Is seed provenance relevant for native grasses?

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From where do we get the seed?

Restoration guidelines

- Guides such as Florabank Guidelines (Mortlock 1999) recommend the use of locally sourced seed

- Belief is that this seed will give the best results
- plants will be locally adapted
- this will maintain the genetic integrity
- there will not be any unwanted hybridisation

Is this relevant for Australian native grasses?

- Guidelines are based on recommended practices for woody plants in the northern hemisphere
- They borrow heavily from studies on trees such as Cork Oak (*Quercus suber*) and related tree species
- They also use examples regarding hybridisation in the animal kingdom

- The guidelines assume that the grasses behave the same way as trees and shrubs (and some animals)

- But are those assumptions correct?

- Should we reconsider the use of these guidelines for revegetation with grasses?

Discussion points / Myths

1. Genetic integrity and unwanted hybridisation
2. Distance is an indicator of diversity
3. What occurs now has always been there
4. Evolutionary change is slow

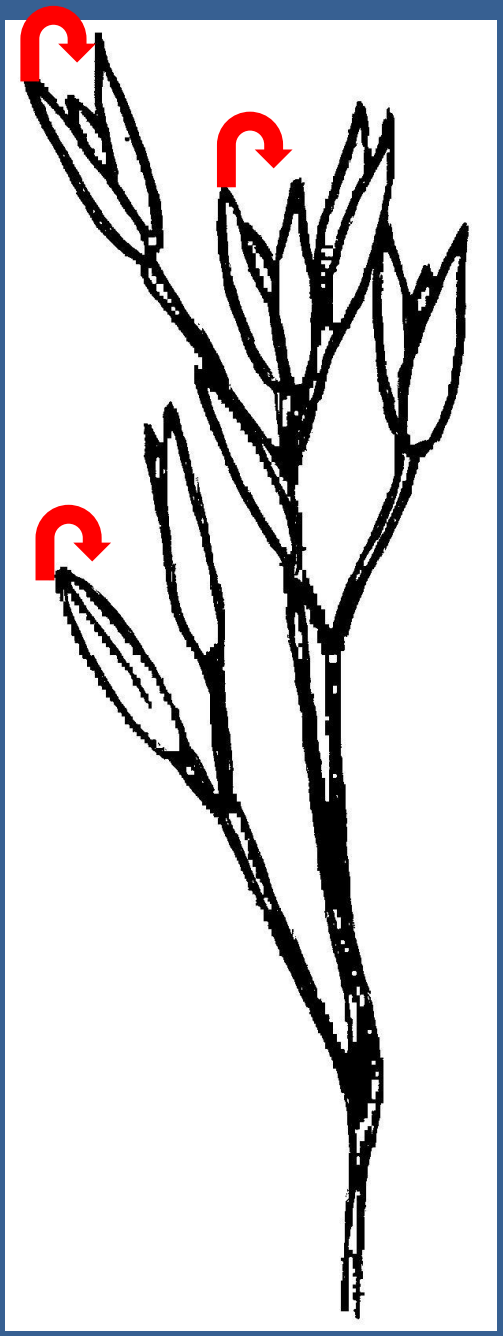
Myth 1

Genetic integrity and unwanted hybridisation

- Cross pollination between the local population and the introduced plants will bring about reduced vigour in subsequent generations.

