Recording Key Ecological Information for Banksia Woodland Plants

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Department of Parks and Wildlife

BANKSIA WOODLAND RESTORATION PROJECT

Ministerial Statement

The approval for the expansion of Jandakot Airport is subject to a number of conditions, specified in the EPBC 2009/4796 approval document, but only Condition 4 b is relevant to this project.

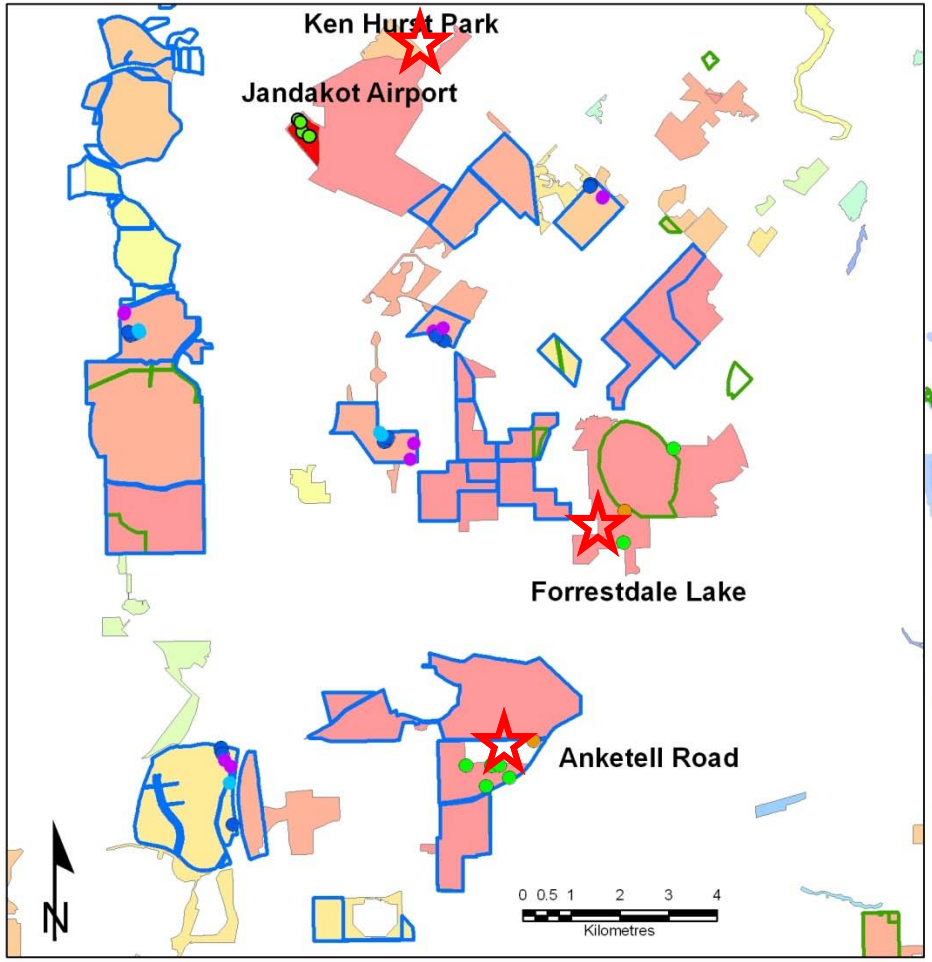
> *… the person taking the action must provide to the Western Australian Department of Environment and Conservation the sum of $9.2 million and topsoil from the Jandakot Airport lease site for use in the rehabilitation and conservation of banksia woodland at an alternative site or sites. The areas to be rehabilitated or conserved must be within 45 kilometres of the Jandakot Airport lease site unless the Minister agrees to alternative siting. The transportation costs for the topsoil are to be paid for out of the $9.2 million. The funding must be provided in proportion to the area cleared each year, and the entire sum must be provided within a maximum of five years from commencement.'*

