Establishing Victoria's Ecological Infrastructure: Guidelines for Building Climate Future Plots

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What are Climate Future Plots?

- Climate Future Plots are areas of revegetated and restored land which incorporate genetic and/or species diversity to enhance habitat resilience to a changing climate.
- Through the use of carefully selected species and provenances (seed sourced from different geographical locations), genetic diversity is maximised, increasing adaptive potential.
- Plots contain a mix of local and climate pre-adapted plant genotypes (such as seed from hotter and drier climates) to monitor over time.

Project Overview

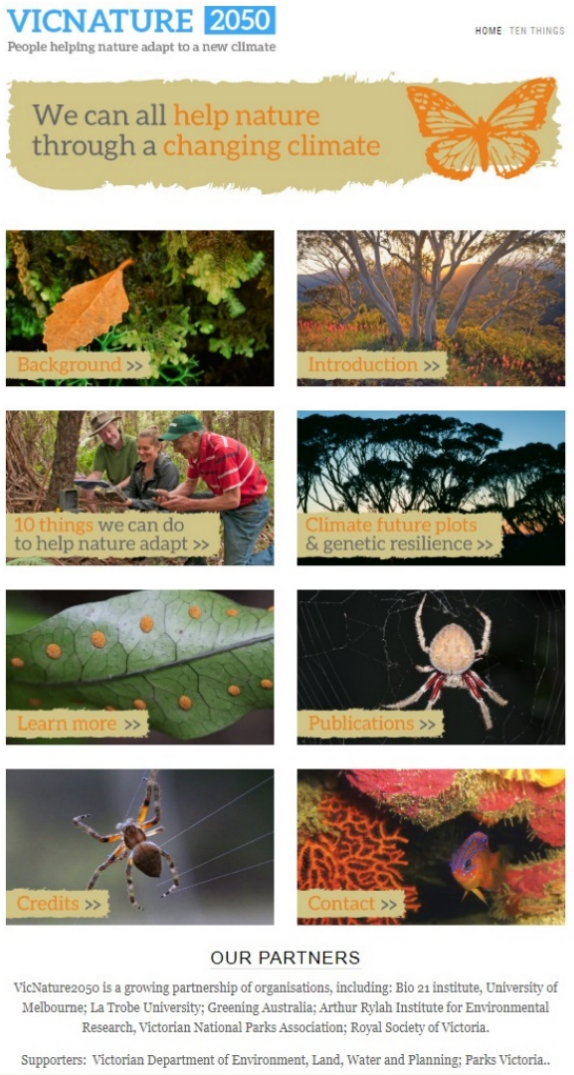
Greening Australia & the Victorian Department of Environment, Land Water & Planning (DELWP) have developed guidelines for undertaking climate adjusted revegetation (Climate Future Plots).

- Project running from June 2018 – June 2020
- Steering Committee (DELWP, CMAs, Universities, VNPA & Parks Vic)
- Funding for guidelines & workshops
- Linked to the Platform for Ecological Restoration Research Infrastructure (PERRI) – CSIRO

"National Guidelines for Experimental Restoration Plantings" for release mid 2020

Objectives for developing Guidelines for Climate Future Plots

1. Understand the impacts of climate change on key revegetation species;
2. Understand how and when to incorporate genetic and/or species diversity into plantings;
3. Develop land management practices that build resilience (through diversity) to climate change;
4. Create climate adjusted seed production areas (SPAs) and climate resilient seed selections to restore plant communities in the future.



Overview of Guidelines

- What are Climate Future Plots and why are they important
- What are the different aims of the Plots:

1. *Creating climate resilient (re) vegetation in cleared and fragmented landscapes.*

2. *Introducing new plant genetics to enhance resilience into existing natural landscapes such as national parks.*

3. *Producing 'climate ready' seed from seed production areas (SPAs).*

4. *Establishing research plots to assess how plants survive grow and reproduce.*

- What are the climate projections and how to choose the correct species and provenances (climate analogues)
- How to implement Climate Future Plots and things to consider
- How to monitor and manage revegetation data

Climate change impacts on plants

Climate change is expected to have influence on:

- Flowering, pollination, seed dispersal, seed production and viability
- Ability of plants to germinate and recruit into the landscape
- Adult plant survival

Declines of one species in turn influences the health of wider vegetation communities

Often little is known of plant lifecycles: Climate future plots will help gain this knowledge across species and across time

Why are climate future plots important?

