

Project Update – July to December 2015

NEWS FROM THE PAST FEW MONTHS –

The new Speciality Wood Products (SWP) partnership with the Ministry of Building Innovation and Employment (MBIE) is well underway with the funding contract signed on 9th September 2015 by Future Forests Research, effective from 1 July 2015. This partnership includes funding for research contracts with the University of Canterbury (UC) and the Marlborough Research Centre (MRC) to undertake NZDFI's tree improvement programme.

There is a SWP Programme Steering Group (PSG), chaired by Peter Berg and includes eight other investor members that make decisions on the governance and management structure for this new partnership. A Technical Steering Team (TST) has also been established to provide technical direction to the programme and to work with the research leaders on shaping the details of the research programme. Members of this team have been selected from investor companies so as to provide forest grower and end user assistance with the programme; to act as industry advocates for the programme and to encourage uptake of research outcomes.

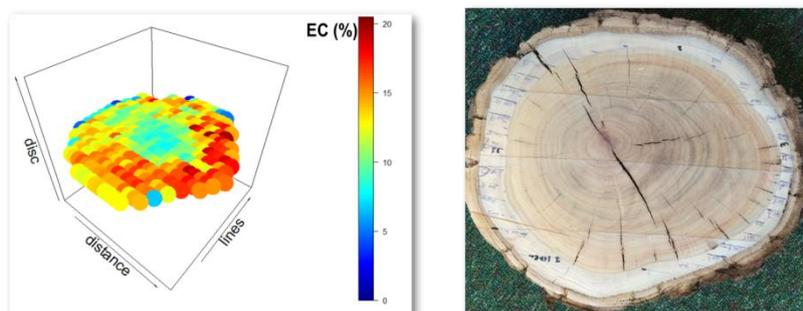
NZDFI's Tree Improvement Programme

Wood Quality Research (update from Clemens Altaner, NZ School of Forestry)

Assessments of growth and form in our breeding populations has continued followed by marking up poorer performing trees and then thinning to remove these including collecting discs from cull trees for heartwood quality analysis. The 2009 *E. bosistoana* trials at Craven Road and an area at Lawsons were thinned in the 2nd week of December. 10-15 cm long 'discs' were cut from 129 trees which contained heartwood. These samples will be used for future studies on the bioactivity and chemistry of *E. bosistoana* heartwood extractives.

Protocols to visualise living cells in *E. bosistoana* have been developed. Conventional staining and immunolabelling approaches have been used combined with UV and confocal microscopy. Protocols to visualise nuclei, microtubuli, chlorophyll, starch, lipids and other plastids have been established.

A protocol is under development to assess heartwood quality by NIR as NIR has been shown to be able to predict extractive content in solid *E. bosistoana* heartwood with an accuracy of 1%. This has been used to map the extractive distribution within *E. bosistoana* discs. The results show typical radial patterns which need to be considered when analysing the cores. A metal template has been manufactured to ensure that NIR spectra will be taken along the core at equidistance. This will allow ranking of families by a) the average extractive content of their heartwood and b) their lowest extractive content (close to the pith).



EC predicted by NIR in a 40 year old *E. bosistoana* disc taken at the stem base

The design of tree corer is being finalised so that work can commence on coring 2009 *E. bosistoana* NZDFI breeding trials. In collaboration with Callaghan Innovation a tree corer prototype has been manufactured which is able to extract 10 mm diameter cores with a smooth surface from high density eucalypts. The tool is powered by a battery drill. A third 'drill-bit' has been manufactured.

The tree corer has been tested under field conditions and extracting a core takes ~10 minutes. Options to optimise the coring have been identified.

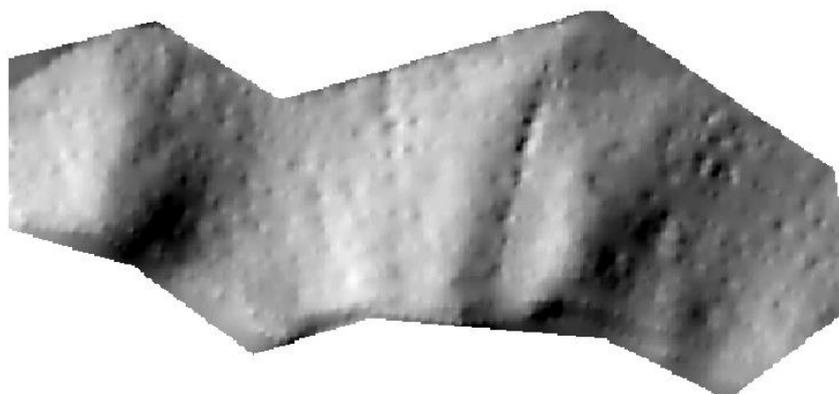


*PhD student Yanjie Li tests the new coring tool on an *E. bosistoana* tree planted in 2009.*

