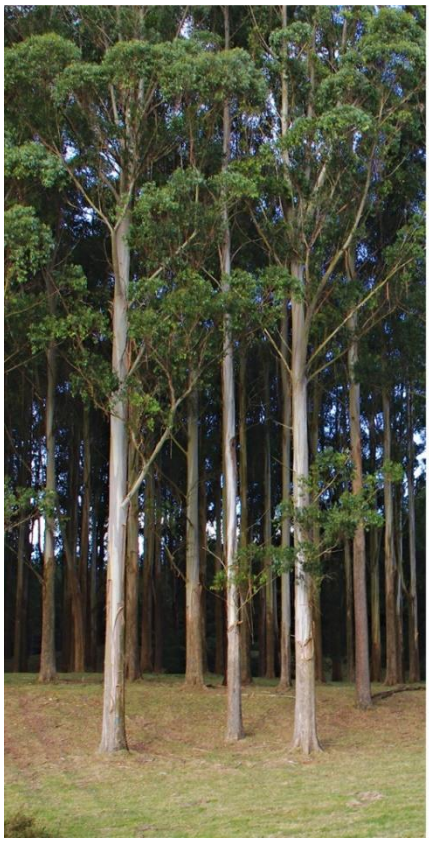
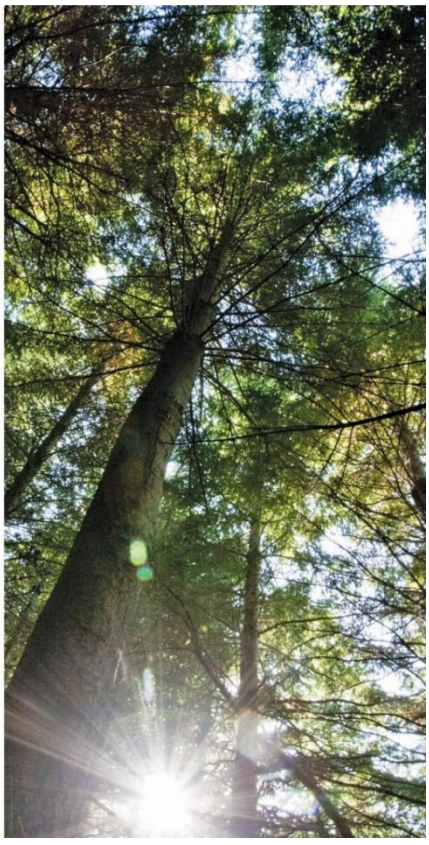
Specialty Wood Products Research Partnership

MARLBOROUGH RESEARCH CENTRE
Te Rito Hiranga o Wairau

Extending durable eucalypt species research by establishing new demonstration trials in 2018

Authors: Paul Millen and Ruth McConnochie





Date: 20th December 2018

Publication No: SWP-T069

TABLE OF CONTENTS

EXECUTIVE SUMMARY

While the NZDFI genetic improvement programme is concentrating efforts and resources on a few promising candidates, these and a broader list of species of interest are being evaluated in demonstration species and management trials. These were established from 2010 - 2014 to test broad-based seedlots of each species.

These trials are strategically located in different sites with varying environmental conditions and are predominantly spread across North Island East Coast regions as well as Marlborough and north Canterbury. They are now providing data to assess species health, adaptability and performance across a matrix of sites with a variety of management.

SWP investors and new farm foresters wanted to establish new demonstration trials of durable eucalypts. NZDFI has worked with those interested to extend our regional demonstration trial network into regions beyond where the existing 30 trial sites are located.

This report records the establishment of eight new demonstration trials including the sites, the species/seedlots deployed and the trial design. The regions where these trials were established include Northland, Waikato, Bay of Plenty, Taranaki, Hawkes Bay, Horizons and Marlborough.

