

Planting trials

The planting trial was located on a west Taupo farm at Waihaha, typical of steep pastoral land. The 4-ha site comprised a steep north facing hill side dominated by exotic pasture grasses.

Approximately 10,000 native seedlings were planted in separate trials across the three years, with each year of planting retired from grazing immediately before planting. Each trial was laid out as a Randomised Complete Block design with 6 replications. Survival and growth was assessed for up to 5 years after planting.



Planting trial 2 years after establishment as a Randomised Complete Block design comprising 12 tree rows comparing performance of 10 native species.

Regrowth of exotic grass and annual weed species was controlled up to three times per year for up to two years after planting using glyphosate applied by knapsack sprayer and thereafter the majority of plants had outgrown the possibility of being overtopped by rank grass and weed growth.

Survival and growth

Trials testing the range of native shrub and monocotyledon found that open-grown stock for most of species performed as well as seedlings of comparable size raised in PB3 containers. Growth of root trainer stock was in general slower than the other two seedling types.



Hebe planted in 2010 3 years old, PB3 left, open ground/bare root centre and root trainer right



Flax planted in 2010 now 3 years old, PB3 left, open ground/bare root centre and root trainer right.

Half the cost and effort!

Open grown seedlings were less than half the cost of those raised in the PB3 planter bags, but similar to that of the smaller Hillson root trainer seedlings. Seedlings raised in PB3 containers required four times as much space for storage and transport to the planting site and took up to four times longer to distribute and plant than open-grown seedlings. Results indicate an opportunity to reduce the cost of establishing native forest on hill country sites using large nursery-raised bare-root seedlings.

Estimated cost of open-ground stock at \$1.50 per plant is less than half that of standard nursery costs of PB3 stock at over \$3 each. Seedlings raised in Hillson root trainers are the lowest price from the nursery but are significantly smaller in root collar diameter and crown spread than seedlings raised either as open-ground or in PB3 containers.

A comparison of seedling cost from the nursery, transport capacity and maximum number of plants carried by a planter on the planting site for open-ground and container-grown plants of the native shrub hardwood and monocotyledon species commonly used in planting programmes. Estimates will vary due to size of seedling orders, distance to planting sites, access and site type.

	Open-ground	PB3 planter bag	Hillson root trainer
Nursery plant cost per seedling*	\$1.50	\$3.35	\$1.35
Storage and transport capacity (plants/m ²)	Max. 800 (2 layers of boxes)	120 (2 layers of trays)	720 (2 layers of baskets)
Maximum no. plants carried/planter	40-50 (depends on species)	12	48 (basket of 12 books)

Plant costs based on 2013 Taupo Native Plant Nursery catalogue for container stock (seedling orders 50+) and estimated cost for open-ground stock obtained from Philip Smith, Manager, Taupo Native Plant Nursery (pers. comm.).

Storage and transporting capacity for bare-root seedlings raised to about 50 cm height was similar to that of Hillson root trainer stock. Similarly, planters can carry 4-5 times the number of bare-root or root trainer stock compared with the larger PB3 stock.

Differences were observed in both ease of planting and time taken to plant between seedling stock types. Open-ground were the easiest to plant. PB3 containers and Hillson root trainers required extra time to extract seedlings from containers and recover plastic waste.

Take home message

Reducing the cost of nursery-raised seedlings of native species without compromising early growth and survival after planting is an essential requirement if the establishment of native forest by planting is to become more economically viable. The results in these trials indicate an opportunity to reduce the cost of establishing native forest on hill country sites using large nursery-raised seedlings of the hardy shrub hardwood and monocotyledon species required to provide the initial cover and shelter for inter-planting or encouraging natural regeneration of native trees.

Acknowledgements

Trials were undertaken in collaboration with community groups and councils in the North Auckland, Taupo and Rotorua regions including Mahurangi Action, North Auckland; Taupo Native Plant Nursery; Auckland Council; Waikato Regional Council; Bay of Plenty Regional Council; Scion; and Future Forests Research. There was substantial input from several individuals including nursery consultant Jaap van Dorsser, Cimino Cole of Mahurangi Magazine, Philip Smith manager



EDITORIAL

THE SHAMEFUL STORY ABOUT THE FUNDING OF INDIGENOUS FOREST RESEARCH

While government funding for research into establishing and managing native trees and forests has been at a low level for some time now, it has never-the-less played a vital role in keeping a focused programme going. However in the last government funding round, now administered by the Ministry of Business, Innovation and Employment (which doesn't appear to have any forestry people in its upper management levels), that funding was completely cut. Indigenous research is now solely funded by a small amount of core research money from Scion and may not be continued past the next few months.

