# ENVIRONMENT & SOCIAL TECHNICAL NOTE

Number: ESTN-017
Date: January 2013

# Functional Forests within New Zealand – Which Species Should We Plant?


## Summary

Future forests will not necessarily be valued just for their productivity or quality of wood, but for their ability to deliver a range of functions that makes them highly valuable for society and the maintenance of a sustainable landscape. How such forests will deliver these functions, what tree species will be able to support such functions, and how we can test these values needs to be based on experiments and trials that are mostly non-existent in New Zealand at present.

The most important environmental services which forests deliver for many stakeholder groups in NZ have already been identified through surveys and workshops during 2009/2010 [1]. Scion will establish at least four new trials planted with a variety of species to demonstrate a range of products and services, for example timber, carbon sequestration, biodiversity and erosion prevention.

An initial range of 22 tree species was narrowed through two Scion workshops. Species included were representative of those in the REINFFORCE[1] programme of the EU and will allow us to link both programmes. These 22 tree species were further narrowed with the aid of a survey of 188 landowners and land managers.

The results of the survey have been useful in aiding the selection of species for future trials. The species selection will be finalised by overlaying survey preferences with suitability based on their natural distribution (environmental envelope).


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## Overview

Scion proposes new trials planted with multiple species to assess the important environmental values and services that forests provide. We also intend to use these trials for a range of important studies in the future, primarily in determining forest adaptation to climate effects, but also in studying ecology, growth and yield, and ecosystem services. Species for inclusion will provide environmental functions such as:

- improved biodiversity or biodiversity maintenance;
- efficient bio-energy production, resource use and long term carbon storage options;
- soil and water protection, conservation and recreational amenities in the different environments in which they are likely to be required in the future.

Primarily we will compare the resilience of selected tree species to changes in climate and their performance in providing ecosystem services.

## To aid in species selection, we conducted a survey…

188 landowners responded to our June 2011 online survey. Respondents were sourced primarily through the branch membership of the NZFFA, as well as employees from Regional councils, DOC and members of the Wilding Conifer Working Group. Three-quarters of respondents were landowners, and 52% of those had planting areas between 5 and 50 ha.

[1] *REsource INFrastructures for monitoring, adapting and protecting european atlantic FORests under Changing climatE* -A network that monitors Atlantic forests' adaptation to climate change.



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## Reasons for Planting Trees:

The main reasons for planting trees were economic, value maintenance and conservation purposes (Figure 1). The least preferred reasons for planting were to enable access to markets or to mitigate climate change impacts. When selecting trees, 80% of participants were aiming for high quality timber, followed by an ability to supply multiple products and conservation/biodiversity values. Carbon sequestration was of least importance.