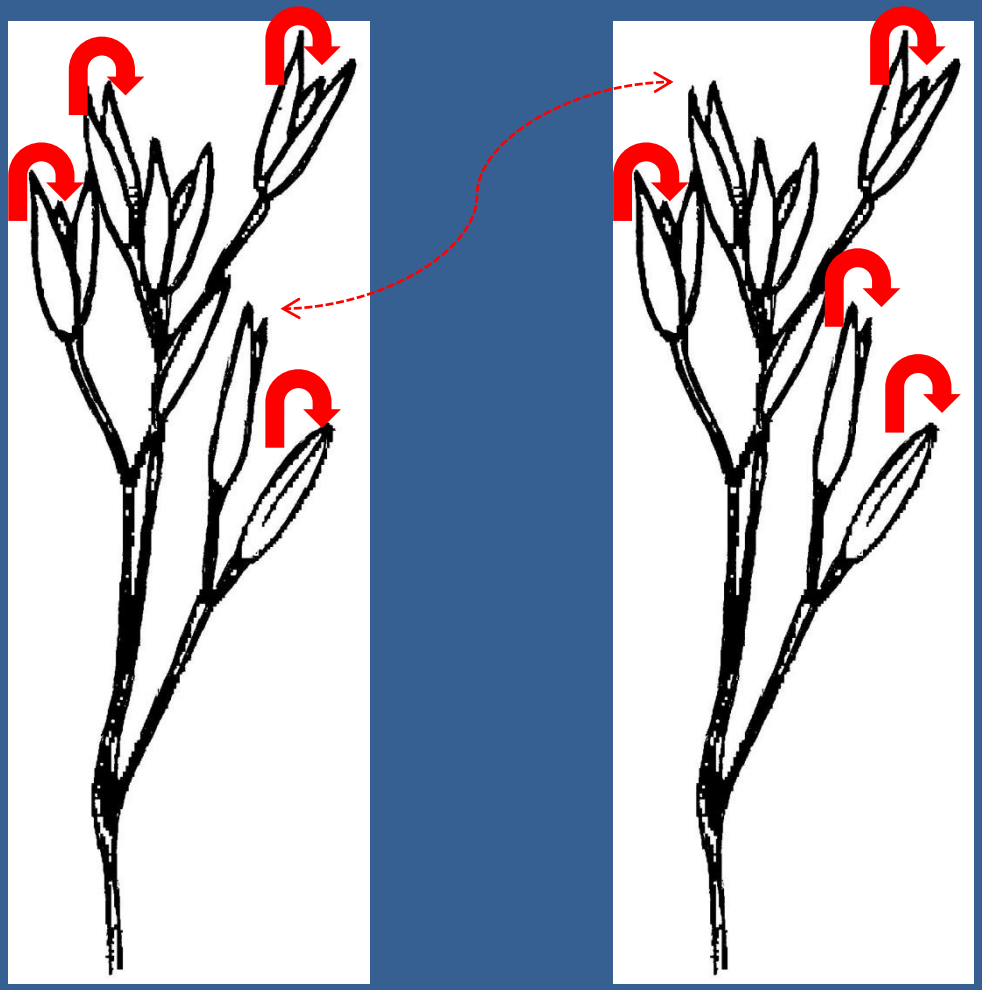
Reality 1

Self pollination is the normal means of pollination in our native grasses.



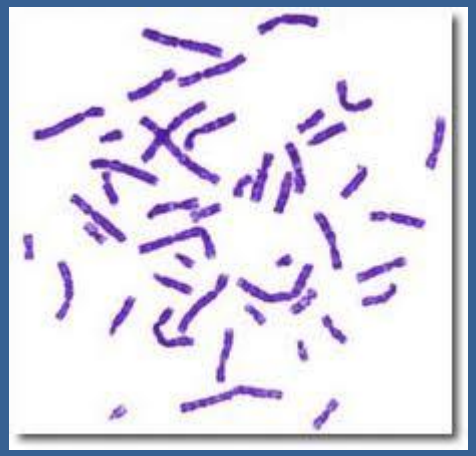
Unlike northern hemisphere grasses, where self pollination is not possible.

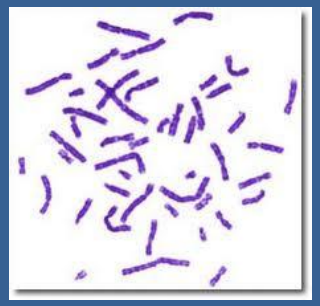
Hybridisation between populations is not common.



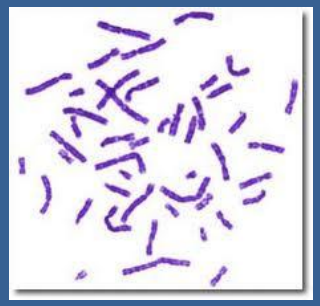
Reality 2

- Australian native grasses are frequently polyploid in nature (have more than one pair of chromosomes)





Common animal state = diploid



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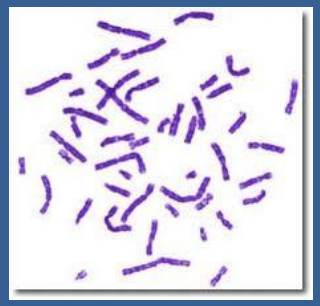


Common native grass state = tetraploid

- Therefore they contain a high degree of heterogeneity (variability) within their genes