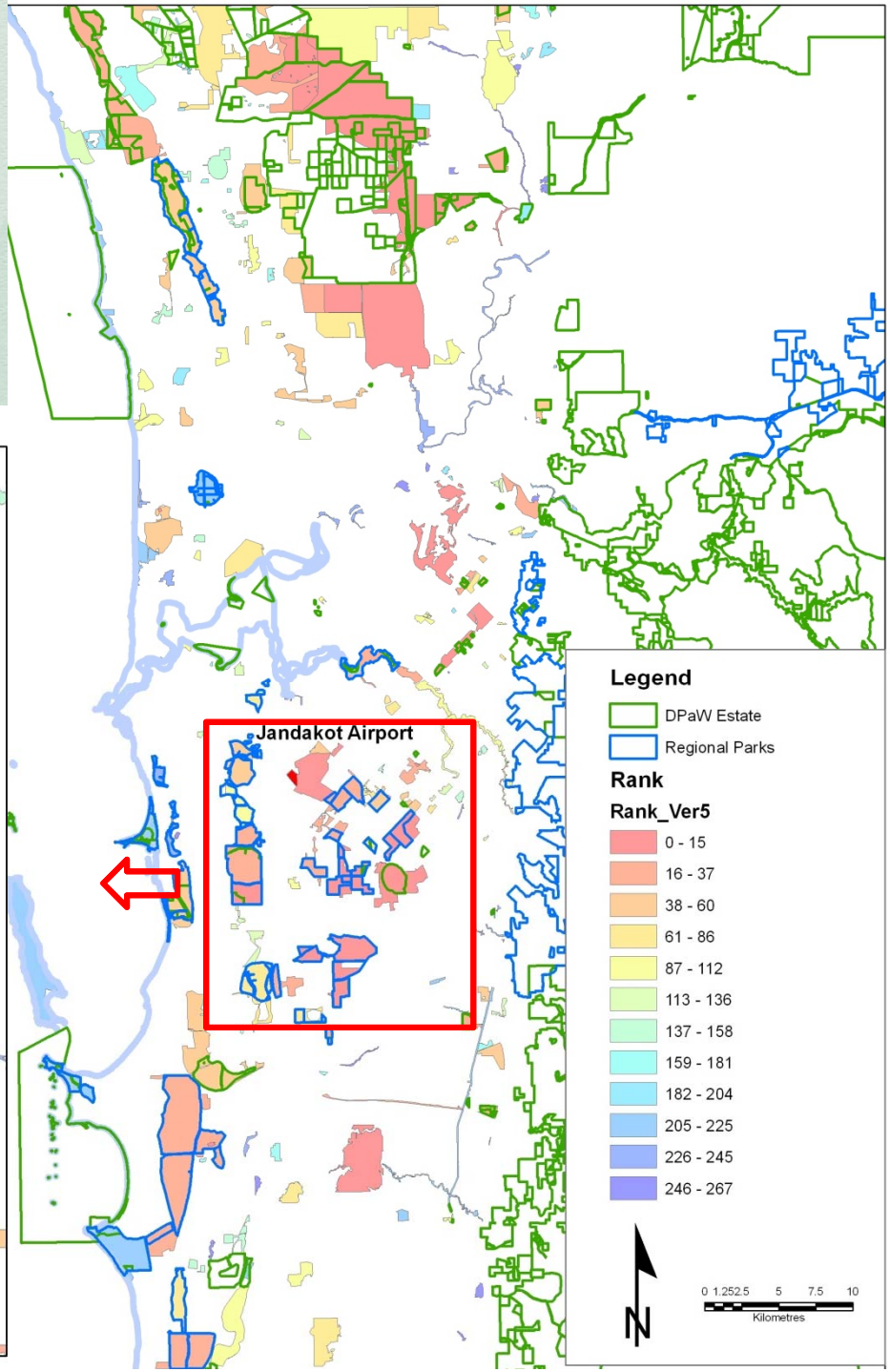
Objectives

- Restore and manage banksia woodland
- Select sites using rigorous ranking process
- Use scientific approaches and evaluate relative effectiveness of methods
- Maximise area restored or managed
- Develop monitoring protocols
- Support community groups and land mangers
- Collate and share information

Ranking Bush Forever Sites

Significance and Similarity






Topsoil Harvesting & Transfer 2012
KOMATSU
740
CAT

Nursery Management

Planting Days

With BirdLife Australia

Direct Seeding 2012-2014

Restoration Potential of Plants

Total Species Richness

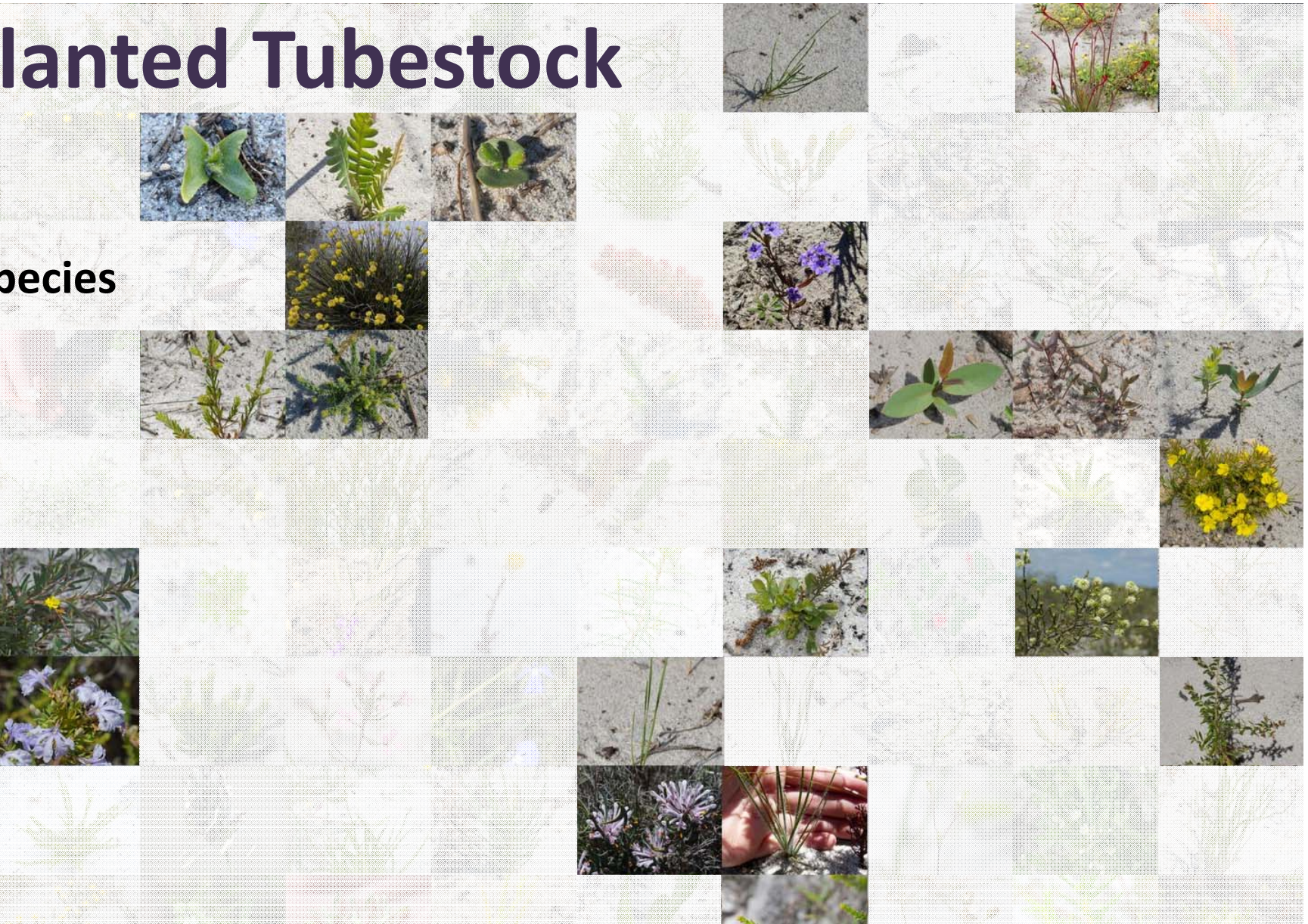
	Status in 2016
s present in 12 reference quadrats	160 native species in total

