Newsletter
2016-2017

Sequoia Action Group

In this issue:

Presidents Comment

Hi all, and welcome to the 2016 SAG newsletter, better late than never! With the 2017 NZFFA AGM less than 2 weeks away, I am looking forward to catching up with some SAG members and particularly the field day planned at the New Zealand Redwood Company's Hunterville Property.

We have had a fairly good run in the research branch over the past year considering Sequoia is not included in any of the industry research programs. In this year's newsletter we are able to provide a summary of the SFF project which took a look at the additional Kuser trial data evaluating the performance of clones across 5 sites. We also have a progress report on the 2 year SFF Heartwood durability project, looking at the development of a means of rapidly determining heartwood durability using Near Infrared scanning technology. I was fortunate enough to be awarded the NZIF Chavasse travel award and will report on my trip to the 2016 Sequoia Science Symposium in Eureka, California where I presented two papers on the New Zealand redwood industry as well as having a really good look around the natural range of our favourite tree. We also have some photos of a domestic milling operation in Putaruru, some background data on the genetic trials that are being carried out by Wade Cornell and take a look at the Carbon Tables being calculated for participants in the Emissions Trading Scheme.

I will be retiring as president at the upcoming AGM, where the election of a new President will take place. It's been 10 years since I was 'nominated' at Bulls in 2007 and its time to let someone else lead the action group moving forward. It's been a great learning curve and with such a small body of enthusiasts and industry professionals I have enjoyed the associated passion and friendships. We are all making great progress together in advancing the art and the science of redwood forest management in New Zealand.

Paul Silcock March 2017

2017 AGM

The AGM of the Sequoia Action Group will be held at the Middle Districts NZFFA Conference at the Fielding Civic Centre at 9.00am Friday the 7th April 2017. This will be followed by an all-day field trip to "Okota", 10 km Nth West of Hunterville. This 250 ha (approx) property is owned by the NZ Redwood Company, and has been planted almost exclusively in redwood, with some experimental plantings of cypress and Eucalypt as well. The last AGM was held at Hokitika on the 9th April 2016, the minutes of this meeting are included with the Presidents report and will be circulated along with the agenda prior to the AGM. There are toilet facilities on site.

Directions:
Turn off SH1 onto Murimoto road 2km north of Hunterville
(adjacent to the SH1and main trunk railway line overbridge).
Drive 4km up Murimotu Rd.
Turn left into Agnews Rd and continue to the end 4km.
Nb: Agnews Rd is gravel and windy.

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Call for Nominations – President

Paul Silcock is retiring after 10 long hard years at the helm. Nominations for President can be submitted by email to the secretary up to Wednesday 5th of April. This leaves 2 days for nominations to be circulated prior to the AGM. Any member of the SAG can nominate another member, or self-nominate. The election will be held at the AGM. If no nominations are received by the due date, then nominations will be called for from the floor during the AGM.

A long-held dream to visit the home range of coast sequoia comes true. Your President at the not-very secret-location of some recently discovered very large specimens. Jedediah Smith Redwoods State Park towards the northern extent of the natural range.

SFF project 404886: The Kuser Trial – An analysis of Genetic by Environment interaction

The one-year Sustainable Farming Fund project which we (SAG) applied for in July 2015 has now been completed and the results are being communicated via a publication from Scion, a Treegrower article and eventually a scientific paper in an international Journal. It's great to see the relationship between the NZFFA and Scion working so well to get quality research completed with the help of MPI/SFF.

With Co-Funding from The New Zealand Redwood Company, SAG and NZ Forestry Limited, Scion were contracted to carry out an analysis looking at the growth performance and wood quality traits of the various clones (198) and provenances (90) from the Kuser collection across a range (5 sites) of environmental conditions across New Zealand.

We wanted to provide information to growers on how the performance of clones change across sites and; where, from the natural range of redwoods, do the best trees for New Zealand come from?

