E. macrorhyncha*	*E. viminalis*				
E. sieberi	*E. muelleriana*	*E. dalrympleana*				
	E.tenella					
	E.youmanii					

Choice of species has changed over the years and seven distinct phases can be identified:

1. *E. globulus:* — was the most commonly planted eucalypt species in the early 1900s. However its susceptibility to insect attack soon indicated it was not suitable for most New Zealand conditions. Remnant stag-headed trees are a testament to the rapid early growth rate. They can be seen in the cooler parts of the South Island where insect attack was less damaging than in humid areas further north.

Canterbury homestead planting of *E. globulus*

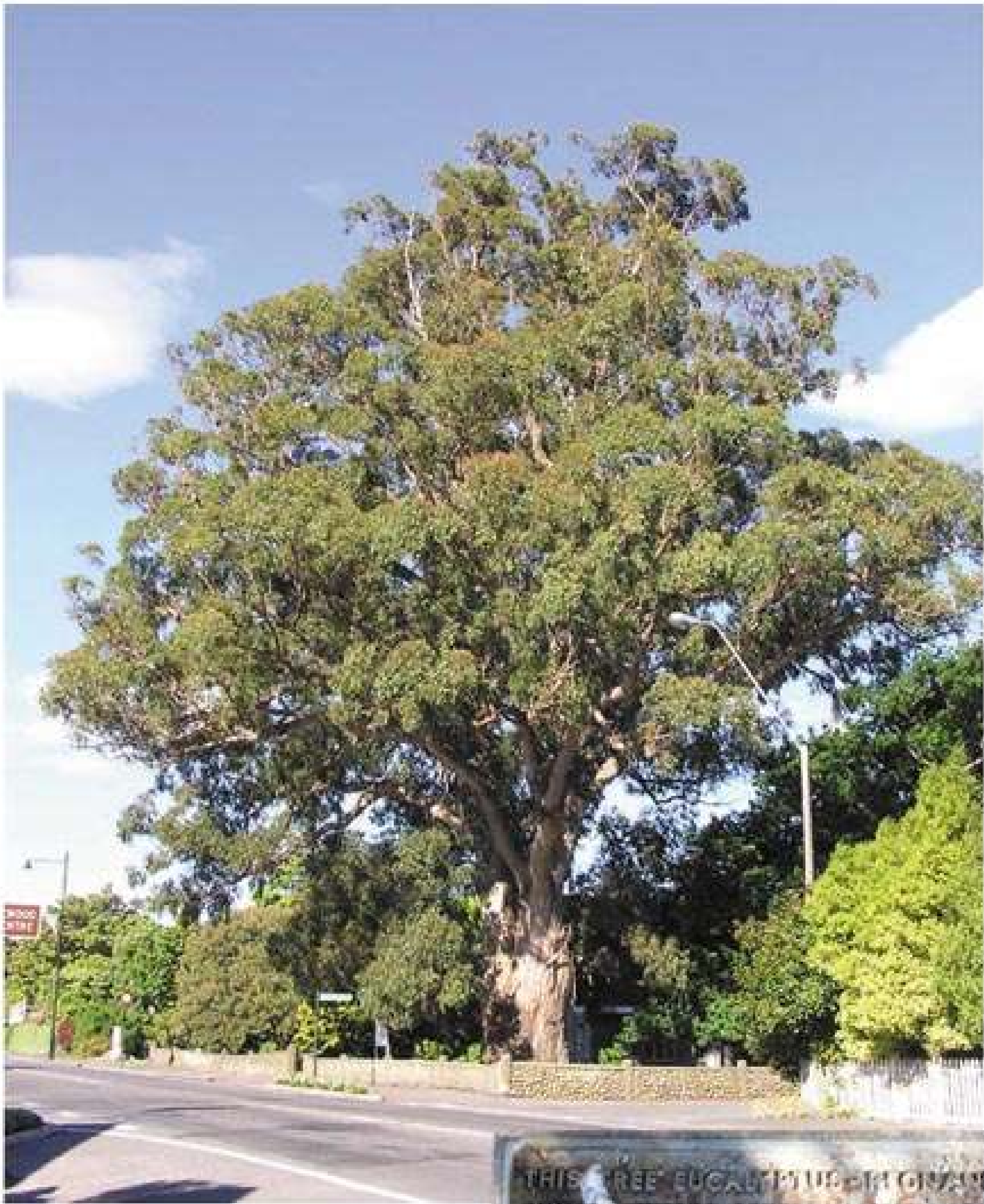
2. *E. viminalis* and *E. macarthurii:* — were found to be hardy and easy to propagate. They became a standard farm tree until the 1950s, but were rarely used for timber production.

