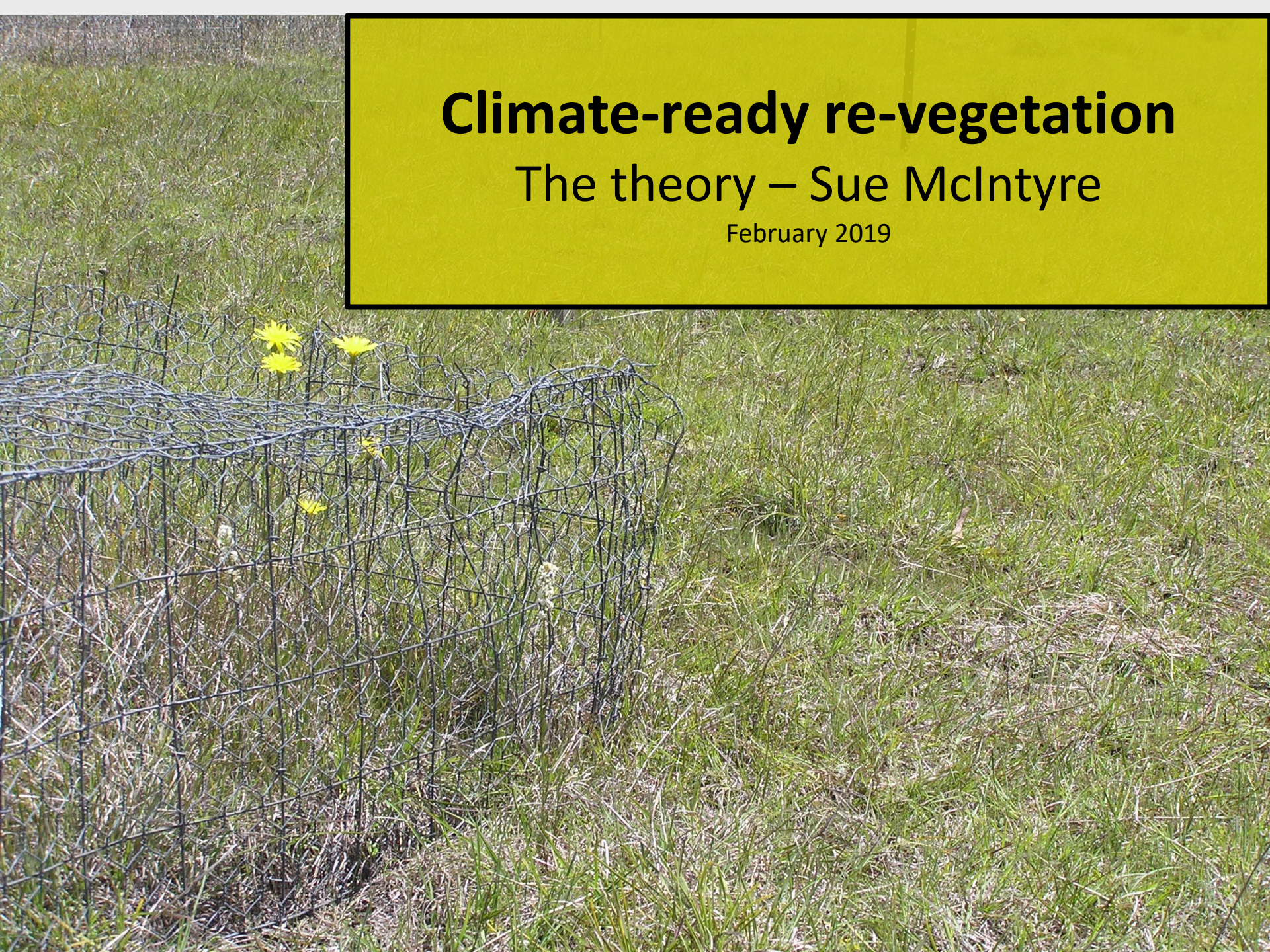


Climate-ready re-vegetation

The theory – Sue McIntyre

February 2019



What is the problem?

- Native plants need help - populations are depleted and fragmented.
- Climate change likely to increase the need for adaptation to different conditions.
- Genetic diversity is the stuff on which natural selection acts, allowing adaptation.
- Fragmentation, small populations and low dispersal capacity all limit the available genetic diversity .

Issues for revegetation

- Local species are favoured to assist with plant conservation and regional identity.
- Climate change is going to select for greater heat and drought tolerance.
- How can we assist natural selection processes and resulting adaptation in settings where populations are small and fragmented?