Clonal rankings were consistent across high quality sites. A clone selected for superior growth and wood properties from a reasonable site, will perform in a similar manner on another reasonable quality site somewhere else in NZ. This is very comforting for those growers who have spent so much time and money on selecting clones with good growth and wood properties – we are now certain these properties will be expressed when the clones are planted on other sites.

Knowledge of sites that may impact on clonal performance. Clonal ranking and performance can change across poorer quality sites. Consideration should be given, where establishing redwood on low quality sites whether the investment into high quality genetic material is worth pursuing, or whether using lower cost seedling material from an appropriate provenance is a more suitable strategy.

We can now continue on with clonal redwood forestry across reasonable quality sites with confidence. This provides the industry & scientists with the knowledge needed to determine the best way forward; if a formal breeding program were ever to get off the ground - or indeed if we were to win Lotto and be able to carry out a complete Provenance Trial.

SFF Project 408110: Heartwood Durability Progress Report
Dean Meason

We have passed the three quarters mark of the two year SFF project – Getting to the Heart of Redwood Durability. We have had a fair share of challenges over the last 21 months, but these were overcome and we are moving full steam ahead.

The project is investigating the natural durability of coast redwood (Sequoia sempervirens) throughout the length and breadth of the country to understand how 3 factors: genetics, site productivity, and age impact durability. Does the natural durability characteristics of redwood change between faster growing and slower growing sites? How much does genetics impact natural durability? At what age does heartwood become resistant to decay?

The main outcomes of this project are:

1. Develop a fast and easy near-infra red (NIR) scanning testing technique to classify natural durability of a wood sample.
2. Develop a mathematical model to predict if/how heartwood durability changes with age.
3. Quantify the impact of site productivity on natural durability. Are some provenances more durable than others?
4. Identify any clones/seedlots with poor durability and recommend their removal from nurseries.

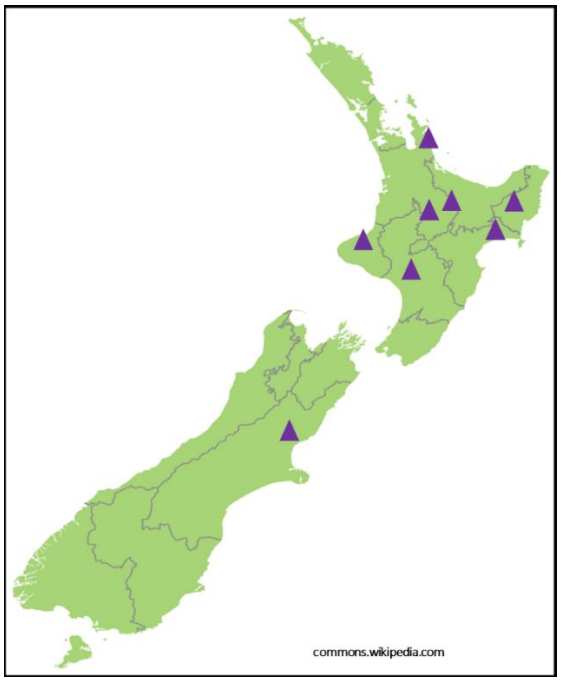
It is envisioned that the results of this project will provide confidence to growers and buyers that NZ grown redwood plantations can produce high quality, naturally durable, wood.

Scion appreciates the in-kind and financial support we have got from Sequoia Action Group (SAG), NZ Redwood Company, New Zealand Forest Owners Association, NZ Forestry Ltd, and the landowners that kindly let us fell trees to collect redwood disks. Without the support of SAG and your energetic president Paul Silcock, this project would not have gotten off the ground. Paul and Simon Rapley have been instrumental in this project in collecting redwood disks from several sites which kept the costs down.