Choice of seed (provenance) is important

- same species can vary widely
- differences are often genetic
- adapt to different environments

40 – 70 m tall *Blue Gum (Eucalyptus globulus)* <3 m tall

Local is best ?

Dominant paradigm for ecological restoration

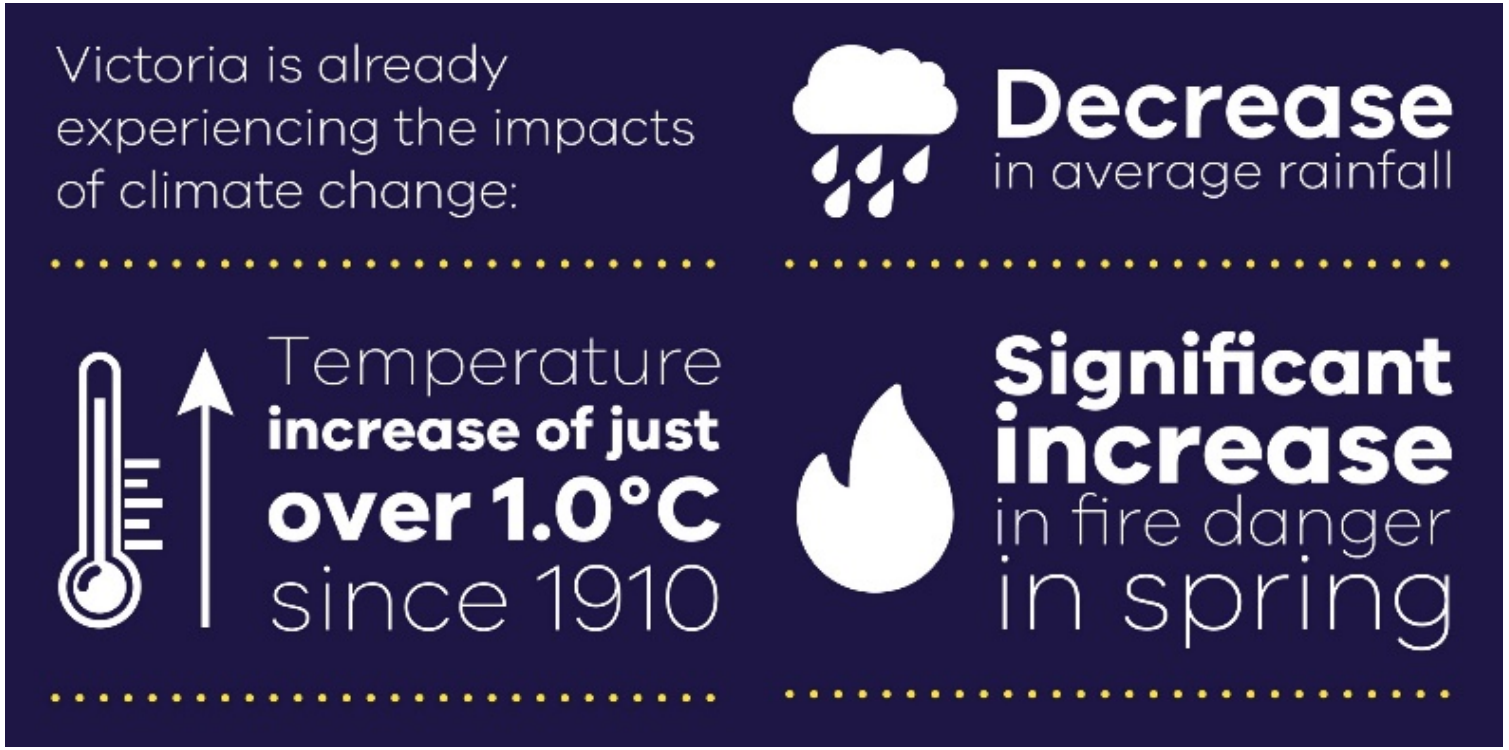
Use locally sourced seed to:

- maintain current patterns of genetic variation
- avoid problems of:
  - poorly adapted seed and seedlings
  - genetic contamination of local populations
  - outbreeding depression

Land-use has changed

- Increased fragmentation
- Reduced genetic diversity in local populations
- Altered environmental processes (nutrient and soil communities)

Climate is changing rapidly



1987

Mienna Cider Gum dieback - Tasmanian Central Plateau

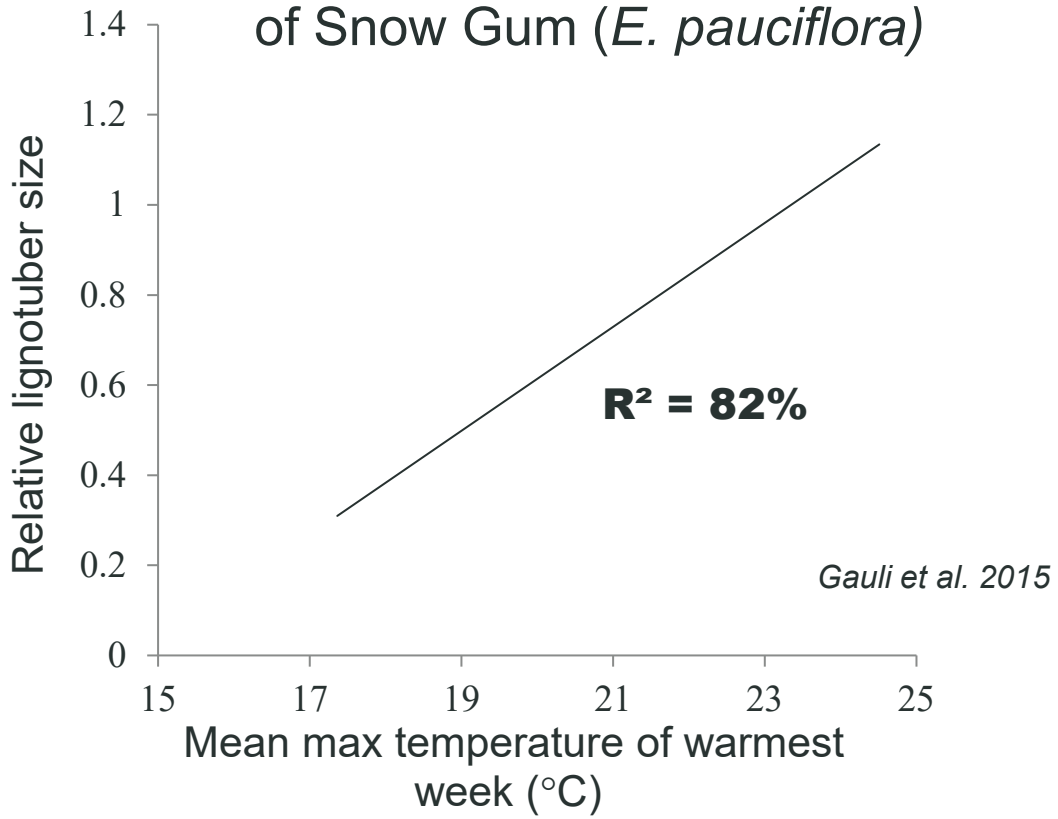
2000

Species must: adapt, migrate or die

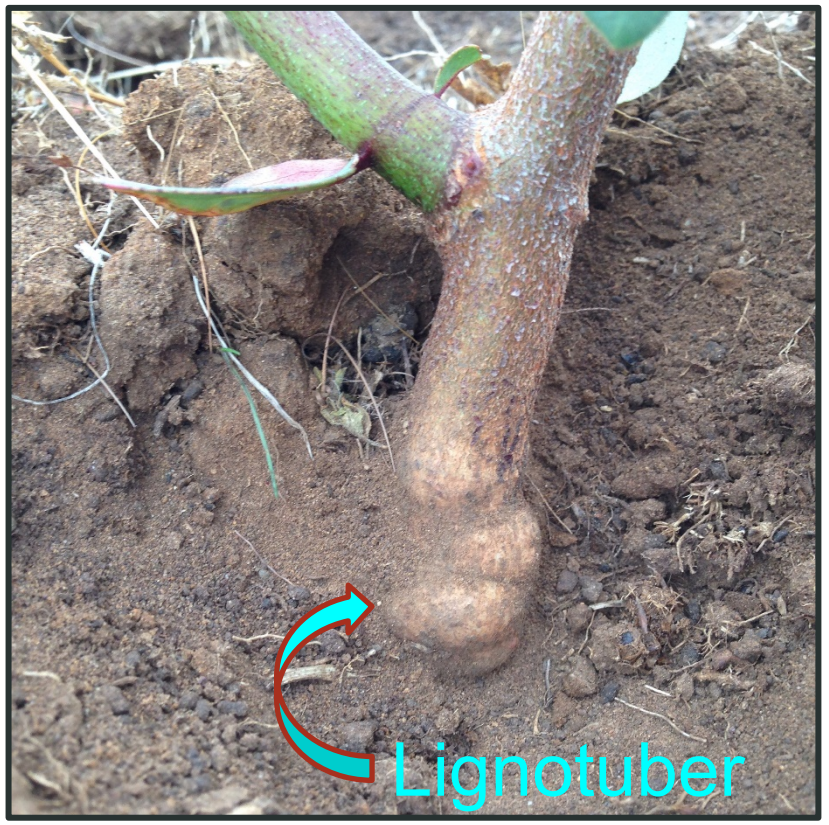