Native Species (top 100)


From Topsoil
84 species

lanted Tubestock

pecies



Direct Seeded

pecies

Local Opportunists

ecies



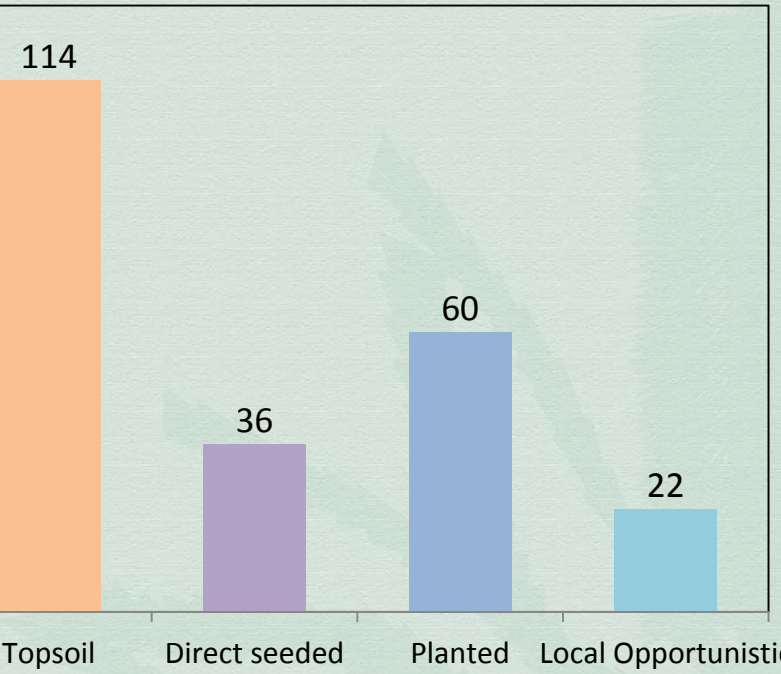








Restoration Outcomes

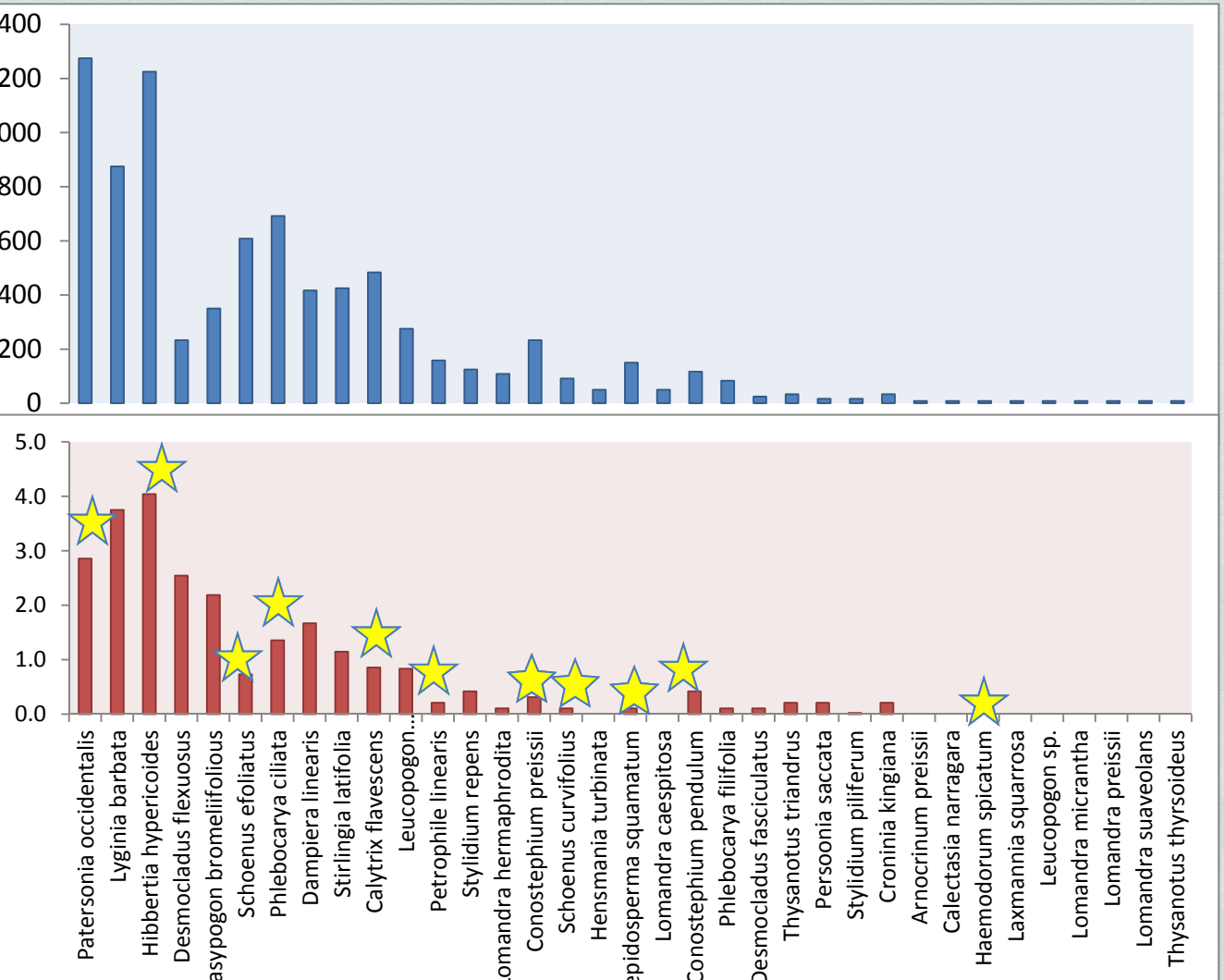


60 native plant species by year 4

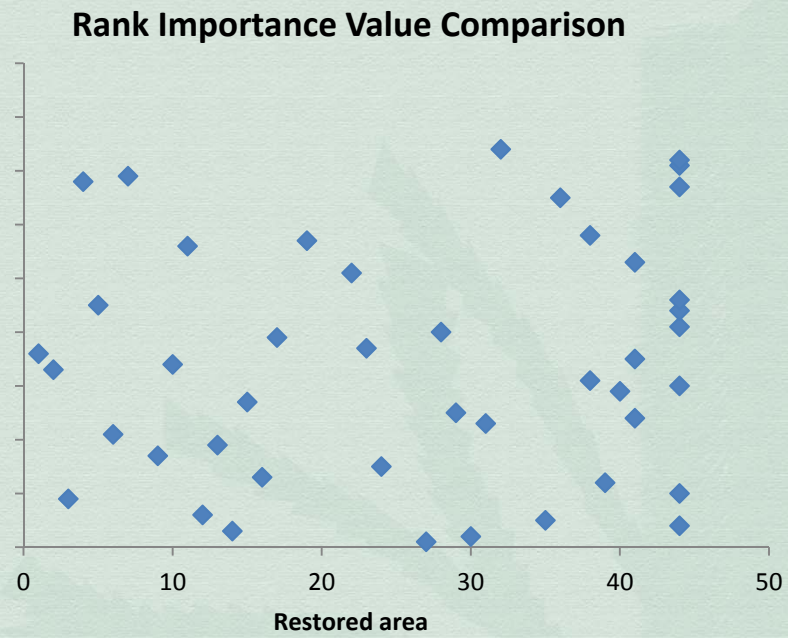
ontinuum from opportunist to recalcitrant species

Propagation Potential of Plants

ome Species are Uncommon or Missing



Restoration Potential



Plant diversity similar (in this case) but these is a very different vegetation structure in young banksia woodland on restoration sites