Work to date

We have obtained wood samples from eight sites from around the country (Fig. 1) ranging from 13 years old to 82 years old (Table 1). The sites ranged in productivity from low (Hundalee) to very high (Awaho) and everything in between. At each site at least four disks were obtained per tree and at least nine trees per site were sampled (Table 1). The disks were taken at a height of 0.2m, 1.4m unless it was a commercial harvest, 4m, 6m, and 10m. The 0.2m represents the bottom of the first log, and 4m and 6m represents the top of the first log/bottom of the second log. The logistics of this project has been at times tricky – how do you efficiently transport many heavy disks from Canterbury, Gisborne, and the Manawatu without wasting too much time and not costing the earth? The dynamic duo of Paul and Simon came to the party and were willing to transport the precious samples from the back and beyond to Scion's facilities in Rotorua. We were very fortunate that Simon got wind of a redwood harvest in Mangatu forest and was able to successfully negotiate to obtain disks from a valuable stand.

Figure 1: Location of sites sampled in year one



Originally, it was proposed that disks would be obtained from three stands older than 60 years old. However, after watching the harvest of a stand of massive, 72-year-old, redwood trees in Kinleith forest – I had second thoughts. Without a professional crew with all the gear, there was no way that we could obtain redwood disks from old stands. Figure 2 gives an idea of the challenge! Thanks to the cooperation of Hancock Forest Management and Rayonier | Matariki Forests, we obtained disks from commercial harvests from old stands in Kinleith forest in the central North Island and Tairua forest in the Coromandel.

Figure 2: Obtaining a disk sample from a 79-year-old stand in Kinleith Forest

Once the disks arrived at Scion, they were individually measured, photographed, and then stacked and filleted to air dry until the wood moisture content was near equilibrium. The disks were then cut into 50 x 25 x 15 mm Sutter blocks with multiple blocks obtained from the inner and outer heartwood (Fig. 3). When a disk was big enough, 30 blocks were obtained for fungal decay testing. We estimate that over 8000 blocks will be tested by the end of this project.

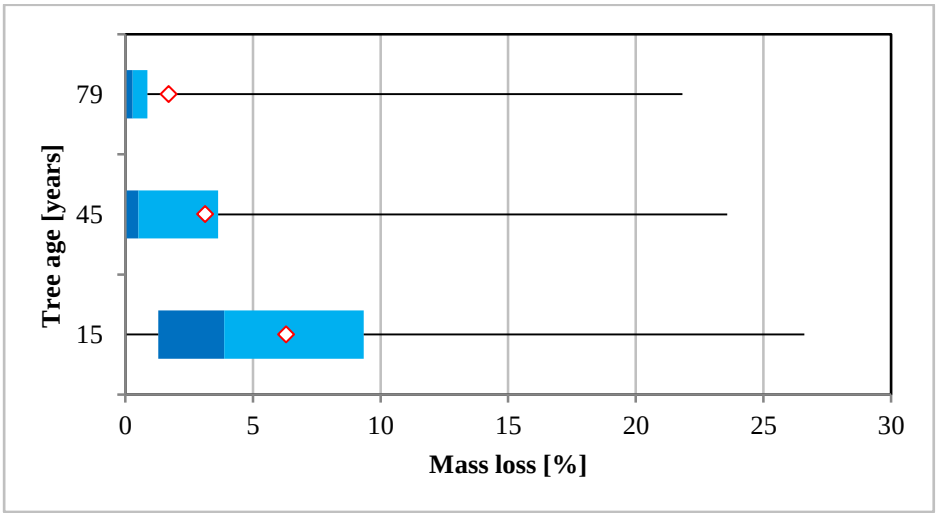
Figure 3: Sutter blocks cut from disks for fungal decay testing (left), SAG's president visiting Scion to check on the project's progress (right)

Three radial (bark to pith) strips were taken from disks: one for scanning with NIR spectrometer, one for archiving, and one spare that could be used for future testing. All blocks were scanned by NIR, prepped for incubation and weighed, one of three different fungi were introduced to each block, incubated for 16 weeks, and then reweighed.