A protocol to assess wound wood in *E. bosistoana* samples is being developed. Approximately 100 *E. bosistoana* seedlings of 20 families have been harvested after previous wounding of the stem. The seedlings have been split perpendicular to the wound. The stem-halves have been oven-dried and subsequently stained with methyl orange to highlight heartwood. The length and the width of the wound reaction have been measured. The data revealed large variation in wound response between the trees. Within family variation was large. Assessment of the genetic control of wound wood formation will benefit from more replicates per family and more controlled environmental conditions. Options are being identified.

Site species matching research (update from Justin Morgenroth and Euan Mason, NZ School of Forestry)

A digital terrain model (DTM) has been produced for two NZDFI sites. This was achieved by using a high grade global navigation satellite system (GNSS) receiver to produce a high resolution model (<1 m cell size), of both the 2009 *E. bosistoana* breeding populations site at Lawsons and the 2011 *E. globoidea* breeding populations site at Avery's. The DTM was used to inform the soil sampling strategy and will be the basis for future growth modelling.



High (<1 m) resolution digital terrain model (Avery)

Twenty three soil pits have been dug at the two NZDFI sites. The soil sampling strategy covered the variation in aspect and slope. Due to the extremely hard soil an excavator was used. Soil horizons have been measured and from each pit four samples were brought back to the laboratory for physical soil properties measurements.



Using an excavator to dig soil pits in 2011 *E. globoidea* breeding population at Avery's



Soil horizon at Avery's site

Insect resistance/tolerance research (Update from Tara Murray, NZ School of Forestry)

Insect defoliation research is on track for 2015 with PhD student Huimin Lin having completed her research proposal and begun her first season of field work. In the summer of 2015-2016 research is focused on establishing a defoliation trial within the 2010 *E. bosistoana* planted at Avery's. The objective is to assess the impact of 50% (moderate) and 90% (severe) defoliation during spring, late summer or both on tree growth. Growth will be assessed monthly for the next 2.5 years to determine if defoliated trees are slowed down relative to controls (no defoliation) and importantly, if they recover (catch up with controls) in the absence of further significant defoliation due to photosynthetic up-regulation. 140 trees are included in the trial with equal numbers being manually defoliated by 90% or 50% in October, February or both. All are being protected from defoliation by real insects using insecticide applied as a soil drench (to minimise non-target effects on natural enemies and beneficial insects such as honey bees – trees are not flowering).



Some of the crew beginning spring defoliation within 2010 *E. bosistoana* breeding population at Avery's.

A full health assessment of 15 *E. bosistoana* families is also underway at Avery's and Lawson's, to determine if different levels of natural herbivory are being sustained by the different families there and the impact on their growth. These trials will help determine if there are any particularly susceptible or tolerant families among the current breeding lines.

To date, overwintering adult Paropsis have gone through the maturation feeding process (September/October) and laid the first generation of eggs for the season. Most insects that hatched completed development and emerged as the second generation of adults in December. The offspring of this second generation generally do the greatest damage. Paropsis, gum emperor moth and leafroller populations will be closely monitored at Avery's to better understand their phenology to help predict when the most damaging life stages are most abundant as this is not well documented in the South Island.

UC SFF Project: Minimising growth-strain in eucalypts to transform processing (Update from Clemens Altaner, NZ School of Forestry)

Good progress has been made over the last months since this new SFF project started in July 2015. This project is supported by a wider group of industry supporters outside of NZDFI.

Another 4,155 trees from 68 additional *E. bosistoana* families were planted at Woodville (Murray's Nurseries) in November. Some remaining *E. bosistoana* and *E. argophloia* families will be ready for planting in February 2016.

More *E. bosistoana* trees have been planted at Harewood (Christchurch) to provide samples to fine-tune the growth-strain measurement procedure.

The 4,500 trees (81 families of *E. bosistoana* and 13 families of *E. argophloia*) seedlings planted in February have been pruned to create a ~40 cm clear stem section at the base of the trees. This will ensure good sample form for the splitting test. General maintenance, such as application of fertiliser and re staking trees, was conducted. Tree height was measured for every second tree.