Provenances vary in climate adaptations

Seedlings from hotter/arid provenances have larger lignotubers

37 Tasmanian populations of Snow Gum (*E. pauciflora)*



Gauli et al. 2015



Snow Gum *(E. pauciflora)*

Such adaptations will likely be critical in the face of climate change

Future climates may change where species survive

Many species will experience increased aridity as climates change

Aridity is a major factor associated with provenance adaptation in eucalypts

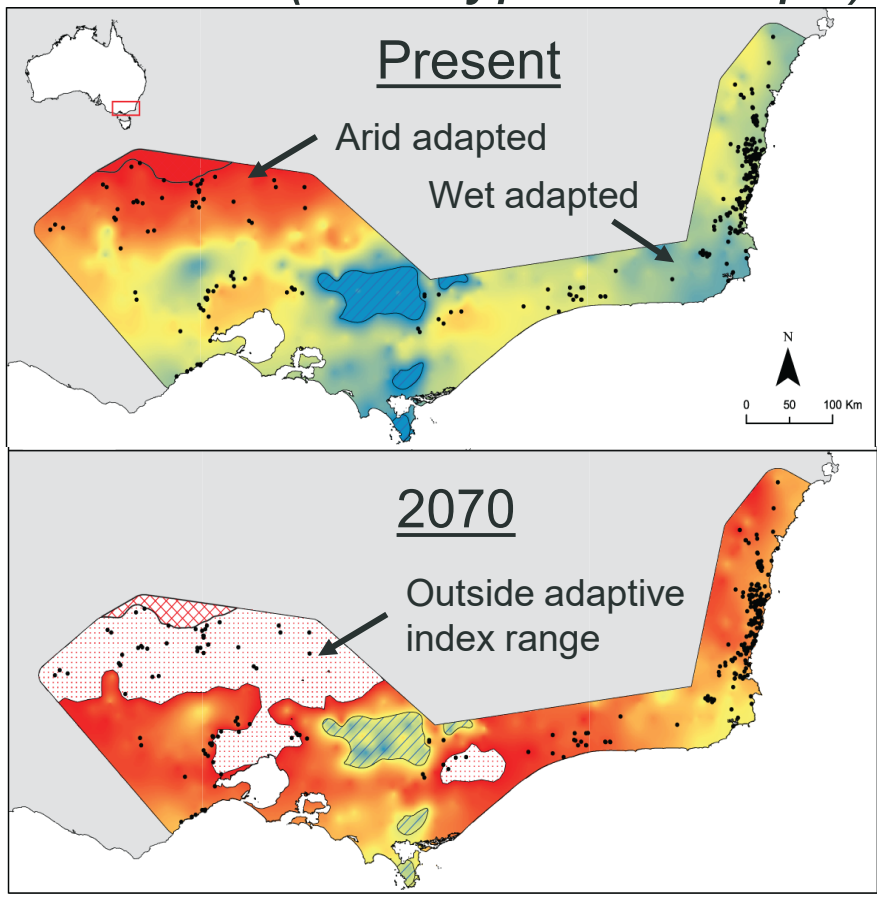
e.g. Ironbark (*E. tricarpa*)