First Results

Incubations have so far been completed for three sites; Collins (13 years), Mangatu (45 years), and Kineith (79 years) (Fig. 4). The heartwood had remarkable resistance to *Coniophora puteana* (brown rot) and *Gloeophyllum trabeum* (brown rot), even though brown rots generally decay wood faster than white rots. Heartwood blocks were more susceptible to *Trametes versicolor* (white rot) and the decay to these fungi will be used to evaluate natural durability. Figure 4 clearly shows that as redwood ages, the resistance to fungal attack decreases.

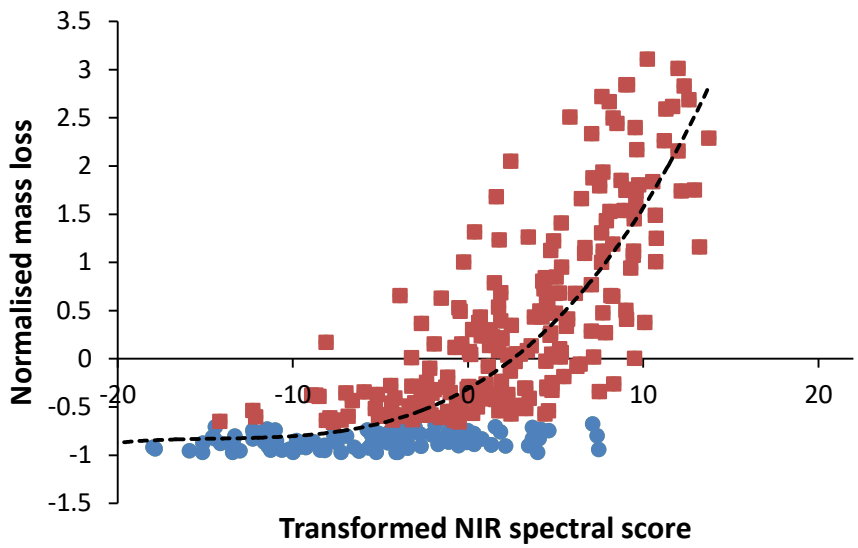
Figure 4: Mass loss of *S. sempervirens* in laboratory tests against *Trametes versicolor*. Diamond symbols show the average, horizontal boxes the median, 25th and 75th percentiles, and the horizontal lines extend to the minimum and maximum values.



The *T. versicolor* mass loss data was used to test if there was any correlation with the NIR spectra from each block for the young Collin's site. The Sutter block resistance to *T. versicolor* was statistically compared to its NIR spectra. The R^2 value was 0.79, which explained 66% of the variation (Fig. 5). This is very good considering this is only one site and the heartwood of these young trees are not yet fully developed throughout the tree.

The results clearly show there is a strong relationship with NIR spectra and its ability to resist fungal attack. This suggests that the NIR spectra does provide a measure of the chemicals in the wood that protect it from decay. More analysis needs to be done to determine if we can get as strong correlations with scanning the radial strip, which would be an equivalent of a wood core sample, so we can predict the overall quality of the heartwood throughout the tree.

Figure 5: Relationship between near infra-red transformed spectral score and normalised percentage mass loss for individual Sutter blocks after four months incubation with *Trametes versicolor* (white rot fungi) for heartwood from a 13-year-old stand (Collins). Blue circles are blocks with less than 2% mass loss, red squares are blocks with more than 2% mass loss.



Summary and Next Steps

Good progress has been made with the redwood natural durability project over the last year. The first results are very promising. The high resistance to fungal attack to all three fungal species appears to indicate that the chemicals required for natural durability are deposited into the heartwood at a young age. There was high correlation between individual blocks NIR spectra and mass loss from *T. versicolor* attack. This result is a strong indication that the methodology used is appropriate to answering the project's objectives.

The upcoming incubations and NIR scanning will provide valuable data on the influence on age, site, and provenances on natural durability. Statistical analysis will determine how well NIR can predict resistance to fungal decay and if a wood core at diameter at breast height (1.4m) can predict if a standing tree has high or low natural durability.