Seed Collection & Propagation

Canopy stored seed

Seed easy to collect

Seed collectible in sufficient numbers

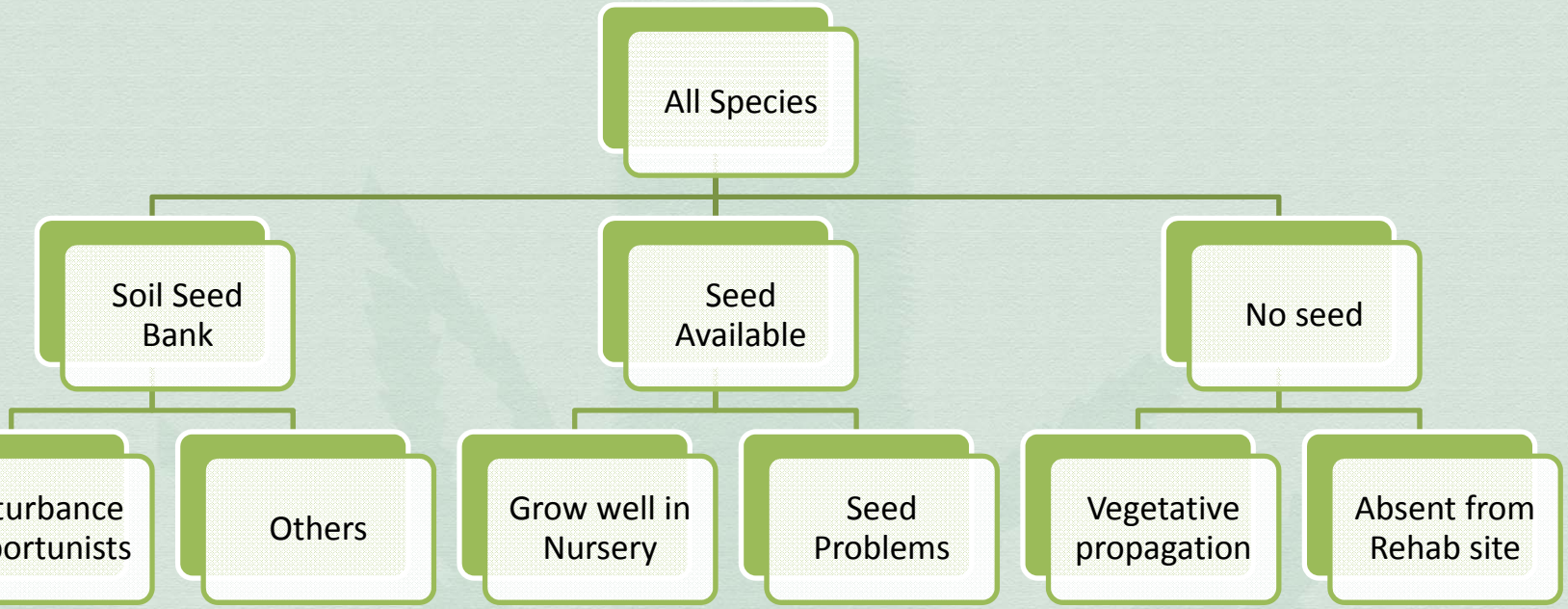
Seed hard to get

Seed quality poor

Seed almost impossible to get

1. Germination easy
2. Seed treatments
3. Germination slow and/or erratic
4. Seed viability low
5. Clonal division works
6. Almost impossible to propagate

Restoration Potential



eds
rt-lived
ect
eased
ortance

- Long-lived shrubs
- Annuals
- Soil germ-promotion trials

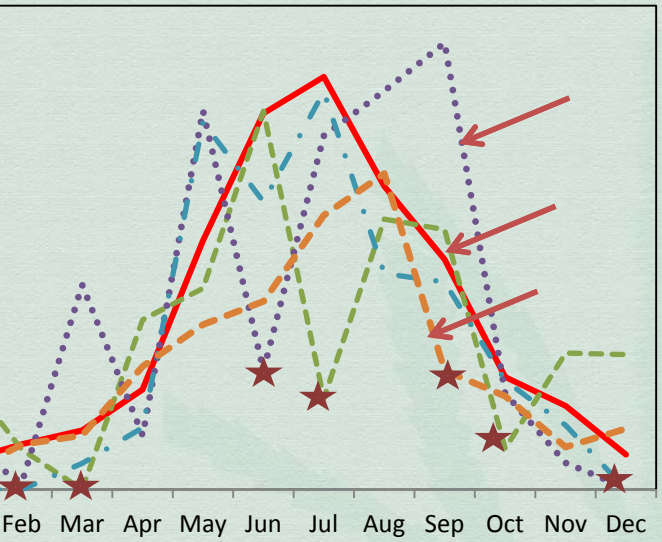
- Canopy stored seed
- Easily collected seed
- Trees and