- ability to adapt (McLean *et al.* 2013)
- genomic outliers (Steane *et al.* 2014)

Restoration plantings may benefit if we assist the migration of genetic material by supplementing local with arid adapted seed

Climate adjusted provenancing

Ironbark *(Eucalyptus tricarpa)*



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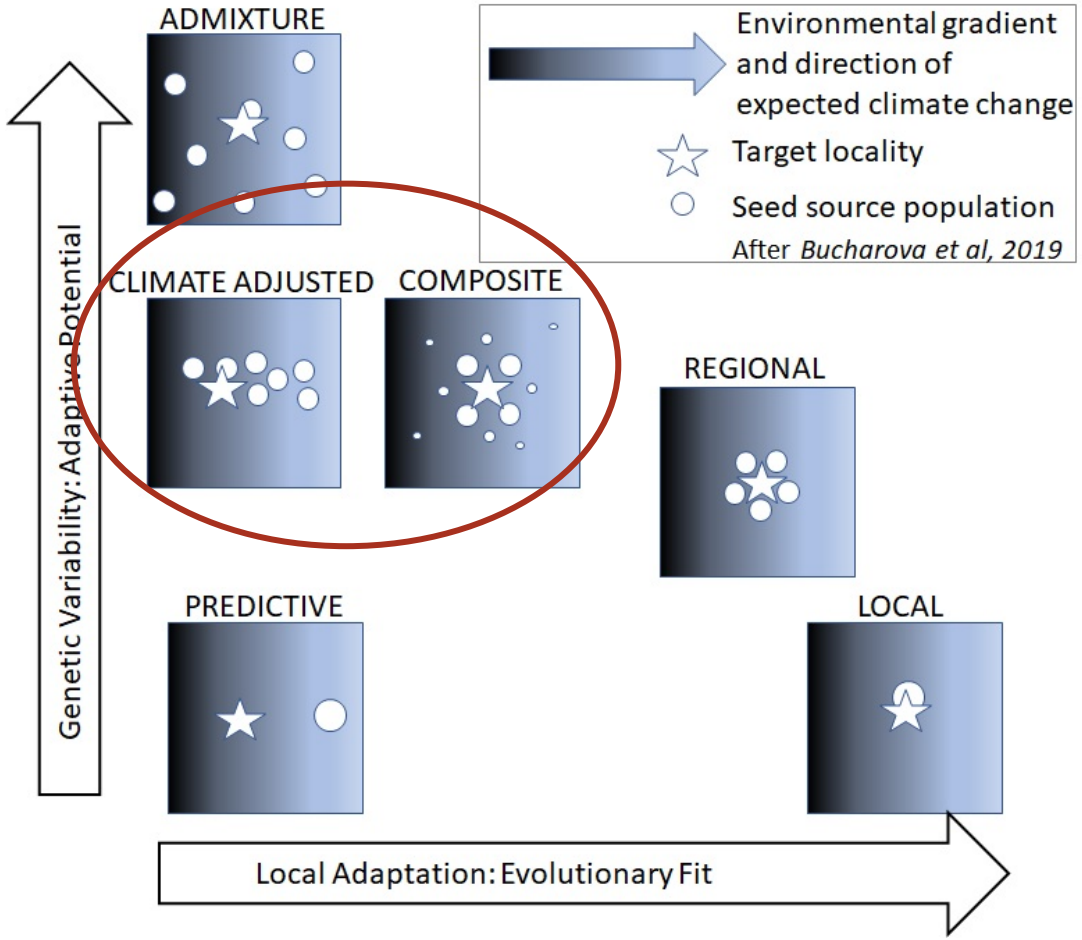
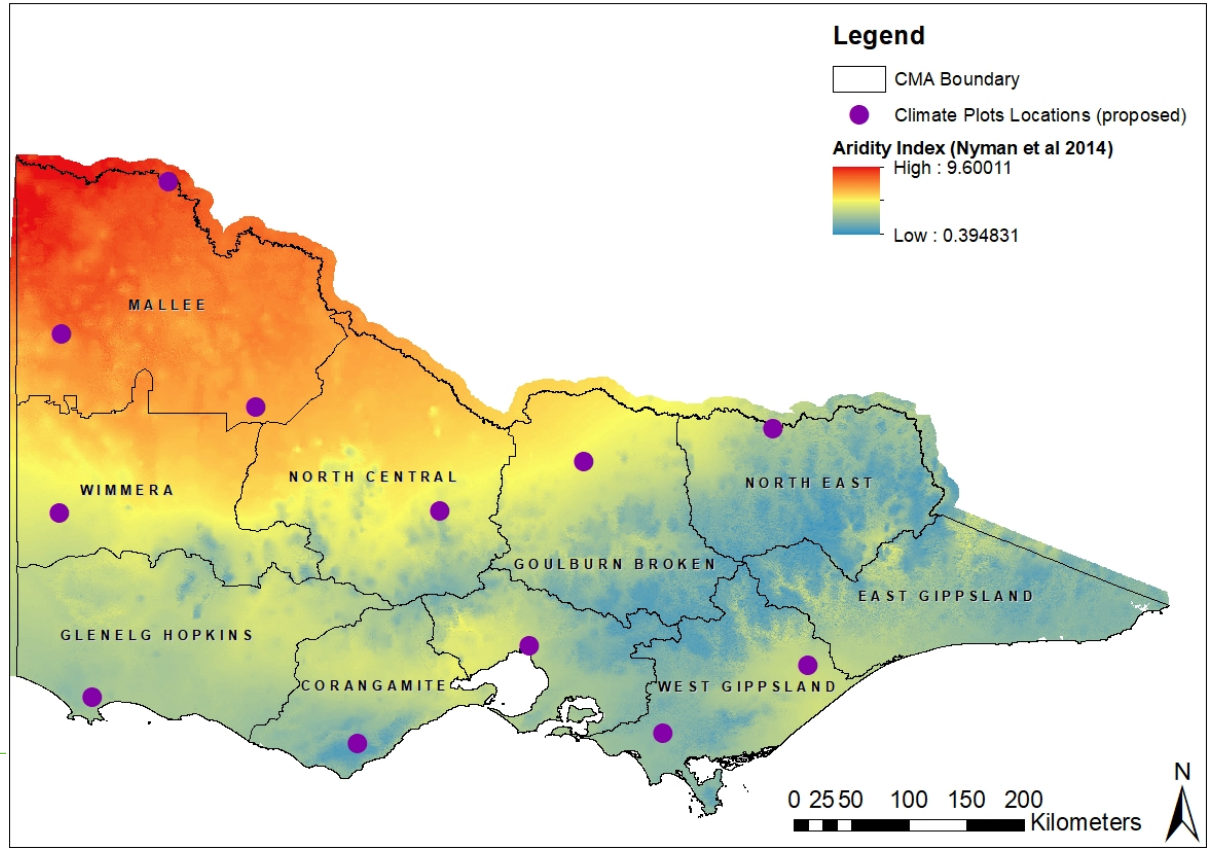
Provenancing strategies



Climate Futures Plots test the Climate Adjusted Provenancing strategy at a number of scales:

- Local
- Regional
- National (PERRI)



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Benefits of Climate Future Plots

- **Enhance conservation** at the landscape scale by creating climate resilient habitat elements within the landscape which maintain ecosystem function in uncertain climate scenarios.
- **Act as nursery sites** for native vegetation due to their high genetic diversity.
- **Building knowledge** by testing predictions and proposed management strategies under a changing climate. Long-term studies are vital, as they help us distinguish between short-term events and long-term trends.
- **Inform future adaptive management** by showing how species respond to interventions. New knowledge and data informs improved practices.
- **Enable community engagement** and awareness of climate change effects by providing opportunities to work and learn together.