The 2016 Coast Redwood Science Symposium

The 2016 Coast redwood Science Symposium was held in the Sequoia Conference Centre, Eureka, California in September 2016. There were ~320 attendees from a wide range of disciplines – commercial forest entities, private forest owners, federal and state universities and research organisations, environmental ngos and indigenous tribes to name a few. The theme of this Symposium which is held every 5 years was 'Past Success and Future Directions'. For a somewhat overwhelmed Kiwi representing a small plantation resource on the other side of the world, the scale and complexity of the California industry was a real eye opener that really made it a worthwhile trip.

"With changes in California's demographic makeup, land ownership, and the regional economy, great interest has developed in areas such as forest sustainability and restoration, watershed assessment, fish and wildlife habitat conditions, and new silvicultural strategies. This symposium is part of a continuing effort to promote the development and communication of scientific findings to inform management and policy decisions."

Flying direct to San Francisco and jumping in my rental car and driving north for 6 hours seemed like a good idea at the time…..36 hours is a long time to be on the run so it was great to finally get my head down in the heart of the Sequoia range – Fort Bragg. Simon Rapley of the NZ Redwood Company kindly put me in touch with Bill Morrison, coastal district manager of Soper Wheeler estate. Bill was good enough to spend a day with me and we visited a swing yarder operation, discussed silviculture and inspected some genetic trials. Bill is very familiar with redwood industry in NZ, and we had some great discussions the differences across the other side of the pacific. Licence to operate in California is very restrictive, and becoming more so. What really opened my eyes was some of the similarities to NZ – labour shortages (much of the contract work is carried out by immigrants on work visas), competition for land (Cannabis farmers inflating land values much like the experiences here with the Manuka honey industry), expectations on forest owners to provide ecosystem services (biodiversity and particularly water quality) – and the challenges in gaining recognition/compensation for these. Environmentally I was astounded by the differences, especially in the southern parts of the range. When they say it doesn't rain in summer…..they mean it doesn't rain in summer! I left Fort Bragg with an inkling of the challenges corporate foresters face in CA, and headed north via the tourist trail, visiting beautiful old growth forests while trying to sample as much bbq'd tri-tip steak and craft beer as possible.

I was warmly welcomed to Eureka by Pascal Berrill – ex-pat Kiwi and Sequoia guru – now a Professor at Humbolt State University. My first night in Eureka I was fortunate enough to share a beer with Professor Bill Libby, Patron Saint of Redwood forestry in NZ as well as Jim Rydelius, another great influence in the early days of the sequoia renaissance in early 2000s. Denis Kelleher, owner of the large redwood estate near Aria, King Country also attended the conference. Denis had a box of random redwood offcuts from various mills – in NZ and CA. There were about 15 of each and the challenge was to identify the source of each numbered piece. It was a great exercise, there were a couple of old growth pieces which were giveaways, however many dusty old sawmillers were surprised to find very little difference between the 2nd and 3rd growth CA and domestic NZ wood samples. I think I got nearly 80% wrong! However I had enjoyed a couple of IPAs which may have skewed the results…..

Comparing samples of wood from NZ and CA while enjoying a fine IPA prior to the conference. Jim Rydelius, Bill Libby, SAG President and Denis Kelleher.

Around 70 papers were presented over the two days, with 2 concurrent sessions being held in each block. The depth of content was amazing, covering Growth, Fire Ecology, Watersheds & Aquatic Ecology, Genetics/Restoration, Silviculture, Wildlife/native plants/Habitat, Policy Economics, Community Forestry and Ecology! I presented a paper written with Dean Meason on the Rapid Assessment of NZ Coast Redwood Heartwood Durability using NIR Spectroscopy and another by Dean Meason and others from Scion on High Growth and Productivity of NZ growth Coast Redwood – Implications for Genetic Selection and Management. I soaked up as much as I could from all the speakers – and was in a much more relaxed frame of mind once I got my presentations completed. I will try to convey some of the more interesting points in an article for the TreeGrower Magazine.