It is extremely unfortunate that this situation, driven by the Government's desire to fund only work which offers immediate financial return, should have occurred at the very time indigenous forest research is poised for several major breakthroughs.

These include the work being done by David Bergin, Paul Quinlan and the Northern Totara Working Group on utilizing the potentially huge volume of totara which is regenerating on farms. There is also the recent work done by Greg Steward on kauri. Using his recently developed 'Kauri Calculator' he has determined that planted kauri has the potential to return \$530,679.00 per hectare after 80 years, a NPV of 8.84%. This compares very well with our major forest tree, the exotic Pinus radiata.

The returns from totara have not yet been as precisely calculated but are likely to be of the same order of magnitude as kauri because there are no establishment costs involved.

Either the Government or its advisors have not been informed of these pending opportunities or they are simply ignoring them.

2014 is election year and it would be great if supporters of Tane's Tree Trust used their contacts in government and other political parties, to get the message across that

New Handbook Articles:

Comparing container and open-ground native shrubs – nursery and planting trials

Two further articles have been published for the Tane's Tree Trust Technical Handbook based on the work and assessments of collaborative nursery and planting trials over the last five years in the Mahurangi catchment, North Auckland, and in the Taupo and Rotorua catchments. These are:

- 5.3 - Choice of nursery methods – container or open ground
- 5.4 - Establishment performance of native shrubs – a comparison of container and OG plants.

These articles explore the merits of the two plant production systems based on early work as well as recent fieldwork initiated by Mahurangi Action. Articles are available from Tane's Tree Trust.

Copies of these technical articles are now available from the TTT office, office@tanestrees.org.nz. Individual article copies cost \$5 for TTT members and \$10 per article for non-members. Copies of the complete TTT Technical Handbook are also available at \$35 for TTT members or \$55 for non-members. Postage and Packaging is \$4.00.



New Zealand-wide classification of outstanding seed-sources to upscale indigenous afforestation

TANE'S TREE TRUST is seeking information from its members, from Nurserymen and Bushmen about the location of stands of high performing native trees with the intention of including these in a nation-wide database for the purpose of developing high performing seed resource availability of our significant native tree species.



Figure 1 *Nothofagus truncata* - outstanding seed-source - Kahurangi NP (HJ Janssen)

Widespread community engagement in restoring use-value¹ of planted indigenous forests is achievable with cost-effective indigenous forest establishment and silviculture. Quality seed-sources are a pre-requisite.

High quality stands of useful native trees cannot easily be located in many of NZ's lowland and hill country environments, as original native forest-covered lands were burned, clear-felled and remnants high-graded ("the hidden disaster").



Figure 2 The 'hidden disaster': Typical high-grading leftovers in forest remnants (HJ Janssen)

The heavy overcutting of native forests in the past has meant most of the best trees were the first to be felled. What fragments remain of indigenous trees and stands in lowlands and hill-country are therefore often of inferior use potential and vitality and a contributing factor towards continuing indigenous biodiversity decline.

There is neither any information on the residual quality of trees and stands nor can stands or sites be compared with each other. Much of what is being planted now is probably of low genetic quality.

We need to identify the remaining high quality parent trees as future seed sources on both private and Conservation land, even though at this stage we cannot collect seed from DoC land.

Optimising planted native trees' timber value and multiple species' use-potential per unit area is the projects' goal, which is set to encourage many more farm-foresters to plant native trees for multiple purposes and thus achieve the desired up-scaling of tree-nursery output and native tree planting.

Lower numbers of better seedlings are less costly to establish and maintain and give earlier and improved returns long-term!

We are particularly interested to include in this inventory the seed-sources for native tree nurseries² and any outstanding examples of *puriri*; *rewarewa*; *tawa*; *taraire*; *titoki*; *tawari*; *mangeao*; *hinau*; *black maire*; *kohekohe*; *kowhai*; *akeake*; *rata*; *the beeches*; *tanekaha*; *kauri*; *totara*; *rimu*; *kahikatea*; *miro* and *matai*.

Please email Mel office@tanestrees.org.nz with your description of sites (name / latitude / longitude) of outstanding native trees that ought to be part of this nation-wide quality seed-source inventory.

Regarding any further information on sites or stands, proposed project involvement and to cc site descriptions please contact HJ Janssen resourceinfo.mgmt@gmail.com

FOOTNOTES

¹ Here use-value primarily refers to the resource needs of people and NZ communities and relates to re-established forest. Use-value comprises for example rongoa and cultural resource needs; it includes yields of naturally durable and structurally sound posts (from 20 years) and timbers (from 40 years), covering useful physical and mechanical properties of strength, toughness, stability, elasticity, good steam-bending / machining / drying properties, high moduli of rupture and elasticity and last but not least good firewood and soil-conditioning properties (enhanced soil-(carbon) storage and exchange capacities for water and nutrients), thus minimising loss of nutrients, risks of flooding and erosion.