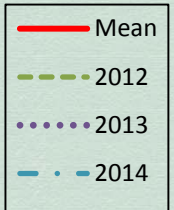
- No seed
- Seed quality
- Seed germ-
- Seed storage
- Germ trials

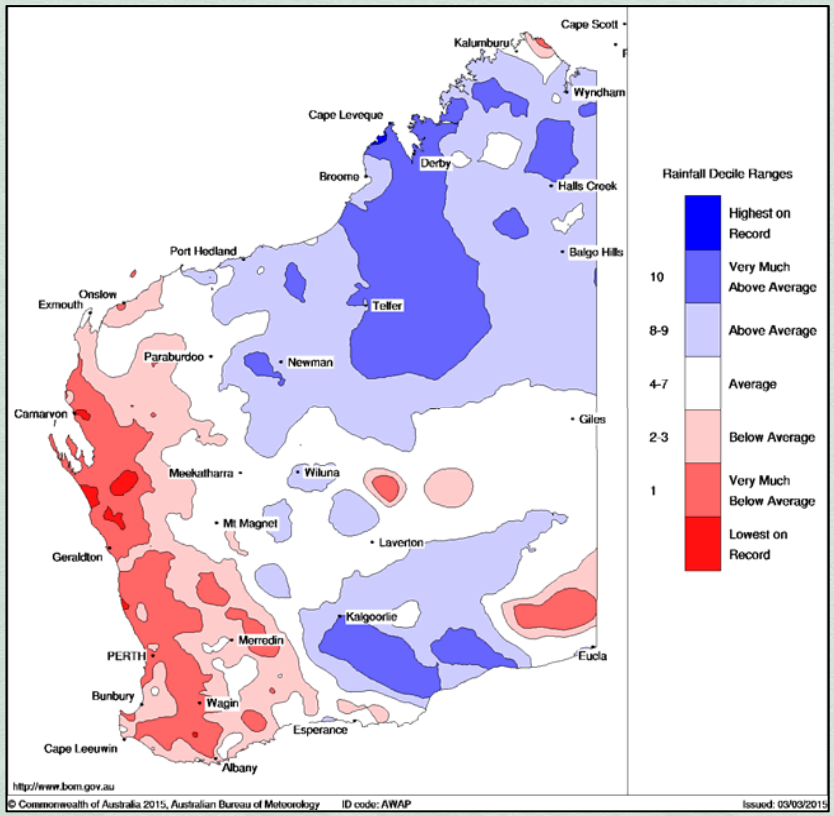
- Important spp.
  - Monocots
  - Sedges
  - Recalcitrant shrubs

- less important spp.
- Some self-dispersing

Responses to Climate







- Severe drought impacts

Seed Germination and Survival

anksia seedling mortality is due to invertebrate grazing and
evere summer drought

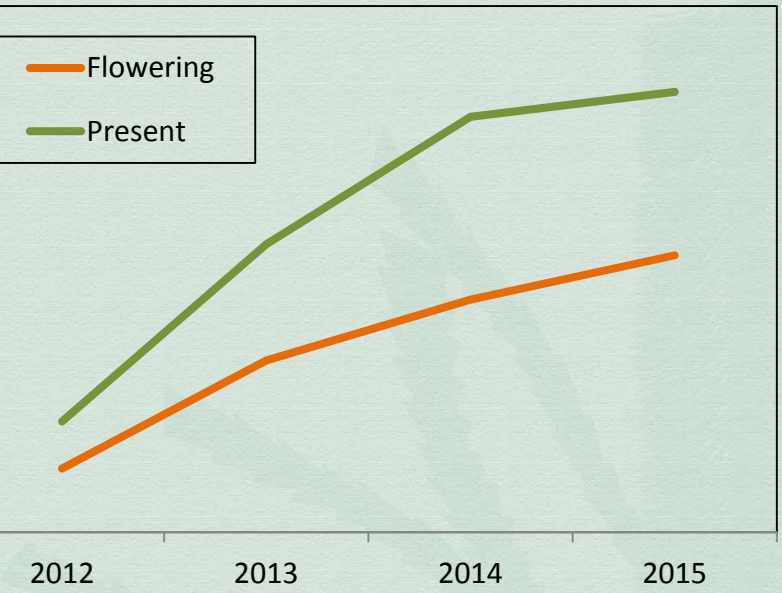
Pollination in Revegetation Sites

Row 1 - native bees

Row 2 – wasps

Row 3 - flies and butterflies

Time to Flowering and Seed



Ecological Interactions

Restoration Ecology

- Importance in reference sites
- Age and month for flowering & seed set
- Seed collection & storage
- Germination or division in nursery
- Germination from topsoil
- Survival after out-planting
- Drought impacts on seedlings
- Topsoil germination potential
- Direct seeding potential
- Growth rate and lifespan
- Seedling susceptibility to:

Data sources:

1. Monitoring data on mortality of species
2. Restoration trials
3. Reference site comparisons
4. Photographs of seed and seedlings
5. Growth measurements
6. Pollination and seed set data
7. Species lists
8. Importance values
9. Weed cover
10. Groundwater and rainfall
11. Fencing trials

vegetation Report Card *Banksia attenuata*

Factor	Data
Seed Collection	0-101 seeds per tree (average 15), Jan-Feb
Seed preparation	Difficult (heat required to open cones)
Seed storage	Requires low humidity and temperature
Seed germination	High (30-95%), Inhibited by high temperature
Topsoil seed bank	No
Direct seeding results	Moderate (0-400 seedlings/ha)
Seedling survival (severe summer drought)	Low in first year (3-20%)
Tubestock survival (severe drought)	Low in first year (10-20%)
Grazing susceptibility	High (kangaroos, rabbits, invertebrates)
Growth rates	Fast (0.3-1 m/year height)
First flowering	Over 5 years
Other impacts on seedlings	Grazing, parasitic galls, weeds