The trip was made possible by funding from the NZIF Chavassse Travel award and support from NZ Forestry limited. It was great to be able to show off about our redwood plantation industry and give those in the US a little insight into the successes and challenges we have been dealing with. After the conference I was able to spend 5 days hiking (not tramping) in many of the national parks. I tracked down some ' off the beaten track' stands of very impressive specimens and then went on another not-really-well-thought-out drive across the state to Redwood national park where I met General Sherman and many of the other Giant sequoia before squeaking onto the plane back home with a few minutes to spare.

Top – While many of the smaller domestic mills have shut down, there is serious scale in those I could find. Bottom left shows a second growth stump with third growth coppice in an uneven age managed forest. Bottom right the remnants of old growth coast sequoia demonstrate the ecological services and carbon storage potential of the specie.

Collaborative Genotype (Clonal) Testing Programme

Further information on the 2016 Trial_ Wade Cornell

A survey was carried out in September 2009 of all the warm, dry, fog-less areas in California's natural range. Some otherwise inaccessible areas were accessed through Government (State and local), private, or institutional owners. Permission was obtained from all to collect from identified superior trees. In all seven counties and seed zones were collected from with some multiple sites within those zones.

Most of these areas have been at some point clear-felled (leaving an even aged stand of coppice) which allowed a good basis of comparison in terms of vigor. All aspects of these trees were assessed according to their environment in order to better judge the relative merits of each (e.g. south facing hillsides in hot dry areas are more prone to drying out so an exceptionally vigorous tree without an obvious source of extra moisture warrants attention). All trees were assessed on form as well as vigor and cored to observe relative density, wood colour, and confirm a good rate of growth.

Climbers were drafted from the Humboldt State University school of forestry under Pascal Berrill, who supervised them. Bill Libby was present to give opinions and assist in selecting trees. The collection started in late September and continued into October concentrating on areas with the ripest cones first. This generally coincided with starting at the Southern end of the range and heading north.

The collection was funded in part by a grant from the NZIF and US Department of Agriculture. In the USA they are somewhat concerned with the potential for global warming causing die-back in the natural redwood range due to less rain and possibly less fog. Unexplained die-back was already evident in some northern stands. This collection is unique in concentrating on redwoods that are not only surviving in hot low fog environments, but was specifically targeting the biggest and best trees thriving in those conditions. One could consider the USDA position to be a Noah's ark collection.

It should be obvious that warm fog-less conditions are a match for New Zealand with our high evapotranspiration rates of 6mm/ day in summer (note that Humboldt county evapotranspiration in redwood forests during summer is 0.5 mm/day). The potential benefit to New Zealand should be obvious, yet it takes a significant amount of time to test seedlings and find those that indeed best match New Zealand conditions as well as having all the right characteristics to enable fast growth and good returns from quality timber aimed at capturing the Western Red Cedar market.

