Yass Area
Network of
Landcare
Groups

Climate-Ready Revegetation in the Yass Area Network Landcare Region

In a nutshell

A new project aims to help indigenous plant species persist under climate change by increasing local genetic diversity. The project has five parts:

1. Understanding our changing climate.
2. Identifying which local species are most likely to survive future climate conditions.
3. Sourcing seed for these species from other regions, including where current climate matches expected future conditions in our region. By increasing genetic diversity in this way, we hope to help local species adapt to future changes.
4. Adopting this seed-sourcing practice in our local Landcare nurseries and revegetation efforts.
5. Running experimental trials to examine the short-term success of plants in the field.

For example, our research has shown that Dean's Wattle (*Acacia deanii*) grows well in areas that are hotter and drier than the current climate for the Yass region. By bringing seeds from other areas, we hope to establish local populations with greater genetic diversity that will develop more resistance to heat and drought. This species is being monitored in the trials.

Why conduct this project?

The global climate is changing rapidly due to increased levels of greenhouse gases that are heating the planet. Established weather patterns are becoming more variable and we are experiencing more climatic extremes. For instance, in south-east Australia the frequency and severity of summer heat waves are increasing, and our annual rainfall patterns are changing.

These changing conditions threaten the survival of many plant species that have evolved during a relative stable climatic period. However, greater genetic diversity is likely to enable plants to adapt as temperatures rise and rainfall becomes more variable and extreme.

Wanting to make a positive difference in our local area, a small group of volunteers from the Yass Area Network of Landcare groups (YAN) started the Climate-ready Revegetation Project in collaboration with Macquarie University and the NSW Government. The project aims to assist the long-term survival of native plants in the Yass Valley region under changing climatic conditions. It closely follows the methods outlined in the 'Climate-ready Revegetation Guide'[1], produced by a team of scientists from Australian research institutions. The core premise in the work is that "survival and resilience will be enhanced for species and local populations with large, genetically diverse populations".

---

[1] Hancock, N., Harris, R., Broadhurst, L. and Hughes, L. 2018. *Climate-ready revegetation. A guide for natural resource managers*. Version 2. Macquarie University, Sydney. Accessible from: https://www.anpc.asn.au/climate-ready-revegetation/

What is involved?

There are five main parts to the Climate-Ready Revegetation Project:

1. Understanding the Yass climate

Before considering which plant species to focus on, the first step in the project was to understand the current and projected climate in the Yass region. We drew on data from the Bureau of Meteorology to understand the current climate profile of the Yass region, and data from the NSW and ACT Regional Climate Modelling (NARCliM) Project to understand how this profile is expected to change by 2030 and 2070.[2] While it is impossible to be 100% certain about how local areas will experience climate change, the climate projection models provide a solid guide as to what is likely to occur.

By 2070, the Yass area is projected to be about 2.5°C hotter compared to the current average annual temperature, though there is a possibility that it could be even hotter than that.[3] This projected increase is likely to be similar to the current average annual temperature of places like Young and Forbes, located to the north-west of Yass.[4] The temperature of the hottest season in the Yass area is very likely to be higher than current summer averages.

Annual rainfall projections in the Yass area are less certain, with the possibility of either more, or less rainfall. However, there is likely to be a change in the distribution of rain over the year. It is expected that winter and spring rain will decrease, and summer and autumn rain will increase.[5] Combined with increased temperatures throughout the year, soil moisture is likely to vary from current levels in different seasons.

With an understanding of what the climate of the Yass area is projected to look like, it is possible to use this information to identify plant species that are more likely to survive in those conditions.

2. Identifying species likely to be tolerant of climate change

Through a rigorous process, the project identified local native plant species that are likely to tolerate projected climate changes in the Yass region.

We started by examining 80 local native plant species that are already grown by YAN Landcare nurseries. Maps of the current distribution of these species were accessed from the website NicheFinder, along with graphs that showed the temperature and rainfall range of where the plants naturally occur, known as 'climate envelope graphs'. These climate envelope graphs were overlaid with the projected temperatures and rainfall for the Yass region in 2070, to identify which species are most likely to tolerate climate change.