The new sites selected were established so as to extend the range of regions where NZDFI species are being evaluated and to demonstrate to the participating landowners the direct benefits of matching eucalypt species to sites and how to achieve successful eucalypt establishment for optimal survival and early growth.

Once trees have grown to sufficient size PSPs can be installed in the species blocks to provide ongoing species productivity data.

INTRODUCTION

New Zealand has a long history of testing Eucalyptus species. Trials established between 1991 and 2004 by NZ Forest Research focused predominantly on non-durable species and the stringybark group (McKenzie, 1993 and McConnochie et al, 2008). The results from these trials along with the experience of Farm Forestry growers were used to select the species for the NZDFI genetic improvement programme, which is concentrating efforts and resources on a few promising candidates.

These species along with a broader list of species of interest are being evaluated in demonstration species and management trials. These were established from 2010 - 2014 and now provide data to assess species health, adaptability and performance across a matrix of sites with a variety of management.

In 2010 and 2011, NZDFI's research team supported twelve landowners in the Bay of Plenty, Gisborne, Hawke's Bay, Wairarapa and Canterbury regions to establish demonstration trials of eleven different durable eucalypt species. The trials were established at thirteen locations to test and assess individual species' performance across varying environmental conditions.

The selection criteria applied to choosing these species:
- Class 1 & 2/3 durable species (Australian Standard)
- Tree form and good growth
- High MOE (Stiffness) and MOR (Strength)
- Drought resistance (< 1000mm/year)
- Frost tolerance
- Proven timber use
- Potential for breeding hybrids
- Vigorous coppice

The species planted in 2010 were *E.argophloia, E. bosistoana, E.globoidea* and *E.quadrangulata*. In 2011 these were all included along with another seven species; *E. camaldulensis, E. cladocalyx, E. eugenoides, E. longifolia, E. macrorhyncha, E. notabilis* and *E. tricarpa*, giving a total of eleven. In 2012, NZDFI supported one of the landowners to establish another trial within their northern Hawke's Bay estate which included six durable species

NZDFI then worked with five new landowners to plant durable eucalypt trials at five new sites in 2013 followed by one of these landowners, plus another five new landowners, planting trials at seven new sites in 2014. In 2013 the species planted was reduced to only *E. bosistoana, E. camaldulensis, E. cladocalyx, E.globoidea, E. macrorhyncha* and *E. tricarpa*, but then expanded for the 2014 trials to include *E. longifolia* and *E. quadrangulata*.

The existing trials are testing broad-based seedlots of each species. They are strategically located in different sites with varying environmental conditions and are predominantly spread across North Island East Coast regions as well as Marlborough and north Canterbury. Within nearly all of these sites there has been sufficient growth for blocks to be selected and established as Permanent Sample Plots (PSPs).

This project was made possible due to the interest shown by SWP investors and new farm foresters that wanted to establish new demonstration trials of durable eucalypts. NZDFI has worked with those interested to extend our regional demonstration trial network into regions beyond where the existing 30 trial sites are located.

This report records the establishment of eight new demonstration trials including the sites, the species/seedlots deployed and the trial design.

PROJECT OBJECTIVE

To establish demonstration trials across a range of sites that include species in NZDFI's breeding programme and other species of interest so as to assess the comparative performance and phenotypic variability in survival, growth and form between species and individual genotypes.

METHODS

Species and seed sources
The original list of species tested in the 2010-14 series of demonstration trials was extensive, including Durability Class 1, 2 and 3 species. The results and experience from these older trials were used to focus the list of species that have been included in these new demonstration trials. The seedlots in these trials are either from natural Australian forest stands or were collected from first generation NZ seedling stands with a narrow range of genetic improvement.

Seed of the following species/sources was propagated for deployment in the new trials.

E.bosistoana Provenance Forest Stand – Seed from top 10 families assessed in NZDFI 2009/10 progeny trials.

E.bosistoana Native Forest Stand – Commercial seedlot collected in SE Australia.