Myth 2

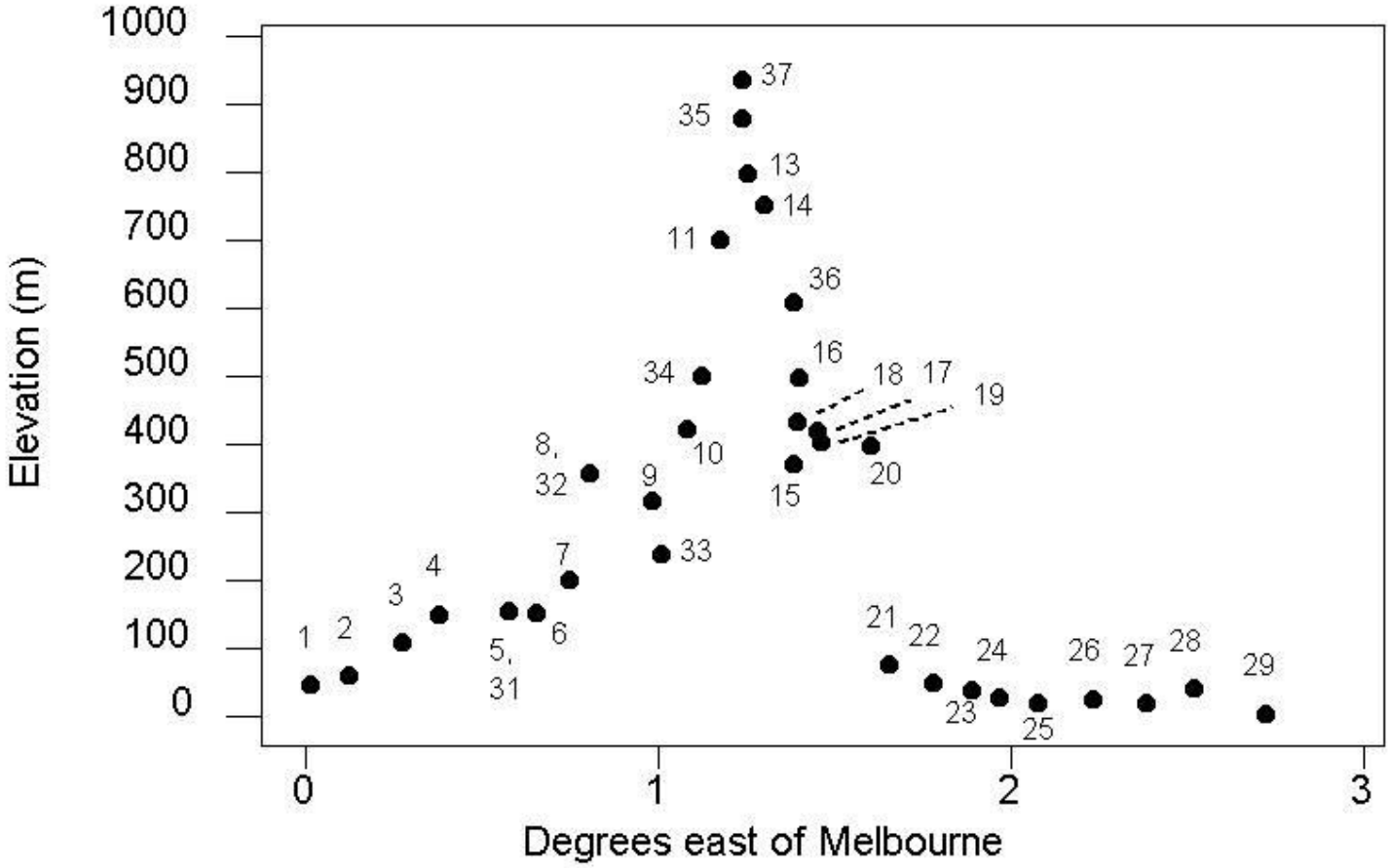
Distance is an indicator of Diversity

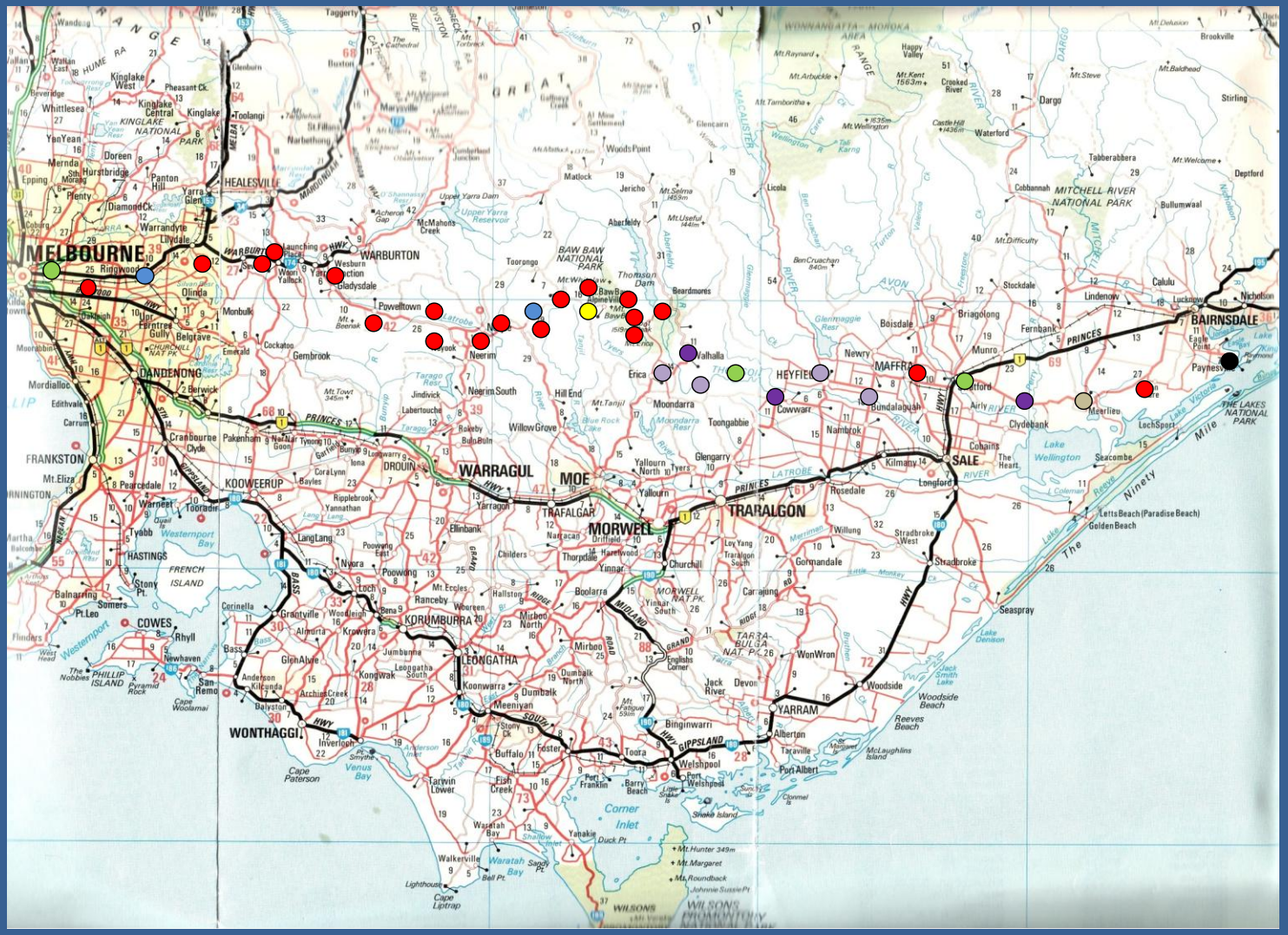
- A greater distance between parent plants means greater genetic variance.

Science 1

- Genetic studies by Fitzgerald et al. 2011 on weeping grass (*Microlaena stipoides*) from a broad collection

Elevation of collection points vs degrees east of Melbourne





Study showed that plants sourced from more environmentally variable areas had greater genetic variability than those from more consistent environments

Science 2

- Work by Waters et al. 2003 on common wallaby grass (*Austrodanthonia caespitosa*) in central west and north west NSW

- They showed that the local environmental condition from which they were sourced was a more predictable indicator of survival than distance

- Some characters varied for populations 6 kms apart and were the same for several hundred kms apart

Myth 3

What occurs now has always been there

- If a population of a grass occurs near a site now, it has always been there and should be restored.

Reality 1

Grasses are known to move rapidly in and out of localities and across substantial distances.

The spread of weeds such as Serrated Tussock or Chilean Needle grass show how fast they are able to move.

These weeds are spreading at around 15 kms per year on average

Reality 2

Long term monitoring of grasslands has shown that the dominant grass species can change over the decades

As conditions change over decades, so do the dominant grasses

Myth 4

Evolutionary change is slow

- Grasses are very slow to change genetically and populations are essentially ‘fixed’ over time.

Reality 1:

- Many grasses have been shown to change genetically within a few generations in response to changed environmental conditions.

- In fact, the greater the stresses the faster the changes; and grasses are particularly adept at rapid changes.

Reality 2

The grasses which were present when European man first recorded them will have changed genetically, even if not physically.

The climate has changed and is continuing to change, therefore genetic change is continuing.

Reality 3

- The current rare and endangered species of grasses are those that have failed to adapt to changes in climate or to European man's presence in Australia.

Summary

Provenance guidelines that were developed for northern hemisphere trees and shrubs have little, if any, relevance to revegetation with Australian native grasses