The lists below show the 'likely tolerance' of the selected species to projected climate change in the Yass region using this method.

---

[2]   https://climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/About-NARCliM, data obtained by Isobel Cummings and Polly Mitchell from the NSW Department of Primary Industry and Environment (DPIE) in 2019.

[3]   AdaptNSW. 2014. *South East and Tablelands Climate change snapshot*. NSW Office of Environment and Heritage, Sydney. Accessible from: https://climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/Climate-projections-for-your-region/South-East-and-Tablelands-Climate-Change-Downloads; Duus, S., Goodfellow, E., Hall, G., McGuirk, K., & McIntyre, S. Pending. *Climate-Ready Revegetation in the Yass Area Network Landcare Region*.

[4]   Based on RCP 8.5 and on 'maximum consensus' in 2050 and 2090, searchable in; Climate Change in Australia, Climate information, projections, tools and data: https://www.climatechangeinaustralia.gov.au/en/projections-tools/climate-analogues/analogues-explorer/

[5]   AdaptNSW. 2014.

3. Sourcing seed

The next step was to identify appropriate 'provenance sites' from which to source seed for those species that we determined are likely to tolerate projected climate change. We did this by again examining the species distribution maps. When selecting sites, we considered

• the general distribution of the species,

• the outer bounds of the species' climate envelopes (the hottest, coldest, driest, and wettest areas), and

• areas with *current* climate that is within the range of the *projected* climate of the Yass region.

At the end of this process, we had a list of multiple seed provenance sites from which we hope to source seed for our Landcare nurseries. The resulting plants will be grown in the Yass area, increasing the genetic diversity of those species and thereby hopefully increasing the species' resilience as the climate becomes more variable and extreme.

'Admixture' Provenance Strategy

There are different approaches that can be used to increase the diversity of genetics in local plant populations. These approaches are referred to as "provenance strategies" for revegetation. For this project we took the 'Admixture' approach, which sources seed from a wide variety of provenances to build evolutionary resilience. This approach is suitable when environmental change is expected but when there is high uncertainty about the rate and scale of change (Hancock et al, p.12).