E.cladocalyx Seedling Seed Orchard– First generation seed imported from Australia.

E.globoidea Seedling Seed Stand – 20 individual families from a Marlborough stand.

E.globoidea Native Forest Stand – Commercial seedlot collected in SE Australia.

E.macrorhyncha Seedling Seed Stand –12 individual families from a Marlborough stand.

E.*quadrangulata* – Mixed Australian seedlot of 74 families in NZDFI 2016 breeding populations.

E.tricarpa – Mixed Australian seedlot of 4 families in NZDFI 2016 breeding populations.

Seedling production
Seedling production was completed under contract by Morgans Rd Nursery, Blenheim. They were supplied seedlots for sowing in December 2017 and raised seedlings in root-trainer containers.

Figure 1: Seedlings being removed from root trainers to be packed for planting.

Figure 2: E. globoidea seedlings in packing box for planting.

E. bosistoana (10 families) and *E. globoidea* (20 families) were propagated by individual family and sorted into a balanced mix of families for planting at each trial.

Fewer seedling numbers of *E. tricarpa* and *E. cladoclayx* were propagated than of the other species as these were only planted at three of the new trial sites where summer drought occurs.

In addition, Proseed NZ successfully produced clonal cuttings of *E.bosistoana* under its propagation research work completed for SFF project 407602. Therefore, 900 of these plants were also established within three of the new trials to test their initial survival and growth.

Sites selection
NZDFI established new trials on properties owned by three new land owners and three landowners that already host NZDFI trials.

The new sites selected were established so as to extend the range of regions where NZDFI species are being evaluated and to demonstrate to the participating landowners the direct benefits of matching eucalypt species to sites and how to achieve successful eucalypt establishment for optimal survival and early growth.

Table One: Sites selected for 2018 demonstration trials

Landowner – Property/site name	Region	Annual Rainfall (mm)-NIWA	Existing NZDFI demo trials	Site description (aspect, slope & existing cover)
Dillon	Marlborough	696	2011	West facing; easy slope; pasture
Landcorp – Omamari	Northland	1206	Nil	North facing; steep slope; pasture
Landcorp - Kapiro	Northland	1601	Nil	East facing; easy slope; pasture
Landcorp - Edenham	Hawkes Bay	1151	Nil	2x areas; north and south facing; medium slope; cutover
Lake Taupo Forest Trust - Rotopuha	Waikato	1253	2014	North facing; easy slope; cutover
Timberlands – Rotoehu	Bay of Plenty	2035	Nil	North facing; steep slope; cutover
NZ Redwood Company- Paparoa	Horizons	1561	2014	West facing; easy slope; cutover
Thomson	Taranaki	2116	Nil	East facing; steep slope; cutover

Generally the trial sites are of even aspect and contour, and good drainage.
(See Appendix One for photos of new trial sites)

Trial design
All or a subset of the species seedlots were planted at each site in a 100-tree randomised block design, 10 trees x 10 trees, with 2 to 3 replications of each seedlot per site.

Tree spacing at each site was selected based on the landowner's interest in evaluating either a short rotation crop of posts/poles or a longer sawlog rotation.
For a short term rotation, 2.3m x 2.3m spacing was used with 2.8mx2.8m being used at sites where a sawlog rotation is planned.

Trial establishment
Trial establishment including layout, demarcation (pegging and labelling) and initial mapping of each new trial site was undertaken by NZDFI Project Manager supported by the landowner or their contractors except the Timberlands site which was set up by their own staff.

New trial sites on farms were fenced by the landowner. The planting layout for individual blocks was marked with dazzle and pre plant weed control undertaken on all sites.
This work was completed from late June to mid August.

During August to October nursery stock was sorted and dispatched to new trial sites with planting completed by the landowner's contractors under supervision of NZDFI's Project Manager except the Timberlands site where planting was supervised by their own staff.