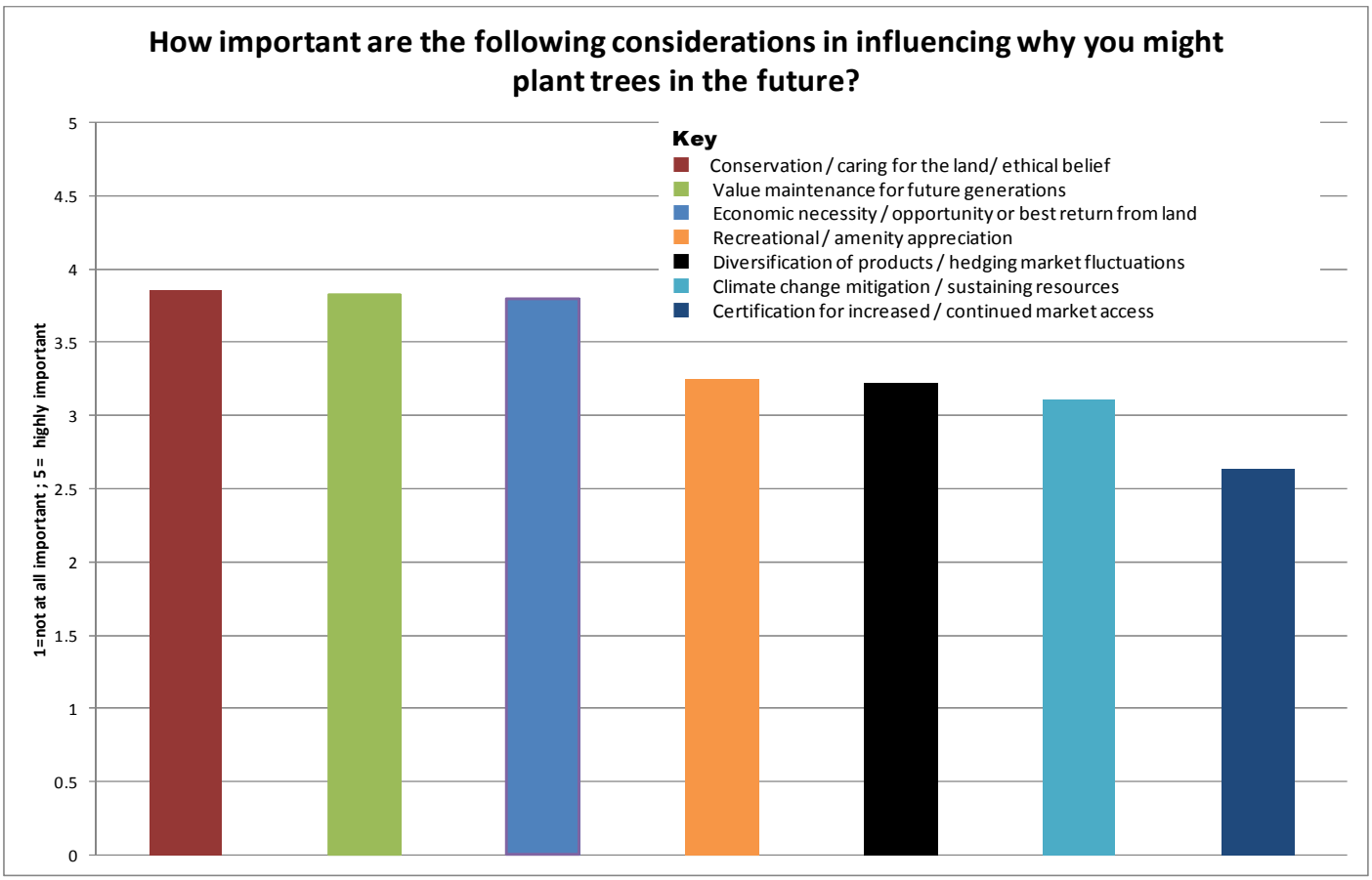


**Figure 1: Purpose of tree planting, based on mean importance**

Drought tolerance is seen as very important for carbon forestry species. Disease resistance and frost tolerance were important across all forest functions. It is expected (and maybe feared) that growing trees for bioenergy will have the greatest demand on soil nutrients and a low expectation to obtain high quality timber from these crops.

## Impacts of Climate Change:

The greatest threat predicted from climate change is wind damage, followed by drought (Figure 2, overleaf).

Participants appear to be least informed of the risk from changes in plant disease occurrence. Changes in temperature are perceived as a low risk to our temperate forests.

Natives> pines> eucalypts reflects the order of perceived resilience across the climate change risks identified. Eucalypts and pines were seen as most resilient to temperature extremes – eucalypts specifically to drought. However, eucalypts are not seen as resilient to disease. Natives are seen as resilient to wind damage and pines to competition from understory weed growth.



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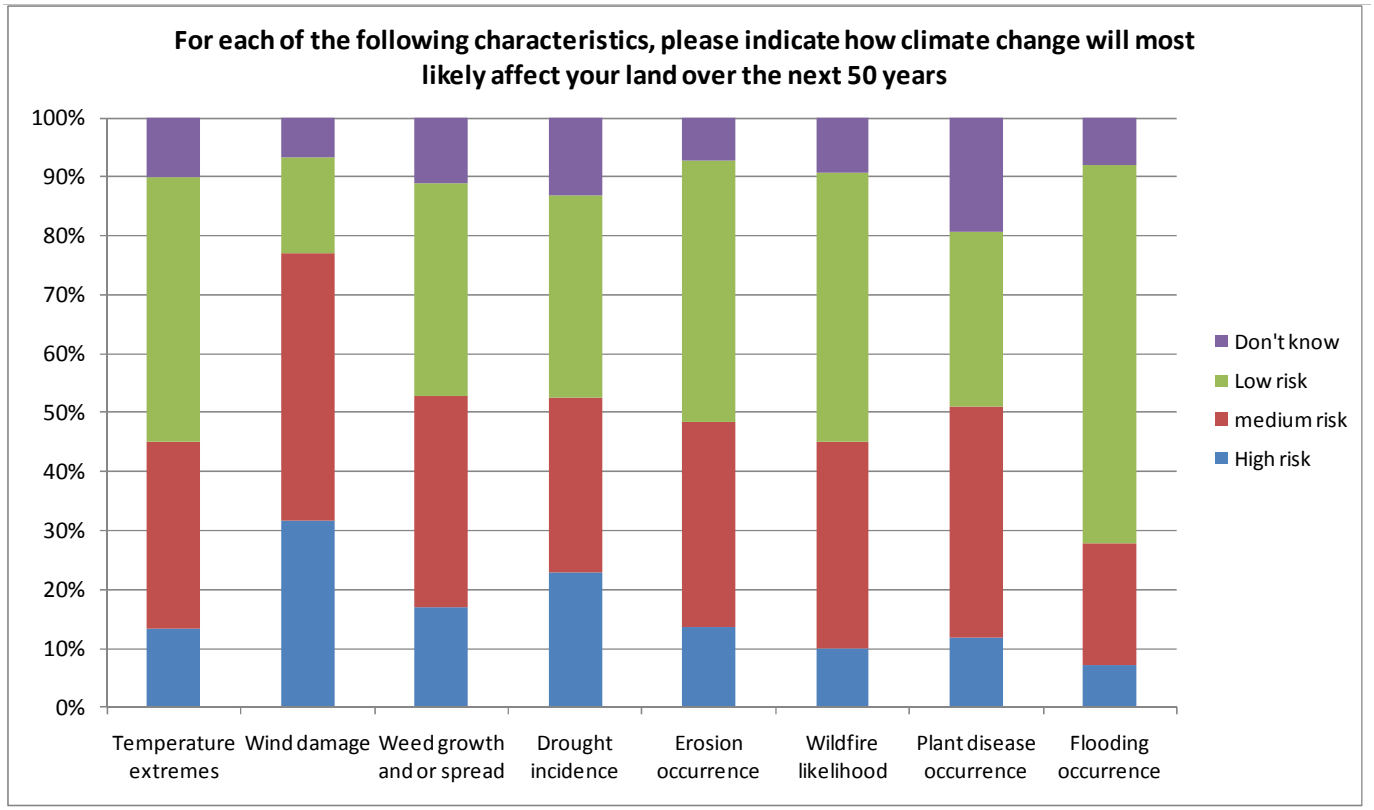