Re-establishing use-value from indigenous forest plantings augments kaitiakitanga and can halt biodiversity decline. It is set to reverse current dependency on the import of quality timbers from unsustainable foreign sources.

² Confidentiality is important to us. The providers of information on hitherto used-, and potential quality seed-sources and sites are kept confidential. Tree-nurseries and other people sharing knowledge on existing seed-sources will be invited to join an interest-group to share project generated information well ahead of anticipated publication of results 3 years from day this project is funded to commence.

TAUPO TRIALS DEMONSTRATE MAJOR REDUCTION IN COST OF ESTABLISHING NATIVE FOREST

David Bergin and Michael Bergin

With funding from the Lake Taupo Protection Trust, nursery and field trials established by Tane's Tree Trust within the Lake Taupo catchment over the last 5 years has demonstrated that the cost of establishing native forest can be half that of many revegetation programmes. Nursery and planting trials comparing the cost and growth performance of open-nursery bed (open ground or bare-rooted) seedlings versus container-raised seedlings established on a hill country site at Waihaha, west of Taupo.

These trials in the Taupo catchment are part of a number of projects undertaken by Tane's Tree Trust in collaboration with community groups and councils in the North Auckland, Taupo and Rotorua regions aimed at reducing the cost of raising and planting natives for large-scale revegetation programmes.

Opportunity for hill country

A considerable proportion of less productive pastoral land in New Zealand, particularly riparian and marginal steep hill country, could be converted into native tree species which would improve environmental outcomes including options for sustainable timber production and carbon sequestration in the longer term. However, a major hindrance to establishing such forests is the cost of native seedlings compared with seedlings of comparable exotic species.

The most common method of establishment of native forest, excluding natural regeneration, is planting nursery-raised seedlings with virtually all seedlings produced by nurseries in containers. The high cost of containerised nursery-raised seedlings and the often uneven quality of nursery-raised plants irrespective of raising method can be significant impediments to large-scale restoration of native forest cover on marginal land.

Container vs bare-root seedlings

Bare-root technology for natives is not new! Techniques for large-scale low-cost production of bare-root native trees and shrubs were developed at the Forest Research Institute from the 1960s based on methods used for radiata pine. The open-ground method involves highly-mechanised production systems to raise and condition bare-root seedlings in readiness for planting. In spite of this, few native plant nurseries have adopted open-ground techniques for native plants. This is largely due to the piecemeal approach and lack of planning associated with most native revegetation programmes.

Container-grown plants are easier to handle in small numbers and are the option favoured by large and small nurseries raising native trees and shrubs. A wide range of containers is available, and there is often debate about the suitability of root trainers, polythene planter bags or plastic pots for different species and planting programmes. Variation in type and size of containers means that costs are also variable.

There is also continuing concern about the quality of planting stock of native trees and shrubs, especially the condition of root systems of container-grown plants. In short, native plant nurseries are forced to produce relatively small numbers of a wide range of species in containers, thus providing greater flexibility awaiting uplift of orders, albeit at a high cost per seedling.

Taupo trials lead the way

The Taupo trials were the first comprehensive trials aimed at comparing the economics and field performance of native species for establishing native forest. The initial focus of these trials was on a range of hardy native shrub and monocotyledon species commonly used in revegetation programmes in New Zealand. The aim was to compare relative cost of nursery-raised open-ground versus container-grown seedlings of selected native shrub hardwood and monocotyledon species; differences in storage, handling and planting of the different nursery stock types; and early survival and growth on a steep hill country site.

Species and nursery trials

Establishing a nurse of a range of native shrub hardwood and monocotyledon species have the advantage of providing rapid canopy cover to control regrowth of exotic weed species and to allow the slower growing planted or naturally regenerating later successional native tree species to emerge within their shelter, especially on exposed hill country sites. Ten species were raised in the nursery for planting including the shrub hardwoods karamu, koromiko, manuka, kanuka, Coprosma propinqua, kohuhu and rautawhiri and the monocots harakeke and toe toe.

Seedlings of shrub hardwood and monocotyledon species were raised within one year in the Taupo Native Plant Nursery in containers and as open-ground transplants using standard methods.



Open grown seedlings in nursery beds showing kanuka (left), toetoe (centre) and hebe (right) at Taupo Native Plant Nursery, Taupo.



Figure 1: Toetoe (top), manuka (middle) and karamu (lower) plants raised for nine months in the larger PB3 containers or equivalent size plastic containers (left); in open nursery beds (centre); and in smaller Hillson root trainers (right).