RESULTS

The location of the eight trial sites established are shown in figure three below with a list of species and seedlots deployed; the number of reps per trial and planting date shown in Appendix Two.

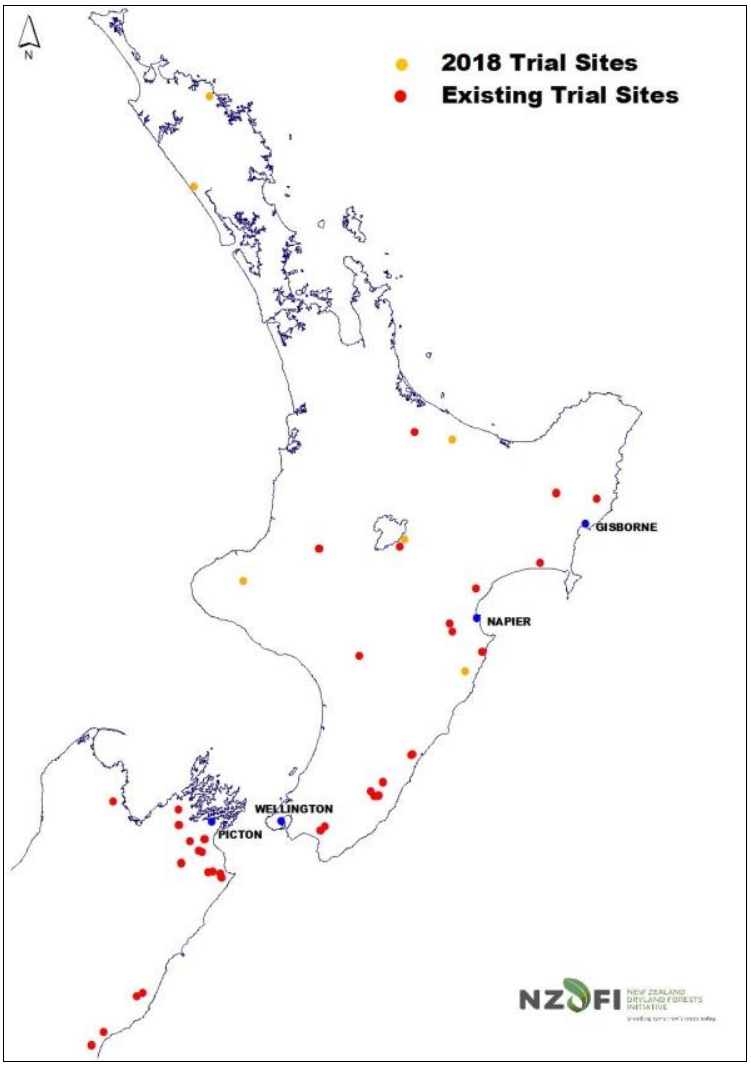


Figure 3: Demonstration trial sites established in 2018

In total there were 14,600 plants established in the new trials with the combined area of these being 11.45 hectares.

The mapping of the new trials has been completed to NZDFI's protocol and uploaded to NZDFI's Drop box for access.

The new trials will be assessed for survival at age 9-12 months and a file note will report the initial establishment success. Ongoing maintenance and protection of the trees is the full responsibility of the landowner as they will own the trees.

CONCLUSION

The new trials established have extended the range of regions where NZDFI species are being evaluated.

These trials will demonstrate to the participating landowners the direct benefits of matching eucalypt species to sites and how to achieve successful eucalypt establishment for optimal survival and early growth.

Once trees have grown to sufficient size PSPs can be installed in the species blocks to provide ongoing species productivity data. This data will contribute to site-species matching research on durable eucalypts and will enhance the database available for the development of juvenile growth and yield models.

ACKNOWLEDGEMENTS

Thanks to the six landowners and their forest managers for providing new trial sites and supporting the establishment of the new trials.

