

# Project Summary: Poplar & Willow Breeding Programme

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## Contact details

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## Project details

**Status:** In progress

**HCEF funding:** \$653,300

**Total project funding:** \$1,275,600

**Proposed start date:** 2008/09

**Proposed finish date:** 2011/12

**Region:** National

## Project description

The New Zealand Poplar and Willow Research Programme is committed to the continuous development and commercial release of new versatile poplar and willow cultivars, supported by the scientific knowledge required for their successful utilisation.

The goal of New Zealand's poplar and willow breeding programme is to use interspecific hybridisation and clonal selection to develop robust willow and poplar genetic material suitable for protecting erosion prone soils particularly on pastoral hill country slopes. Ancillary uses of this material include shelter, fodder, timber, bio energy and bioremediation.

## **The issue/opportunity**

Domestication of poplars and willows internationally has been a process of interspecific hybridisation and clonal selection. It is the hybrids that have given poplars their prominence, and it is safe to say that they will be the mainstay of both poplar and willow culture in the future. Crossability among many of the species is high, vegetative propagation is easy, and juvenile growth is rapid. These are all sound reasons for continuing to develop these species for specific uses in the New Zealand landscape.

There are three key objectives of the Poplar and Willow Breeding programme.

1. Maintaining and enhancing the poplar and willow genetic stock
2. Breeding new varieties
3. Technology transfer to Regional Councils and farmers.

## **The context/background**

New Zealand's primary wealth is dependent on fertile land and plentiful, clean water. Water, in appropriate quantities, is essential to New Zealand's productive economy. Yet, in excess, its destructive power through soil erosion and floods can cause massive economic loss and social upheaval.

Minimising pastoral hill country erosion and maintaining river protection requires constant management, and is a key responsibility of Regional Councils.

Poplars and willows have been the most widely used trees for planting in these unstable situations for a number of reasons. They establish readily from poles and cuttings in difficult environments and in the presence of domestic stock on grazing land. New clones with superior characteristics such as improved disease resistance can be multiplied rapidly by hardwood cuttings in local authority and private nurseries and by individual farmers. Their extensive and unique root networks anchor unstable soils on slopes, thereby reducing the impacts of water movement on valuable productive land. Their high evapotranspiration rates during the growing season ease management problems in wet areas. Willows and many poplars are tolerant of flooding and periodically saturated soils. Their early growth rate is superior to all cool temperate trees with the exception of some Eucalyptus species. They are deciduous allowing pasture to be retained under the canopies while the foliage provides high quality herbage.

Poplars and willows are vital components of hillside erosion management systems, and willows are a vital component of bank protection for exposed waterways on pastoral land. These management systems must be extremely flexible, dynamic and resilient in order to respond to changing land use, changing climate and the arrival of new pests and diseases. In particular the conservation and protection values of the poplar and willow trees are at risk from diseases such as rusts and pests such as willow sawfly, which has no natural controls in New Zealand.

Because of their key role in land and waterway protection, our poplars and willows require an ongoing programme in breeding and research to provide the strategies required to retain adaptability

and to minimise vulnerability to new diseases and climate conditions. New Zealand has benefited substantially from the international network of poplar and willow scientists that constitute the International Poplar Commission (IPC), a technical body of the FAO, to which New Zealand is a signatory.

The key stakeholders in this programme are Regional and Unitary Councils, plus the pastoral, dairying and horticulture industries. They provide technology-transfer pathways and contribute to the overall research direction. Close working relationships exist between the researchers and two pan-Regional Council groupings that have been co-funding aspects of the research in these areas: the River Managers Group (2000-03), and the Willow and Poplar Research Collective (since 1993). MAF has funded aspects of the applied research through its SFF programme.

## Methods

The activities listed would be initiated and progressed over the 4-year period to 2012. Some activities necessarily follow earlier activities. Any activities initiated during this 4-year module would be developed through subsequent stages. Some imported pollen will be needed for the proposed poplar breeding programme, otherwise all genetic material is held in the germplasm collections in New Zealand.

### Poplars

1. Breed new hybrid poplars for use in soil stabilisation and with enhanced wood production, disease resistance and stool management properties.
2. Incorporate *P. trichocarpa* into the breeding programme using resident clones and imported pollen to utilise its faster growing capacity, rougher bark, timber and resin producing properties to provide more diversity and utility.
3. Establish spacing and management protocols for plantings in conjunction with FRST programme SLURI.
4. Release trialled clones to Regional Councils for soil stabilisation and shelterbelt application. (1993 *P. maxi-nigra* series, 1998 *P. maxi-nigra* x *P. nigra*, *P. deltoides* × *trichocarpa* 82-171-6, three *P. deltoides* x *ciliata* clones).
5. Conduct and report on experiments and trials that inform performance of poplars in field situations particularly root attributes.