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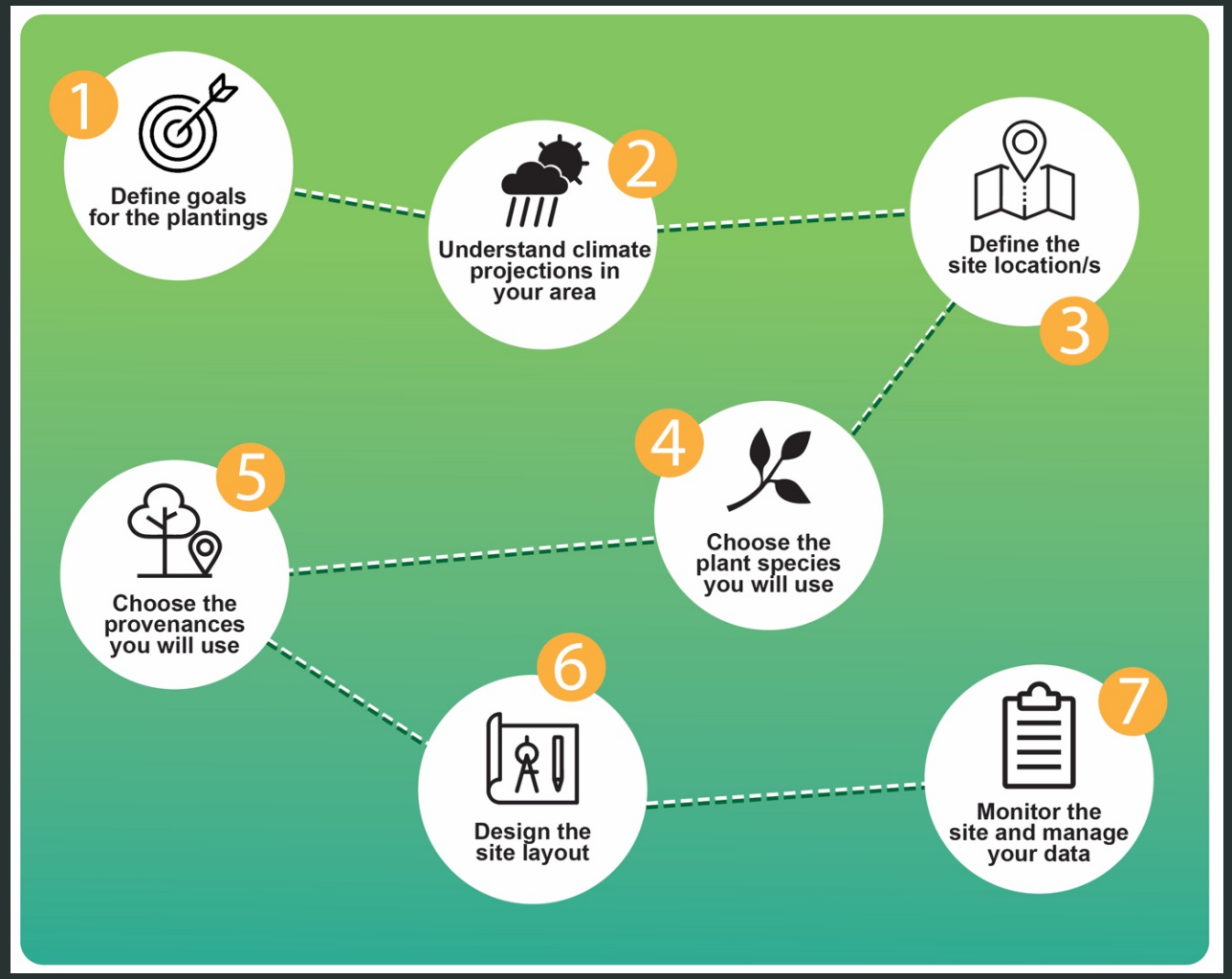

A 7-step process for organisations and community groups to plan, establish and monitor Climate Future Plots