REFERENCES

- Apiolaza, L., McConnochie, R., & Millen, P. (2011). Introducing Durable Species to New Zealand Drylands: Genetics of Early Adaptation of Eucalyptus bosistoana. Paper presented at the Developing a Eucalypt Resource: Learning from Australia and Elsewere, Wood Technology Research Centre.
- Mason EG., Salekin S. and Morgenroth J. (2017) Comparison between meteorological data from the New Zealand National Institute of Water and Atmospheric Research (NIWA) and data from independent meteorological stations. New Zealand Journal of Forestry Science 47(7) http://dx.doi.org/10.1186/s40490-017-0088-0.
- McConnochie, R., Nicholas, I., Low C., and Dungey H. 2008. Evaluation of the stringybark group and other species. Unpublished science report Scion, July 2008.
- McKenzie, H. (1993). Growing durable hardwoods- a research strategy. NZ Forestry 38(3) 25-27.
- Millen, P. (2009). NZ dryland forests initiative: a market focused durable eucalypt R&D project. In *"Revisiting eucalypts"* (L. A. Apiolaza, S. V. S. Chauhan and J. C. F. Walker, eds.), pp. 57-74. Wood Technology Research Centre, University of Canterbury, Christchurch, N.Z.

APPENDIX ONE - NEW TRIAL SITES ESTABLISHED 2018

Figure 4: Landcorp Kapiro site being planted in Northland.

Figure 5: Landcorp Omamari site in Northland.

Figure 6: One areas of the Landcorp Edenham site in Hawkes Bay.

Figure 7: Lake Taupo Forest Trust site beside Rotopuha road.

Figure 8: NZ Redwood Company site being planted at Paparoa near Taumaranui.

Figure 9: Thomson site being planted in Taranaki.

Figure 10: Dillon site being planted in Marlborough.

APPENDIX TWO – TABLE OF SPECIES AND SEEDLOTS DEPLOYED; THE NUMBER OF REPS PER TRIAL AND PLANTING DATE

Seedlot	E.bosistoana Individual Families	E.bosistoana Clones Ex Woodville	E.bosistoana Seedlot 16/619 Gippsland	E.globoidea Individual Families Waikakaho	E.globoidea Seedlot 10/714 Cann River	E.quadrangulata	E.tricarpa Mixed Seedlot	E.macrorhyncha Seedlot 17/642 Waikakaho	E.cladocalyx Hamilton Seed Orchard	Trial block size	No. Blocks	Trial area (ha)	Date planted
Nursery Code/Seed Source	**Code 1**	**Code 2**	**Code 3**	**Code 4**	**Code 5**	**Code 6**	**Code 7**	**Code 8**	**Code 9**				
Site	PFS	CCS	NFS	SSS	NFS	NFS	NFS	SSS	SSO				
Landcorp – Omamari, Northland	300	200	200	300	200	200		300	200	28m x 28m	19	1.49	27th Aug
Landcorp - Kapiro, Northland	300		300	300		300		300		23m x 23m	15	1.18	28th Aug
Landcorp - Southern Hawkes Bay	300	300	200	300	200	200	300	300	300	23m x 23m	24	1.88	13 & 14th Sept
LTFT – Taupo	300	300	300	300	300	300		300		28m x 28m	21	1.65	17 & 18th Sept
NZRC-Taumaranui	300		300	300	300	300		300		28m x 28m	18	1.41	18th Sept
Kaingaroa Timberlands – Bay of Plenty	300	300	300	300		300		300		28m x 28m	18	1.41	31st Oct
Dillon – Marlborough	300		200	300	200	200	300	300	300	28m x 28m	21	1.65	4th Oct
Thomson-Taranaki	200		200	200		200		200		28m x 28m	10	0.78	31st Aug
TOTAL	**2300**	**1100**	**2000**	**2300**	**1200**	**2000**	**600**	**2300**	**800**	**14600**	**146**	**11.45**	