

**CLIMATE –READY REVEGETATION IN THE YASS AREA NETWORK LANDCARE REGION.
Draft Project Plan. Date: 08/06/19**

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Background:

The climate is changing rapidly and this threatens many species, including plants. In an attempt to devise a method to assist nurseries and others to help populations of plants to withstand this rapid change, a publication has been produced by Hancock et al (2017) called Climate-ready Revegetation Guide. The method outlined in this publication is thought to be likely to enhance the chances of survival of plant species into the future when the weather is expected to be more variable and less predictable.

The Climate-Ready Vegetation Guide provides natural resource managers with hands-on tools to assist nurseries and landholders to develop a plan to decide which plants will be best suited to the predicted climate, and how to source and grow seed. It outlines methods to ascertain the current distribution of different species, to find out what are current predictions of localised climate change using online predictive models, and to overlay the distribution and predicted climate to determine a suitable seed sourcing strategy. Nola Hancock and Linda Broadhurst described the rationale for the Guide as follows:

The information in the Guide is based on the premise that survival and resilience will be enhanced for species and local populations with large, genetically diverse populations. Species differ in their vulnerability to climate change. Species that cannot evolve and adapt to new environmental conditions in-situ as fast as the climate changes, or disperse to more suitable climates, will be more vulnerable than those with the evolutionary potential and/or the capacity to disperse. In theory, plants with wide distributions are more likely to cope with climate change than those with narrow distributions. However, even if a species' distribution indicates that it is able to tolerate a broad range of climate conditions, survival of local populations are not guaranteed.

Quote from Climate-ready Revegetation workshop handout, Yass, October 2018

Revegetation is an activity prioritised by Landcare, a volunteer organisation that extends throughout much of Australia with support from some government paid positions. Members are brought together by a common interest to *Care for Land*, and a number of groups have nurseries that grow plants suitable for revegetation. In the Yass Valley region there are six? Landcare groups that are under the umbrella of the Yass Area Network of Landcare Groups, and three? Groups have community nurseries that grow local native species. Currently seed is mostly sourced from local vendors (including Greening Australia), but the application of the Revegetation Guide is likely to require sourcing of seed from more widespread regions. The Landcare networks provide a starting point for collaboration for sourcing seed across wider areas.

This plan outlines how the methods in the Guide could be adopted in a real-life setting by Landcare and other stakeholders in the Yass Valley region. In the Yass region a preliminary analysis has suggested that up to half current species may be threatened by climate change.

Hopefully, by adopting the Climate-ready Revegetation Guide methods, species will survive into the future through judicious selection of seed sourcing strategies to enhance genetic diversity. Additionally, by trialling the application of the Guide in the Yass Valley region, strategies developed will be able to be replicated in other regions.

Overall Aim: To assist the survival of native plant species during climate change in the YAN Landcare Region through judicious selection of seed provenance to enhance genetic diversity

- This will be achieved by applying the methods described in the Climate-ready Revegetation Guide (Hancock et al, 2017) as the ‘current best science’ strategy. The guide describes overlaying current species climate envelopes with the predicted climate, leading to selection of suitable provenance sites for seed sourcing. This project will use the ‘admixture’ seed sourcing strategy. The rationale for this is given in appendix 1.
- Given the pressing nature of climate change, seed from admixture provenances will be incorporated where appropriate as the ‘current best science’ strategy, replacing single source seed in working Landcare nurseries. If information becomes available that alters our understanding of ‘best science’, then the process will be amended accordingly.
- Additional work on assessing species survival and health from specific provenance sites will be undertaken later if capacity permits.

Note: The project covers the YAN region and a known climate gradient exists within this area, between Canberra and districts further north and west. The gradient in the recent past for temperature and rainfall across the YAN region is shown in appendix 2. This shows fairly similar rainfalls but a gradient of about 1 degree annual average temperature increasing across the region from Canberra to further west. The predictive climate modelling in this project is centred on Yass.

Methods:

There are two parts to the project, each with a different time frame and prerequisites for commencement. The first is to incorporate *climate ready* revegetation strategies into current standard nursery and revegetation practices. The second is to assess whether there is variation in survival/health across different species and provenances.

1. Incorporate *climate ready* revegetation strategies into current standard nursery and revegetation practices.

To effectively implement and evaluate admixture seed provenances and climate adjusted planting strategies, we need to enhance current practices related to revegetation by YAN Landcare, especially activities in the community nurseries (Murrumbateman, Yass, Bowning-Bookham). This is explained in parts 1.1 and 1.2 below. It is envisaged that these two parts will run in parallel.

1.1 *Selecting climate ready species and seed*

To focus on species and seed provenance most likely to lead to tolerance of climate change in YAN region, several steps need to be taken. The steps aim to identify suitable species and admixture seed provenance locations. These include:

- a. Ongoing assessment of climate predictions with distribution of local species (basically using Hancock et al method), to identify species most likely to tolerate climate change.
- b. Overlay these climate factors with considerations of local adaptation, local habitat, landscape position, soil tolerances, overall balance of life-forms (shrub, tree etc), and seed availability (using expert advice).
- c. Develop and implement strategies for sourcing and mixing seed from appropriate locations for community nurseries (using admixture strategy and working closely with GA).
- d. Review our planting recommendations to the community regarding use of local, vs non-local species (via online, face-to-face and other communication methods)

1.2 *Enhancement of current working nursery practices:*

To achieve the steps above, some enhancements of current nursery practices are required- in particular, improvements to record keeping. These enhancements need to occur in parallel with the steps above.