---

4. Developing nursery practices

The project involves incorporating climate-ready strategies into YAN's four native plant nurseries. The nursery managers recognise the importance of good record keeping and nursery procedures to be able to identify plants from various seed stock, especially because the climate ready work is still in its experimental phase. Detailed records will be maintained in each nursery to record sowing and germination information on seed from other regions. The resulting plants will be routinely used in Landcare revegetation activities.
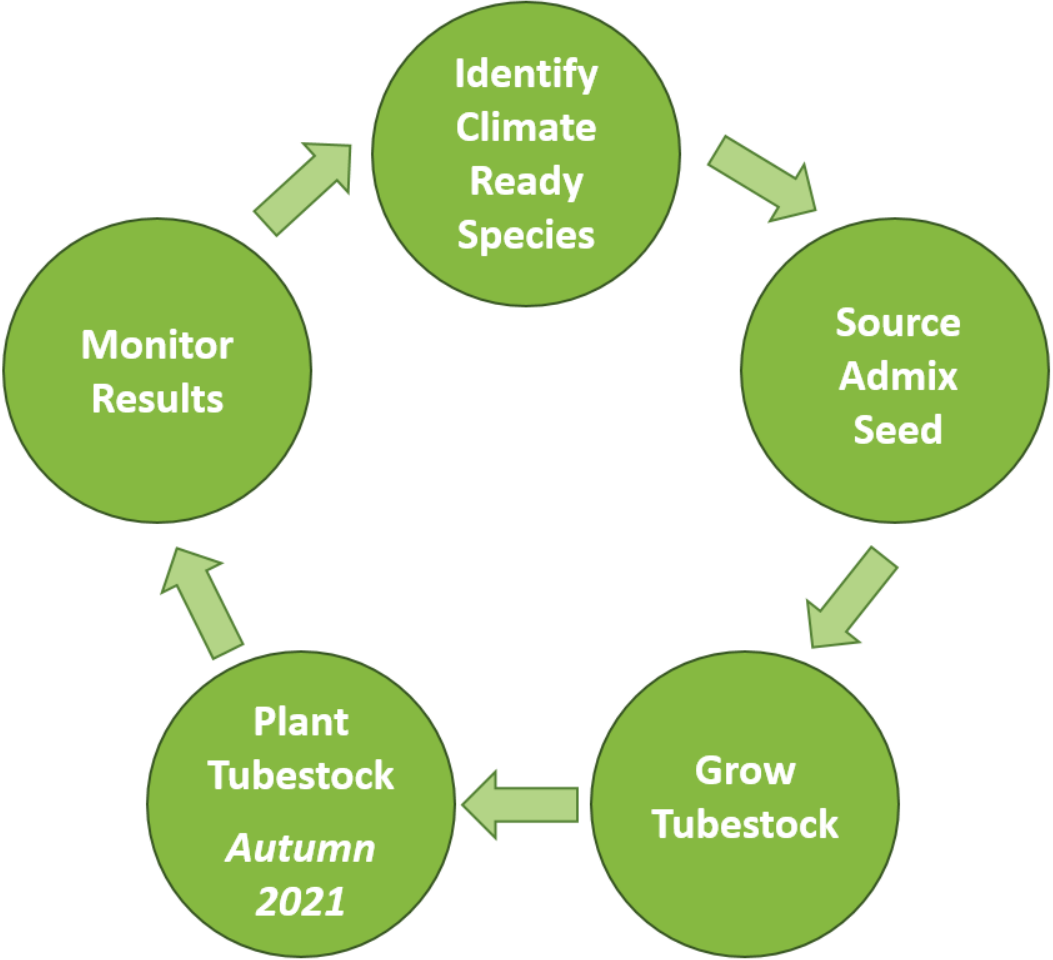
5. Conducting experimental trials

Experimental trials are being conducted to assess whether the short-term performance of the plants grown from admixture seed is comparable with that of purely locally sourced seed. Three species are being planted on local properties and will be monitored for five years.

Photo: Geoff McFarlane. Experimental trial of Climate Ready plants on Mountain Vale, established in April 2021.

Yass Area
Network of
Landcare
Groups

Climate-Ready Revegetation: the research and trial cycle

Identify Climate Ready Species

Source Admix Seed

Grow Tubestock

Plant Tubestock *Autumn 2021*

Monitor Results

Likely tolerance of 80 species to Climate Change in Yass region

Note: these lists have been generated from desktop analysis using the methods described above. Please see the full report for more details on methods. This may change as more information and more sophisticated assessment methods become available.

Local plant species likely to have a moderate to high degree of tolerance to projected climate change in the Yass region

These species currently occur in the Yass region but also in areas that experience moderate to strong similarities in temperature and rainfall to what we expect in the Yass region in future years

Eucalypts: White Box (*Eucalyptus albens*), Blakely's Red Gum (*Eucalyptus blakelyi*), Apple Box (*Eucalyptus bridgesiana*), River Red Gum (*Eucalyptus camaldulensis*), Hill Redgum (*Eucalyptus dealbata*), Red Stringybark (*Eucalyptus macrorhyncha*), Yellow Box (*Eucalyptus melliodora*), Grey Box (*Eucalyptus microcarpa*), Inland Scribbly Gum (*Eucalyptus rossii*), Mugga Ironbark (*Eucalyptus sideroxylon*)

Other trees: Black She-Oak (*Alllocasuarina littoralis*), Drooping She-Oak (*Allocasuarina verticillata*), Kurrajong (*Brachychiton populneus*), Black Cypress Pine (*Callitris endlicherii*), River She-Oak (*Casuarina cunninghamiana*)