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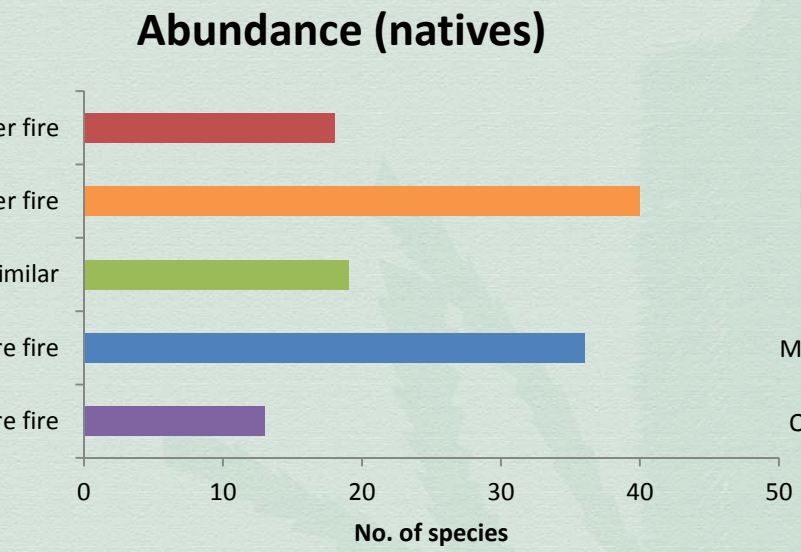
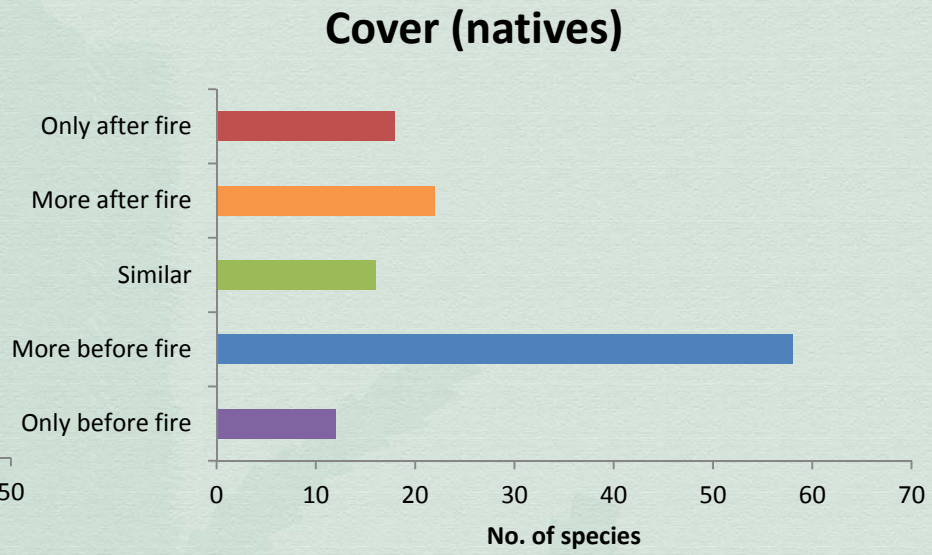
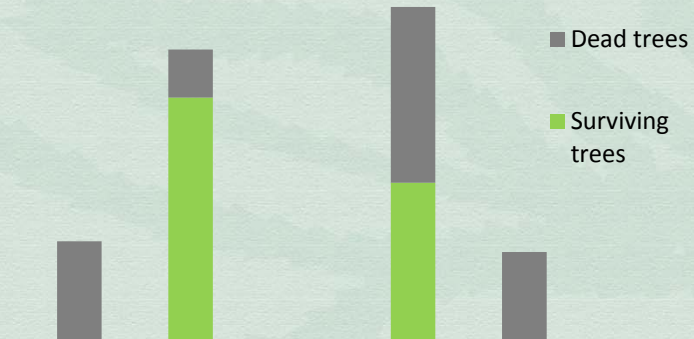
Fire Impacts in Banksia Woodland