- a. Review our practices and documentation of nursery seed acquisition and seed provenance history.
Note: a complementary project is being run to train local landcarers to collect seed locally in the YAN Landcare region. See appendix 6
- b. Develop a system to document seed germination success and seedling health in the nursery. Relate these to the age of seed, storage conditions, and nursery environment.
- c. Keep thorough records of stock that is released by the nursery and record locations of field plantings (for orders of 100 or more tubestock and direct seeding material)
- d. Follow up success or otherwise of plantings (monitoring method to be determined)
- e. Revise our policies regarding advice and recommendations for revegetation.

2. Assessment of whether there is variation in survival/health in different species from specific provenances

Implementation of Part 2 is dependent on achieving all of 1.1 and 1.2 first, with a minimum of 3-4 provenances sourced for at least one species. In addition, sites and landholders appropriate for long-term monitoring must be identified, and appropriate project leadership and expertise available.

Two time frames could be explored:

- a) Provenance trials of survival and health of plants in establishment phase (~5 year timeframe). Provenances planted out and assessed separately.
- b) Success of integration of provenance material into functional (self-replacing) vegetation (~100 year timeframe). Will require long-term storage of seed samples and planting locations. Aim would be to assess establishment and regeneration success in mixed provenance populations using DNA analysis techniques in the future.

A project workplan to complete part 1 is in Appendix 7, along with detailed actions as an excel workbook. As steps are undertaken, detailed documentation of progress is being added as appendices.

Part 2 will be considered later.

Results: summary of key outcomes to date 080619

See appendices for details

Starting list of 20+ species from nurseries

Bursaria spinosa subspecies *spinosa* (Sweet Bursaria)
Acacia dealbata subspecies *dealbata* (Silver Wattle)
Brachychiton populneus subspecies *populneus* (Kurrajong)
Dodonaea viscosa (Sticky Hop Bush)
Eucalyptus polyanthemos subsp. *polyanthemos* (Red Box)
Acacia deanei subspecies *paucijuga* (Deane's Wattle)
Chrysocephalum semi-papposum (Clustered Everlasting)
Eryngium ovinum (Blue Devil)
Xerochrysum viscosum (Sticky Everlasting)
Acacia implexa (Hickory Wattle)
Callitris endlicheri (Black Cypress Pine)
Allocasuarina verticillata (Drooping She-oak)
Indigofera australis (Australian Indigo)
Eucalyptus sideroxylon subspecies *sideroxylon* (Mugga Ironbark)
Eucalyptus bridgesiana (Apple Box)
Eucalyptus macrorhyncha (Red Stringybark)
Acacia decora (Western Silver Wattle)
Acacia verniciflua (Varnish Wattle)
Acacia buxifolia (Box-leaf Wattle)
Eucalyptus microcarpa (Grey Box)

First Lot of 7 Species after climate envelope study

Eucalyptus microcarpa ** Possibly change this to *E. albens* in light of new info
Eucalyptus melliodora

Callitris endlicheri
Allocasuarina verticillata
Acacia deanei subspecies *paucijuga*
Dodonaea viscosa augustissima
Chrysocephalum semi-papposum

Suggested Provenance sites for First Lot of 7 Species after examining climate envelope 'extremes'

Completed Tables coming soon

State	Bioregion	Example towns	Closest Seed Source (GA)
Vic			
NSW			
Qld			

Funding:

Funding secured by March 2019 includes:

- a. OEH funding to Nola to allow her to participate in the project and to document how the project proceeds. Her main output will be a resource for others who want to do similar work. This money will include funds for a workshop for Nola to work with the core team, and some money to buy seed.
- b. \$1000 from SE Landcare from mini-muster held in Yass Feb 2019.

Appendices (Not included)

App 1 Rationale for admixture provenance

App 2 Assessment of the current climate gradient in YAN region

Appendix 3 Nursery and 20+ species lists

Appendix 4 Process and outcomes for selecting the First Lot of 7 species for admixture seed provenance **App 4a: accompanying graphs and data**

Appendix 5 Process and outcomes for the selection of the provenance sites for the First Lot of 7 Species **App 5a: accompanying graphs and data**

App 6 Complementary project: Increasing seed collection capability in YAN region

App 7 Workplan 230419 **App 7a: Detailed timeline and activities (excel spreadsheet 23/03/19 and updated later)**

References

Hancock N, Harris R, Broadhurst L and Hughes L.

Climate-ready revegetation. A guide for natural resource managers by

Accessed 15/11/18 <http://anpc.asn.au/sites/default/files/Climate%20Reveg%20Guide.pdf>

Breed MF, Stead MG, Ottewell KM, Gardner MG, Lowe AJ (2013) Which provenance and where? Seed sourcing strategies for revegetation in a changing environment. *Conservation Genetics* **14**, 1-10.

Prober SM, Byrne M, Mclean EH, Steane DA, Potts BM, Vaillancourt RE, Stock WD (2015) Climate-adjusted provenancing: a strategy for climate-resilient ecological restoration. *Frontiers in Ecology and Evolution* 3, Article 65. Doi: 10.3389/fevo.2015.00065.