**Figure 2: Survey responses of the predicted affects of climate change on forest land over the next 50 years**

## Tree Attributes and Species Preference

The survey sought respondents' views on which species they would plant to provide one of seven environmental functions:

- stabilising erosion-prone slopes;
- protecting water yield/ quality;
- aiming for timber productivity;
- enhancing biodiversity;
- creating recreational space and amenity;
- producing bioenergy crops; and
- fixing carbon.

The most popular species choices for each function are recorded in Table 1 (overleaf).

## Recommended Species for these Trials

A provisional list of the six species which could provide Scion with unique methods of monitoring forest functions are to be planted in four locations in Spring 2013.

Provisional species to be planted:

- **Coastal redwood** (*Sequoia sempervirens*)
- **Brown Barrel** (*Eucalyptus fastigata*)
- **Ash** (*Fraxinus excelsior*)
- **Red Beech** (*Nothofagus fusca*)
- **Totara** (*Podocarpus totara*)
- *Cypressus arvensii* (*lusitanica* x *nootkatensis*)

The locations (provisional at this stage) are:

- Hawke's Bay
- Northland
- Masterton
- Waipori, Dunedin

A further four species are to be planted in sites where these species have already shown good performance in providing certain services but are seen as not suitable for the wider range of environments:


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- **Oak** (*Quercus robur*) for dry sites
- **Poplar** (*Populus* spp.) for eroded sites
- **Kauri** (*Agathis australis*) in Northland
- **High country pine** (*Pinus cedrus x attenuata*) for high country

Planning and preparation is currently under way to establish and monitor these sites.

Trial setup will incorporate an initial measurement of environmental variables and soil properties, describing the site before trees are planted. The list of measurements required for the initial assessment still needs to be finalised, but will likely include a range of soil physical, soil chemical and biological properties. Monitoring of climate data and trees will occur throughout the trial.

## Forest Management Implications

Support to plant a range of species for specific forest functions and attributes is shown by the survey responses. Previously, the major considerations for planting species were "the right tree for the right place". Now ideology is moving towards the view that it's "the right tree in the right place for the right reasons".

## Acknowledgements

Scion on behalf of Future Forests Research Ltd thanks all those who responded to our recent survey. Your contributions have helped in the selection of species for this trial series, and the time taken to respond and capture your experience is therefore much appreciated. We also wish to thank Landcorp for providing trial sites for this work.

**Table 1: Respondents' collated view of preferred tree species to obtain certain tree functions**

| | Pines and cypresses | Exotic conifers | Deciduous | Eucalypts | Natives | Preferred species for this function |
|---|---|---|---|---|---|---|
| **Stabilising Erosion prone sites** | 21% | 12% | 46% | 7% | 14% | Radiata pine; Poplar; Willow; Coastal redwood; Kanuka |
| **Growing for bioenergy** | 13% | 0% | 23% | 62% | 2% | Poplar; Willow; *E.fastigata; E.nitens* |
| **Conserving water yield #** | 7% | 5% | 16% | 5% | 67% | Redwoods; Poplar; Willow; Beech; Totara; Kanuka |
| **Protecting water quality #** | 7% | 5% | 16% | 5% | 67% | Willows; Monocots |
| **Fixing carbon ##** | 7% | 33% | 4% | 26% | 30% | Coastal redwood; *E.fastigata; E.regnans;* Totara |
| **Enhancing biodiversity** | 1% | 5% | 11% | 4% | 79% | Beech; Totara; Kanuka; Mixed species planting |
| **Creating amenity planting ###** | 2% | 6% | 39% | 8% | 45% | Oak; Cherry; Poplar; Mixed native bush |
| **Timber productivity ####** | 69% | 12% | 2% | 15% | 2% | *C.Lusitanica*; Leyland Cypress; Radiata pine; Coastal redwood |

***# this was asked as "reducing negative impacts on water systems"***

***## 6% wanted E.regnans***

***### 31% wanted a mixed range deciduous; 33% wanted mixture of other natives***

***#### 12% wanted cypress hybrids***

## Reference

1. Hock, BK & Clinton, PW, 2012: Determining Priorities for Sustainability Research on New Zealand Forestry. FFR Environment and Social Technical Report Ref: FFR-ES-012.



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