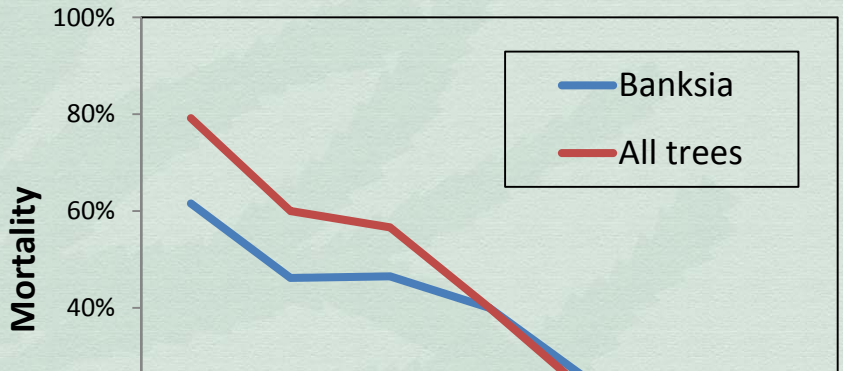
Fire Responsive Species

Fire Impacts on Plants

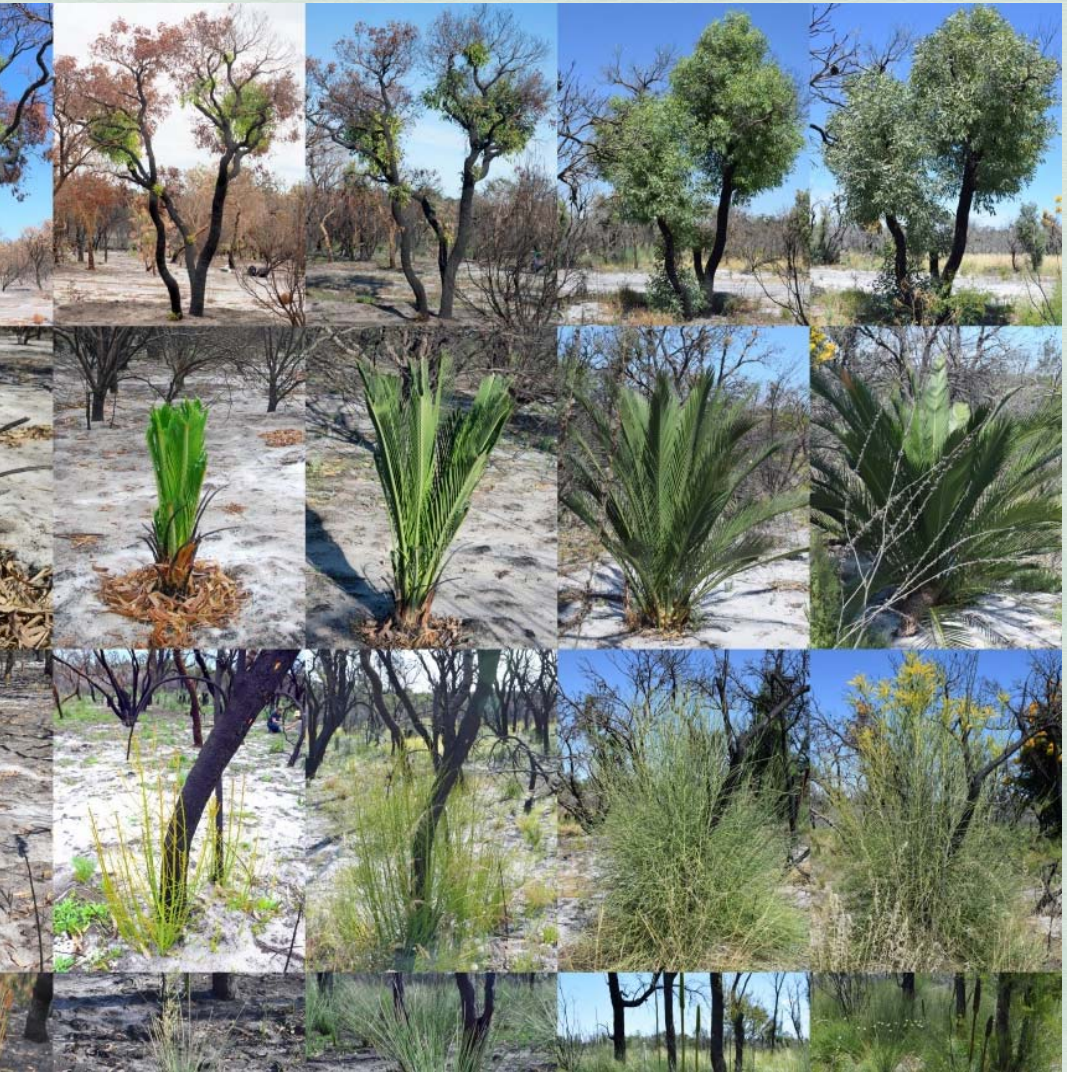








Recovery of Plants



25 Time series photographs which illustrate the recovery of common banksia woodland plants in the first 2 years after fire at Shirley Balla Swamp (Feb 2014 to Nov 2015).

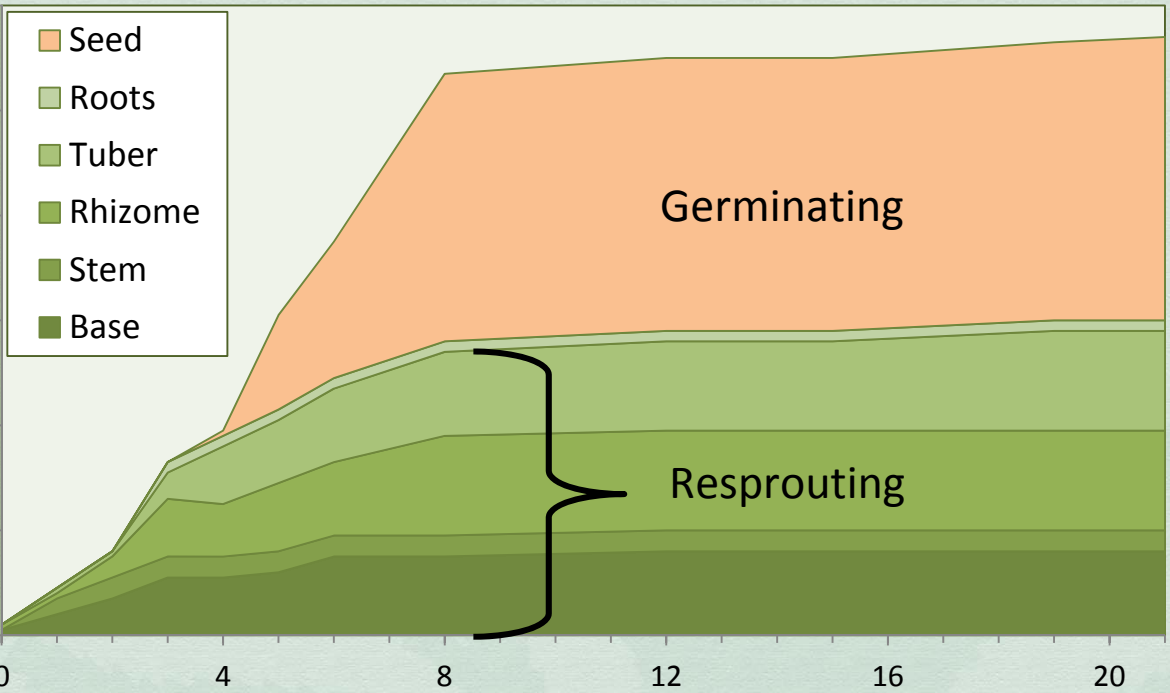
Row 1 - *Eucalyptus todtiana* - pricklybark tree.