Wattles: Box Leaf Wattle (*Acacia buxifolia*), Dean's wattle (*Acacia deanii subsp. paucijuga*), Western Silver Wattle (*Acacia decora*), Spearwood (*Acacia doratoxylon*), Hickory Wattle/ lightwood (*Acacia implexa*), Blackwood (*Acacia melanoxylon*), Kangaroo Thorn *(Acacia paradoxa*), Red Stem Wattle (*Acacia rubida*), Prickly Moses (*Acacia ulicifolia*), Varnish Wattle (*Acacia verniciflua*)

Other shrubs: Australian Blackthorn (*Bursaria spinosa subsp. lasiophylla*), Sweet Bursaria (*Bursaria spinosa subsp. spinosa*), Crimson Bottlebrush (*Callistemon citrinus*), Lemon Bottlebrush (*Callistemon pallidus*), River Bottlebrush (*Callistemon sieberi*), Cough Bush (*Cassinia laevis*), Shiny Cassinia (*Cassinia longifolia*), Broom Bitter Pea (*Daviesia genistifolia*), Narrow Leaf Bitter Pea (*Daviesia mimosoides*), Small Leaf Parrot Pea (*Dillwynia phylicoides*), Narrow Leaf Hop Bush (*Dodonaea viscosa subsp. angustissima*), Sticky Hop Bush (*Dodonaea viscosa subsp. cuneata*), Australian Indigo (*Indigofera australis*), Kunzea/Burgan (*Kunzea ericoides*)

Flowers: Bulbine Lily (*Bulbine bulbosa*), Billy Button (*Chrysocephalum apiculatum*), Clustered Everlasting Daises (*Chrysocephalum semipapposum*), Blue Flax Lily (*Dianella revoluta*), Purple Coral Pea (*Hardenbergia violacea*), Hoary Sunray (*Leucochrysum albicans*), Sticky Everlasting (*Xerochrysum viscosum*)

Grasses: Wallaby Grasses (*Austrodanthonia spp*) (*Rytidosperma caespitosum*), Tall Sedge (*Carex appressa*), Redanther Wallaby Grass (*Joycea pallida*) (*Rytidosperma pallidum*), Spiny Headed Mat Rush (*Lomandra longifolia*), River Tussock (*Poa labillardierei*), River Club Rush (*Schoenoplectus validus*), Kangaroo grass (*Themeda triandra*)

Local plant species not so likely to tolerate projected climate change in the Yass region

These species do NOT currently occur in areas that experience temperatures and rainfall similar to what we expect in the Yass region in future years

Eucalypts: Argyle Apple (*Eucalyptus cinerea*), Silver Gum (*Eucalyptus crenulata*), Broad Leaved Peppermint (*Eucalyptus dives*), Long Leaved Box (*Eucalyptus goniocalyx*), Brittle Gum (*Eucalyptus mannifera*), Snow Gum (*Eucalyptus pauciflora subsp. pauciflora*), Red Box (*Eucalyptus polyanthemos*), Candlebark (*Eucalyptus rubida subsp. rubida*), Ribbon Gum / Manna Gum (*Eucalyptus viminalis*)

Wattles: Gold-dust Wattle (*Acacia acinacea*), Silver Wattle (*Acacia dealbata*), Spreading Wattle (*Acacia genistifolia*), Ploughshare Wattle (*Acacia gunnii*), Woolly Wattle (*Acacia lanigera*), Black Wattle (*Acacia mearnsii*)

Other shrubs: Dolly Bush (*Cassinia aculeata*), Hop Bitter Pea/ broad leaf bitter pea (*Daviesia latifolia*), Slender Bitter Pea (*Daviesia leptophylla*), Wooly Grevillea (*Grevillea lanigera*), Small Fruited Hakea (*Hakea microcarpa*), Silky Hakea (*Hakea sericea*), Prickly Tea Tree (*Leptospermum continentale*), Woolly Tea Tree (*Leptospermum lanigerum*), Silver Teatree (*Leptospermum multicaule*), River Tea Tree (*Leptospermum obovatum*), Rough-barked Honey-myrtle (*Melaleuca parvistaminea*)

Flowers: Blue Devil (*Eryngium ovinum*)