3. *E. saligna*, *E. botryoides* and *E. pilularis* : — had been used by early settlers as shelter trees. In the 1970s, the New Zealand Forest Service established *E. saligna* plantations in Northland, Coromandel and the Bay of Plenty. *E. saligna* was also planted to shelter kiwifruit orchards between the 1970s and 1980s. The original recommendation for multiple-row coppicing was not taken up by fruit growers, and unmanaged eucalypts had to be removed as the trees became unwieldy.

4. *E. delegatensis, E. regnans, E. fastigata, E. obliqua:* — (Often referred to as the ash group.) Under the influence of foresters trained in Australia, these species were selected by the New Zealand Forest Products in the 1970s and 1980s for planting around the pulp mill at Kinleith, near Tokoroa. As more information about timber utilisation and health aspects became available, the popularity of specific members of the ash group changed. *E. delegatensis* and *E. regnans* are rarely used today. *Eucalyptus obliqua* planted around homesteads has grown well in dry and hot areas but was seldom used in large scale plantations because of inconsistent performances and the risk of kino (gum bleeding).

28-year-old plantation of *E. saligna* in Northland

A 60-year-old stand of *E. fastigata* in Kaingaroa Forest.



E. regnans tree planted in 1856 in Greytown, Wairarapa. The commemorative plaque explains its history.

5. *E. nitens:* — Known for its fast initial growth, this species was expected to perform well for early utilisation, but health problems reduced its popularity in the 1970s and 1980s. Optimism about biological control of the leaf-chewing insect, *Paropsis charybdis* and the consequent development of two eucalypt pulp resource companies in the 1990s stimulated the planting of approximately 20,000 ha of *E. nitens* in Southland and the Bay of Plenty. The failure of biological control through hyper-parasitism and poor performance of this species in milder climates has reduced interest in this species.

A 12-year-old plantation of *E. nitens* in Southland.

A 50-year-old stand of *E. muelleriana* in Northland.

6. *E. muelleriana, E. globoidea:* — and other stringybark species, also *E. pilularis*: The minimum sawing and drying problems and success with the marketing of these species by Eucqual in Northland has stimulated current interest in this group.

7. *E. fastigata:* — This species is considered to be the most suitable for the majority of sites due to its relative freedom from health problems and acceptable utilisation characteristics. There is a long history of *E. fastigata* planting in New Zealand, and Taranaki has some outstanding examples of this successful eucalypt.

E. globoidea stand in Canterbury.

Reasons for planting

Over the last century, the purpose of large-scale planting of eucalypts has changed, from production of solid timber to production of fibre (pulp/chips), and back again to solid timber.

Major shifts have occurred in the pulp and paper industry. Recent owners of the Kinleith Mill have not seen a need to maintain the short-fibre resource. Other forestry companies that purchased state forests in which eucalypt plantations had been established for solid wood production, are more interested in planting radiata pine, and conversion is taking place as soon as markets (usually chip) can be found for the eucalypts.

Strong market pressure has reduced the available/affordable land bank in Southland. In the Bay of Plenty, the sale of Tasman Forest Industries to GSL Capital Ltd in 1999 halted new planting.

As a result, the rate of planting of eucalypts for fibre has slowed down in recent years. Despite a long history of interest in eucalypts there is still no sign of a mature industry based on consistent supply and demand.

Appropriate processing skills, quality standards and, of course, a consistent market are vital to stimulate planting and allow the full potential of eucalypts to be realised. Renewed interest in large-scale plantations might also be stimulated by current interest in carbon sequestration.

Health issues

Although some eucalypt species present serious health issues, susceptibility to insect or fungal attack varies considerably among the 250 species grown in New Zealand. Species choice needs to be based on the latest information about site and health problems. The provenance (origin of seed from a species' natural range) can also make a significant difference in performance, especially if it can be matched to climate and site factors including micro-environmental effects.