E. bosistoana planted in February 2015 at Woodville following pruning in November.

In September a propagation workshop was held with representatives from several commercial nurseries following which a work programme to assess the coppicing and transplanting ability of *E. bosistoana* root stock was initiated. This demonstrated that lifting young *E. bosistoana* plants that have been cut for growth-strain analysis without prior root-pruning/undercutting is not straight forward. The risk of losing plants is high.

However, three nurseries; Proseed NZ, Southern Cypresses and Morgans Road have started to attempt to propagate *E. bosistoana* from cuttings. In addition, Proseed NZ staff, Paul Schroeder and Marie Cresswell, visited Narromine Transplants in Australia to get firsthand experience with propagating eucalypts from cuttings.

A presentation on the early results on the development of the methodology for selection of eucalypts for low growth-strain was given by Nick Davies (PhD student) at the 8th Plant Biomechanics International Conference held between the 30th November and the 4th December 2015 in Nagoya, Japan. There was a high level of interest in this research.

Forest Operational Research and Extension Programme

SFF 13-024 project: Enabling growers to maximise value from planting durable eucalypts

(Update from Paul Millen, NZDFI Project Manager)

There has been good early growth and survival at most of the new management trial sites inspected in the past six months particularly Waihapua planted by the Hawkes Bay Regional Council.

However, at Robb Macbeth's two trial sites in North Canterbury, where there has been a prolonged severe drought, survival and growth have been affected.

At Lake Taupo Forest Trust's trial, sensors have been recording winter temperature variation on this north facing site. This will allow an excellent comparison with species survival on this cold site.



Kevin Thomsen inspecting the new trials planted last year at Waihapua forest by Hawkes Bay Regional Council in August. Now the 'fleabane' weed around the eucalypt seedlings has died back leaving the eucalypts seedlings well developed amongst the dead stalks.



The dry slopes of the new eucalypt block planted last year by Robb MacBeth near Cheviot. Despite receiving less than 500 mm in the twelve months following planting there is good survival and some growth on most species.

Extension has continued this past 6 months. This includes links to two short videos that cover eucalypt form pruning being added to the NZDFI web site.

One of these is the new eucalypt form pruning video produced by the NZ Farm Forestry Association with support from NZDFI under a recent MPI SFF funded project. <http://nzdfi.org.nz/grower-information/growing-ground-durable-eucalypts/growing-regimes/form-pruning/>

There's been continuing interest in the NZDFI R&D programme with a presentation given to the Romeo Bragato (Wine industry) Conference on 26th August that was held in Taradale, Hawkes Bay. There was also a NZDFI field trip combined with an evening seminar held at Havelock North in Hawkes Bay on 4th November. Despite some very wet and windy weather that afternoon, this was well attended by 5 speakers and 45 participants. Many thanks to Ben and Peter McNeill for hosting the field trip to their property.

A group of NZ ex pats living in UAE requested that a video be made of the seminar presentations and they contributed toward the cost of this being done. These videos can be viewed on <http://nzdfi.org.nz/news-and-events/seminars-2015/> Also at the Hawkes Bay event there was an additional guest speaker, Joanne Lewis, who is

a senior forester with Heartwood Plantations based in SE Victoria. Heartland Plantations are, one of the few Australian companies growing durable eucalypts, and they are working in partnership with a radial sawmill.
<http://www.heartwoodplantations.com.au/>



*Hawkes Bay field trip attendees inspect the NZDFI's *E. quadrangulata* breeding populations planted in 2011 at McNeill's.*

AGMARDT project: Matching elite high value eucalypts to productive drylands (update from Euan Mason, NZ School of Forestry)

The University of Canterbury's AGMARDT project on matching two NZDFI durable species (*E. bosistoana* and *E. globoidea*) to dry land sites in Marlborough is progressing well.

Hobo microloggers have been installed with soil moisture measurement probes, thereby completing the scheduled installations for temperature and soil moisture monitoring.