Some controversy

- Some argue that only local seed sources should be used. *Outbreeding depression*
- The counter argument is that boosting genetic diversity in small populations is more important. *Inbreeding depression*
- The reality is that landcarers ...
 - i) ...plant out non-local species and...
 - ii) ...when locals are used, the population source is generally unknown, not considered and not thought to be important.

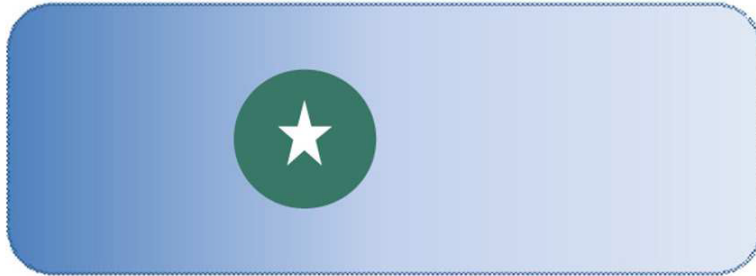
How can we do better?

- Consider species selection carefully, as well as the seed source.
- Use some of the seed collection strategies suggested by plant geneticists.
Climate-adjusted and *admixture provenancing*
- Establish plants in sufficient numbers to form viable populations.
- Provide suitable conditions for regeneration to allow natural selection and adaptation to occur.

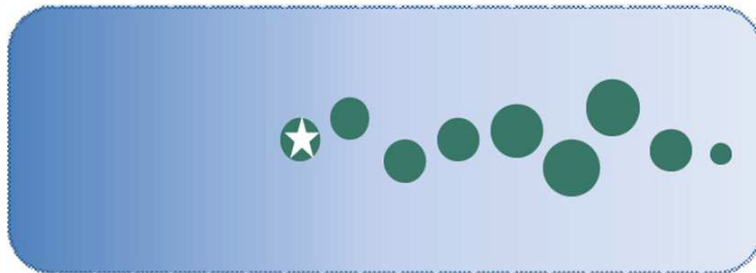
Direction of expected climate change at site
e.g. site likely to increase in aridity



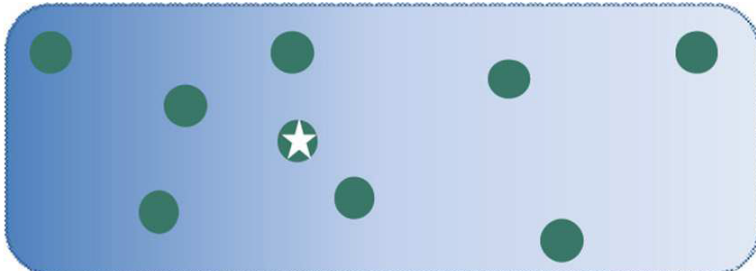
Local provenancing



Climate-adjusted provenancing



Admixture provenancing



Climate gradient e.g. increasing aridity

Different seed collection strategies (=provenancing)

Redrawn from Prober *et al.* (2015)

Frontiers in Ecology and Evolution, 3, 65.

Numbers of plants established after 8 years

(McIntyre et al. 2019, Australian Journal of Botany)

	Microseris	Bulbine	Stackhousia
Total plants Season 6 (no. flowering)	331 (142)	1351 (15)	608 (202)
Total plants Season 8 (no. flowering)	344 (170)	1621 (95)	1364 (347)
Total plants in grazed areas (Season 8)	87	384	388
Total plants in ungrazed areas (Season 8)	257	1237	731
Plants per 100 seeds sown	1	6	7

- Important result was that plants from all four populations were able to be established (smallest number was 50, Pop. 4 *Microseris*)

Summary

Seed selection

- No evidence of sensitivity of forbs to non-matching substrate (granite home populations did well on sedimentary soils).
- Home site advantage not strong.
- Good capacity to establish populations over a 2°C range in average temperature.

Management

- Weed competition can be eliminated by low fertility levels, but may result in small plants.
- Macropod grazing can significantly reduce plant numbers and reproduction.

Important conclusion

Natural selection can only take place when plants are reproducing.

If genetically diverse seed sources are used, you would not expect uniform survival and growth of planted out or sown populations.

Planting in conditions where regeneration from seed will occur is fundamentally important to the success of this strategy.

These conditions are usually grassland or woodland long-unfertilized and dominated by native plants, or eroded areas.