Lessons can be learned from the days of serious insect infestation of *E. globulus* at the beginning of the 1900s and more recent incursions. Although close proximity to Australia means that new health problems may arise at any time from trans-Tasman introductions, selecting from the suite of currently-resistant species and matching to the right site, does offer some degree of risk mitigation.

Looking ahead

Small private plantings by farm foresters throughout the last century reflected the species preferences outlined above. These were scattered throughout the country, with uneven quality resulting from lack of attention to species requirements for site and use of appropriate establishment and silvicultural techniques.

As the emphasis changed from timber to fibre production, research on silvicultural techniques declined. More recently, data from the early experimental trials has been used to develop growth models for *E. saligna, E. nitens* and *E. fastigata*. Utilisation studies of *E. nitens* wood for laminated veneer lumber and a recent comparison of *E. fastigata, E. muelleriana, E. globoidea* and *E. pilularis* have shown promising results. Evaluation of plantings of the stringybark species has indicated that as a group they tolerate a wider range of climate than was previously recognised.

Eucalypt species choice and site selection, not least for micro-environmental effects play a major part in determining establishment and growth rates, as well as resistance to pest attacks. Health issues do continue to be a major concern with eucalypts and these need to be considered before any major investment is made.

New Zealand-grown eucalypt wood is suitable for many purposes. Challenges in dealing with growth stresses during sawing have been partially overcome with appropriate techniques, (growth stresses, a common feature of hardwoods, results from wood near the bark being under tension and shortening when released, while wood near the pith is under compression and expands. The problem is worse in long, small-diameter logs). Difficulties experienced with drying of some species are less important in the production of veneer, and can be managed if early rapid drying is avoided. A utilisation study of *E. nitens* has shown that there is considerable between-tree variability in terms of growth stress and checking. This could be exploited by tree breeders to improve sawn timber outputs. Species choice has a major bearing on these factors.

Current interest in eucalypt species centres on *E. fastigata*, *E. pilularis* and the stringybarks. Preference for *E. fastigata* developed from the utilisation of old large trees which generated a successful market profile. The stringybarks and *E. pilularis* present fewest problems with sawing, and they are relatively resistant to pest attack. Regional resources based on these species could be established by the eucalypt industry.

Due to their rapid early growth, research is also being carried out on the potential of eucalypt plantations as a source of bioenergy.

Young eucalypts take up larger amounts of nutrients from the soil than young pine trees, and their use for fuel production during land treatment of waste water and waste solids is being investigated.

Because profitable eucalypt forestry has not been demonstrated to the major forestry companies, the future of New Zealand eucalypt solid wood research and production appears to be in the hands of farm foresters. Opportunities lie ahead - a major deficit in hardwood supply is likely and there is evidence of Australian interest in New Zealand eucalypt timber. In 2007 New Zealand imported NZ$33.8 million worth of hardwood sawn timber/sleepers, and the majority of this was eucalypt.

Despite the current lack of processing knowledge and co-ordinated supply there is a future for the eucalypt industry. Demand already exists for timber with strength and decorative appearance grown in sustainable plantations. There is also a growing demand for strong naturally durable timbers. We know how to grow and process eucalypt wood, but we need to develop greater confidence when relating species to site. We also need to consider the merits of appropriately sized, regionally-located resources consisting of the most desirable species.

Eucalypt growers need vision and commitment, and farm foresters have the best opportunity for the creation of a valuable New Zealand hardwood resource.

60-year-old *E. blaxlandii* planted on a farm in the King Country.

Key Points

- New Zealand has considerable experience in growing and processing eucalypt wood, but needs to learn how to maximise return from small well grown sawlogs.
- Eucalypt species respond differently to site, climate and the presence of pests.
- Site/species matching is vital to minimise risk.
- There is considerable knowledge about the eucalypt species that are appropriate for New Zealand conditions.
- Demand for hardwood is likely to increase in the future.

Suggested reading:

Barr 1971

King 1980

McKenzie & Hay 1996

Miller *et al* 2000

Mortimer & Mortimer 1984

Nicholas 1991

Stockley 1973

Weston 1957

Yeates 1948

Visit www.nzffa.org.nz for the most up-to-date information available.