A comparison between nine independent climate stations (seven NZDFI and two from other experiments) and modelled estimates at the nearest points from the National Institute of Water and Atmospheric Research's virtual climate station network (VCSN) has been completed and the results are fascinating. In brief:

- 1) VCSN estimates of daily maximum temperature were excellent on a daily basis ($R=0.97$ after adiabatic adjustment for differences in elevation between the VCSN points and our stations).
- 2) VCSN estimates of daily minimum temperature were more highly correlated with actual minima when not adjusted adiabatically ($R=0.93$).
- 3) On a monthly basis correlations for mean daily maximum and minimum were better but followed the same pattern of adiabatic adjustments as for daily estimates (both $R=0.98$).
- 4) Daily radiation was also very well estimated by the VCSN at a daily level ($R=0.97$) and at a mean monthly level ($R=0.98$).
- 5) Rainfall was roughly estimated at a daily level by the VCSN ($R=0.54$), but monthly estimates were somewhat better ($R=0.73$).
- 6) Relative humidity was reasonably well estimated by the VCSN at both daily ($R=0.82$) and monthly ($R=0.83$) levels.

We have concluded from this that we can use VCSN estimates at a monthly level for modelling at sites where we do not have climate stations, but if possible we should establish rainfall gauges at important sites. However, it is important to frequently inspect and clean rainfall gauges.

Collaboration continues with SCION through their SLMACC hardwood productivity research project. Dean Meason, Ecosystem Analyst for SCION gave a presentation about the outputs from this productivity research on *E. globoidea* at the NZDFI's Hawkes Bay seminar held on 4th November. This can be viewed on line <http://nzdfi.org.nz/news-and-events/seminars-2015/>

IN THE PIPELINE

2016 FIELD DAYS AND SEMINAR

As part of our current Sustainable Farming Fund programme, we will hold four field visits and one seminar in February and March 2016. These events will provide an opportunity to see some of our trial sites, learn about the practicalities of establishing and managing ground-durable eucalypts, and hear presentations from scientists and others on the latest research and development advances being made by this project.

2016 Field days – dates and locations

- **Wednesday 10th February** (2.00-5.00 pm): **Marlborough** – Marlborough Regional Forests Pukaka forest, and Siggers trial site, South Marlborough. Planting and management of durable eucalypts on (i) pine cut-over, and (ii) a dry grassland site. [More details here.](#)
- **Saturday 20th February** (1.30-4.30 pm): **Gisborne** – Gaddum/Wishart Trial Site, Te Koawa Station, near Gisborne. Durable eucalypts on typical East Coast hill country. Indoor presentations followed by an afternoon field visit. [More details here.](#)
- **Friday 26th February** (12.00-4.30 pm): **Bay of Plenty** – Tect Park Trial Site – establishment and management of a range of species on a relatively high-altitude pine cut-over site. Also eucalypt insect pests and biological control research. [More details here.](#)
- **Thursday 24th March** (10.00am-3.00 pm): **North Canterbury** – establishment and growth on two dry North Canterbury sites, plus a visit to Proseed's new state-of-the-art propagation facility, Amberley. More details will be included on the NZDFI web site soon.

2016 Seminar – Tuesday 1st March (1.30-8.30 pm): Taupo

This seminar is being held due to the high level of interest in our research and the exciting levels of survival and early growth rates in Lake Taupo Forest Trust's new trial. The trial is the first on pumice soils and is on a pine cut-over site.

We will have an afternoon visit to the trial site followed by evening meal and indoor presentations by scientists and others involved in the work of the NZDFI. [Full details and registration here](#) . **Please note that you must register for this seminar, and pay for the evening meal on registration.**

Pruning demonstrations and equipment

Timely pruning is a key part of the early management of ground-durable eucalypts. Lakewood Products Ltd is one of the sponsors of our field days, and the workshops will feature demonstrations of Pro-Pruner pruning equipment.

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Permanent Sample Plot measurement summer programme

Jack Burgess, a recent University of Canterbury graduate who worked for NZDFI last summer and Saturo Kuwabara, a UC summer scholarship student will be working throughout the summer months to re-measure most of NZDFI's existing PSP's as well as all other trial plots planted 2010-2014. More PSP's will be established in trials planted during this SFF project where trees have grown to sufficient size.

A final word from Paul....

This Project Update provides a short overview of the wide range of research projects on durable eucalypts that have been initiated by the NZDFI and the diversity of skills and knowledge of the NZ School of Forestry team based at the University of Canterbury who are leading these projects.

This experienced science team is backed by a cohort of new PhD students who are highly motivated to advance NZDFI's vision to develop elite germplasm and best practice management systems that will enable forest growers and farm foresters to establish a durable eucalypt forest resource in NZ drylands.

I believe that the success of NZDFI's vision lies in encouraging both excellence and innovation by this team as research of new knowledge is the key to NZ's success in the global economy.

Anyone wanting further information and you can encourage others to contact:

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