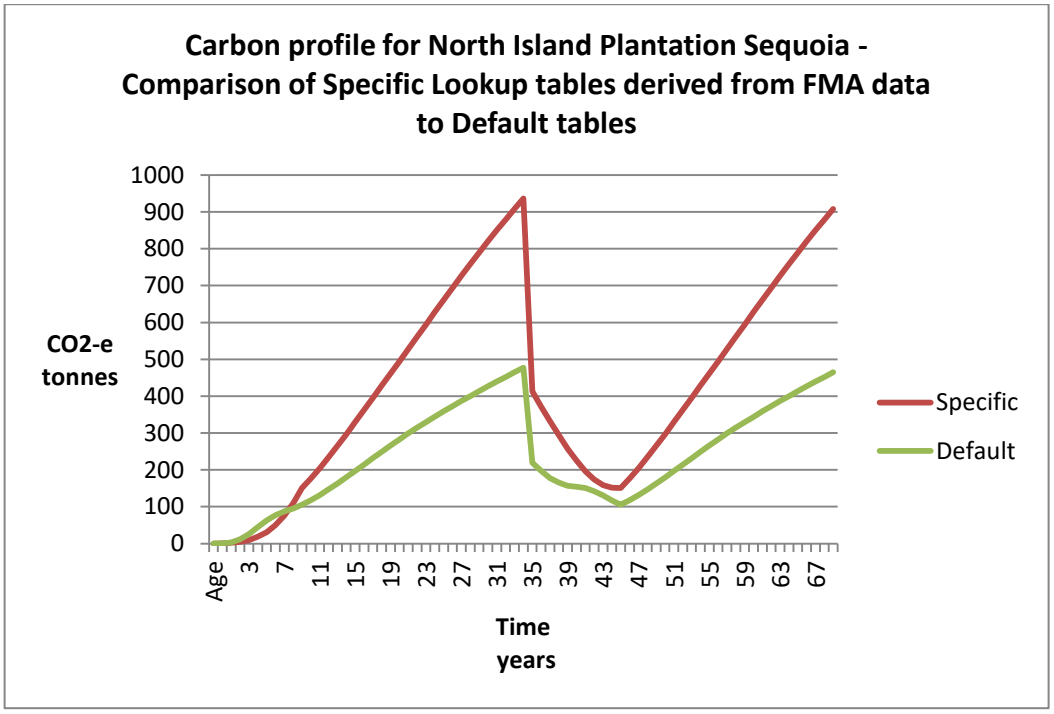
The seed collected in 2009 was imported to New Zealand in 2010. A collection was germinated and went into trials in the winter of 2012. Those seedlings were assessed in 2015 and cuttings taken form the top 2% to 5% based strictly on Growth and Form. Those cuttings were propagated and have this year gone out into secondary trials so that we can see which of those potential clones could be suitable for further testing and eventual deployment. The "mother trees", from which the clones were taken, will (in the meanwhile) grow on enabling the eventual testing of their wood properties (durability, stability, density, etc.). If we have a relatively inexpensive means of determining durability in the next three years then we will be able to make recommendations as to which of these clones may be suitable for specific areas of the country or some that may have general New Zealand-wide adaptation.

Domestic sawing of Sequoia_ Putaruru.

Images above show the sawing of domestic redwood by a woodmizer. Logs are broken down (conversions up to 70% achieved on larger diameter material) and air-dried on site. The majority of the wood is cut to spec and shipped to North America, destined to be manufactured for Park and Playground structures where naturally durable, non treated softwoods are required. Many of the logs sourced have not had any silvicultural tending, so there is a prevalence of Merch and Industrial material. Demand for material >35 years old is high.

Redwood in the ETS

Any participants in the NZ Emissions Trading scheme with redwood forest less than 100 hectares will be using the default lookup tables to calculate their annual carbon sequestration rates. Those with greater than 100 hectares have their very own tables built following the completion of a 'Field Measurement Approach' inventory once every 5 years. By necessity, redwood has been grouped with other 'minor' softwood species and the lookup table has been built to encompass these growing across all sites over NZ – therefore of course it is conservative. I have always felt disappointed at just how conservative it is, given the massive Stand Density Indices NZ grown redwood (ref: 2016 newsletter) and Total Standing Volume (ref: 2008 newsletter) the species is capable of. So once we received our very own lookup table for a 200ha forest growing in the Waikato I was eager to compare the two.



The graph above shows the quantum of difference – an increase of ~ 400T of Carbon per hectare at age 35 from the default lookup table to the specific table. In simple terms, at current price of $17/NZU, that represents ~$6,800 per hectare of value lost over a rotation for owners with less than 100ha, or 400T of carbon that is going unreported in our national carbon budget. Your president raised this issue in the latest round of the ETS review with MPI and it has been added to the long list of suggested revisions to the ETS rules. With the redwood estate being significantly larger now than it was back in 2008 it is hoped that the default softwood table could be modified into regions of low/medium/high productivity, or to split redwood out as its own species. If the Government is to walk the talk and get afforestation up from its current level of ~3,500ha[1] to the ~40,000ha/annum needed to satisfy our 2030 Emission Reduction targets – they should be hunting out every incentive available to help investors get their money out of the bank and trees into the ground.

[1] https://www.mpi.govt.nz/document-vault/5578