### Willows

1. Using selected parents (inc. *S. lasiandra*), breed, develop and field trial new selections of hybrid tree willow clones to extend genetic diversity, extend leaf retention and improve resistance to willow sawfly
2. Advance recent crosses to the selection and trial stage.
3. Release new and improved tree willow selections to Regional Councils for effectiveness trials in soil stabilisation and other purposes.

4. Conduct and report on experiments and trials that inform performance of willows in field situations.

## **Project update: December 2009**

The New Zealand Poplar and Willow Research governance group met in September and in December 2009. A strategic framework document was developed by the trustees to define the scope of the programme and how it connects to the various end-users.

Several interspecific experimental tree willow crosses were made in September from clones held in the Aokautere germplasm collection. Fertile seed yield was lower than expected. The seedlings have been transplanted into root trainers for growing on.

Plant material was sent to Environment Bay of Plenty for testing (*Salix lasiandra* willow), and to Taranaki Regional Council and ECAN for bulking up (poplar). Three field-trialled *Populus deltoides* x *P. ciliata* clones NZ5025, NZ5026 and NZ5027, identified as being suitable for commercial use, are being bulked up at Taranaki Regional Council and Aokautere nurseries.

*Populus maximowiczii* x *P. nigra* clones scheduled for commercial release by 2012 are being bulked up at Environment Canterbury, Hawke's Bay, Greater Wellington and Taranaki Regional Council nurseries and at Aokautere nursery.

An article "Rust disease of poplar and willow" was published in NZ Tree Grower Vol. 30 (4), 29-30. Requests are being put out via the next issue of the magazine to readers of NZ Tree Grower to send in samples of rust-infested poplar and willow leaves. It is anticipated that this will provide more widespread data than were gathered in the initial survey of regional council nurseries.

Two small field trials of six experimental *S. lasiandra* willow clones and four poplar clones were established in Central Hawke's Bay in October 2009.

Field experiments investigating the effect of 1) seasonality on fine root:coarse root biomass and length in 'Veronese' poplar at Ballantrae farm, and 2) pollarding as a management tool on fine root:coarse root biomass and length, are continuing. Field experiments investigating root development over three years in a range of commercial poplar and tree willow clones were set up in August 2009. These will continue through until winter 2012. Root growth will be measured after one, two and three growing seasons. This is a collaboration with the SLURI research programme.

A funding proposal "Effectiveness of young conservation poplar and willow trees in erosion control: when?" was submitted to MAF SFF 2010 programme in October 2009 with support from EW, GDC, HBRC, farmer groups FF and MWI and individual farmers in these regions.

Ian McIvor presented an invited poster, paper and a field demonstration on shrub willow root development at the International Energy Agency (IEA) Task 30 Conference "Linking Technology and Biomass", held in Taupo, 1-4 December 2009.

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## **Project update: June 2009**

The project is progressing well. The New Zealand Poplar and Willow Research Trust has been formed, six Trustees have been appointed, the Trust Deed is close to being finalized, a draft business plan for the project has been completed which will be submitted to the next meeting for the Trust in September 2009 for confirmation. A research plan was presented to the Technical Advisory Group (comprising Willow and Poplar Research Collective members) and approved for the next financial year.

New hybrid poplar (N=720) and willow (N=320) experimental seedlings bred in 2007 were transferred from root trainers into open ground in October 2008, and were assessed for rust resistance in February 2009.

Three field-trialled *Populus deltoides* x *P. ciliata* clones NZ5025, NZ5026 and NZ5027 have been identified as suitable for commercial use. Propagating material was collected and stored for bulking up during winter 2009.

A national assessment of the status of rust species was initiated in January 2009 to determine:

1. if any new species have arrived in New Zealand;
2. whether further hybridisation has occurred between known rust species;
3. the relative frequency of the different species.

Spores from samples of rust infected leaves of different commercial poplar clones sourced from poplar pole nurseries in Gisborne, Hawke's Bay, Manawatu, Wairarapa and Taranaki, were photographed using scanning electron microscopy (SEM). All rust samples were identified as belonging to *Melampsora larici-populina* the rust species that arrived in the country in 1973.

A scientific paper entitled "Survival and growth to age 8 of four *Populus maximowiczii* × *P. nigra* clones in field trials on pastoral hill slopes in six climatic zones of New Zealand" (authors I R McIvor, S Hurst and L Fung) was submitted for peer review to NZ Journal of Forestry Science in March 2009.

### **Contact for Enquiries**

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