Row 2 - *Macrozamia fraserii* - cycad.

Row 3 - *Nuytsia floribunda*, the WA Christmas tree.

Row 4 - *Xanthorrhoea* sp. -

at are they and where do they come from?



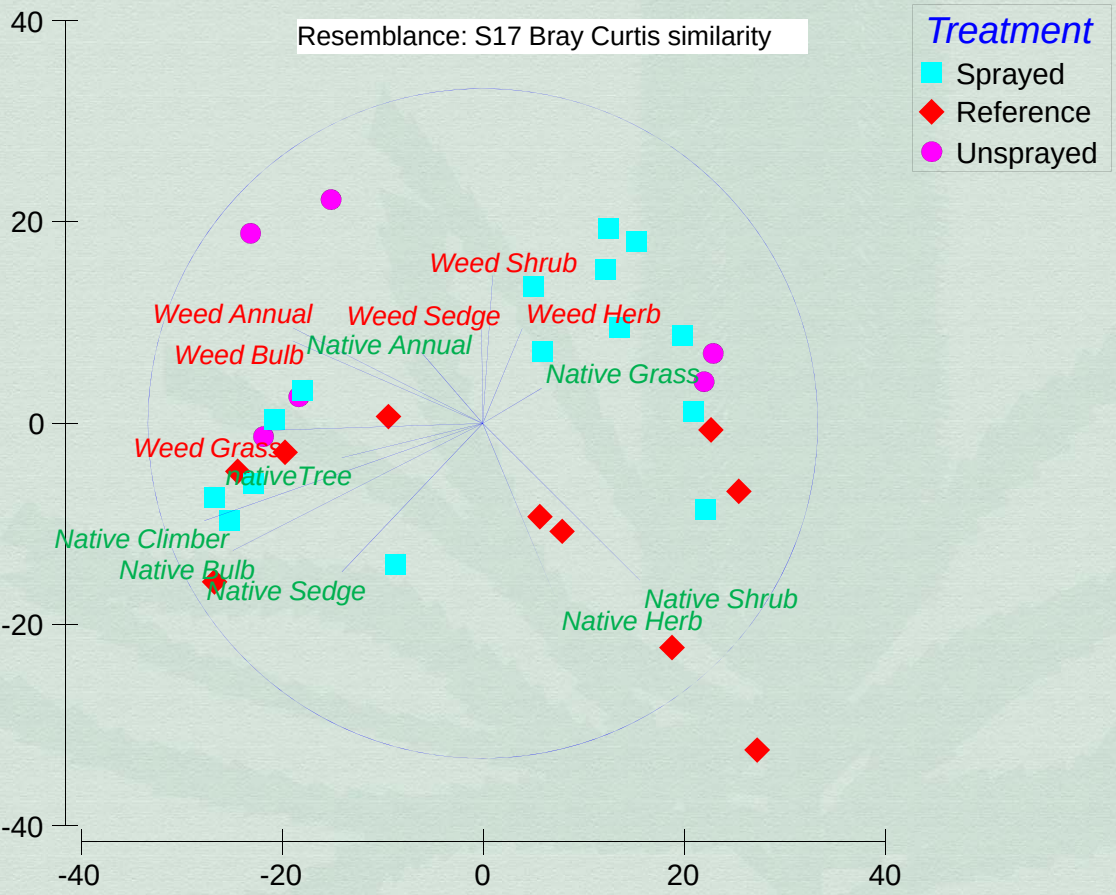
After weed control

8 months post-fire

12 months post-fire

Weed Control in Banksia Woodland

Responses to Weeds



- Vegetation structure differences in more weedy vs. less weedy plots in the same reserves (reference sites have low weed cover)

Banksia Woodland Community Grant Workshop

Data Required by Land Managers

Species lists for restoration sites:

- ✧ Sorted by habitat type (e.g. upland only)
- ✧ With soil/hydrology preferences
- ✧ With relative importance/frequency
- ✧ With seed collection/germination issues
- ✧ Flowering and seed dispersal times
- ✧ With restoration potential and issues
- ✧ Animal associations (e.g. Carnaby's cockatoo food plants)

Species data for land management:

- ✧ Fire recovery type and frequency

Species Ecology

mportance in reference sites
ge and month for flowering
& seed set
eed collection & storage
ermination or division in
ursery
ermination from topsoil
urvival after out-planting
rought impacts on seedlings
opsoil germination potential
irect seeding potential
rowth rate and lifespan
eedling susceptibility to:

1. Importance in reference sites
2. Habitat/substrate preferences
3. Provenance data
4. Flowering season and age
5. Pollination rates and pollinators
6. Seed set time & amount
7. Drought impacts on adults
8. Fire impacts and recovery
9. Seedling recruitment
10. Tolerance to disturbance
11. Growth rate and lifespan

cological Report Card *Banksia attenuata*

tor	Data
etation associations	Banksia woodland
sity, frequency, cover	50-500 stems/ha, common, cover high
vival after fire	High or low (85% or less)
eneration after fire	Sprouting from canopy (25%), stem (23%), or base (15%)
d germination after fire	High (1300 seedlings/ha)
dling survival (severe summer ught)	Low over first summer (16%)
er impacts on seedlings	Grazing and weeds
wth rates	No data
t flowering	Over 5 years
ination	High (birds, insects)
d Production (in a dry summer)	0-101 seeds per tree (average 15)
d dispersal	Wind, cockatoos
ease susceptibility	High (Phytophthora dieback, cankers etc.)

New Banksia Woodland Datasets

Data available for in NatureMap

- ✧ Species lists with cover and abundance from 31 plots
- ✧ Species occurrence data from 51 Plots

Identification resources online

- ✧ Banksia woodland plants photo resource
- ✧ Banksia woodland pollinators and other invertebrates
- ✧ Reference herbarium

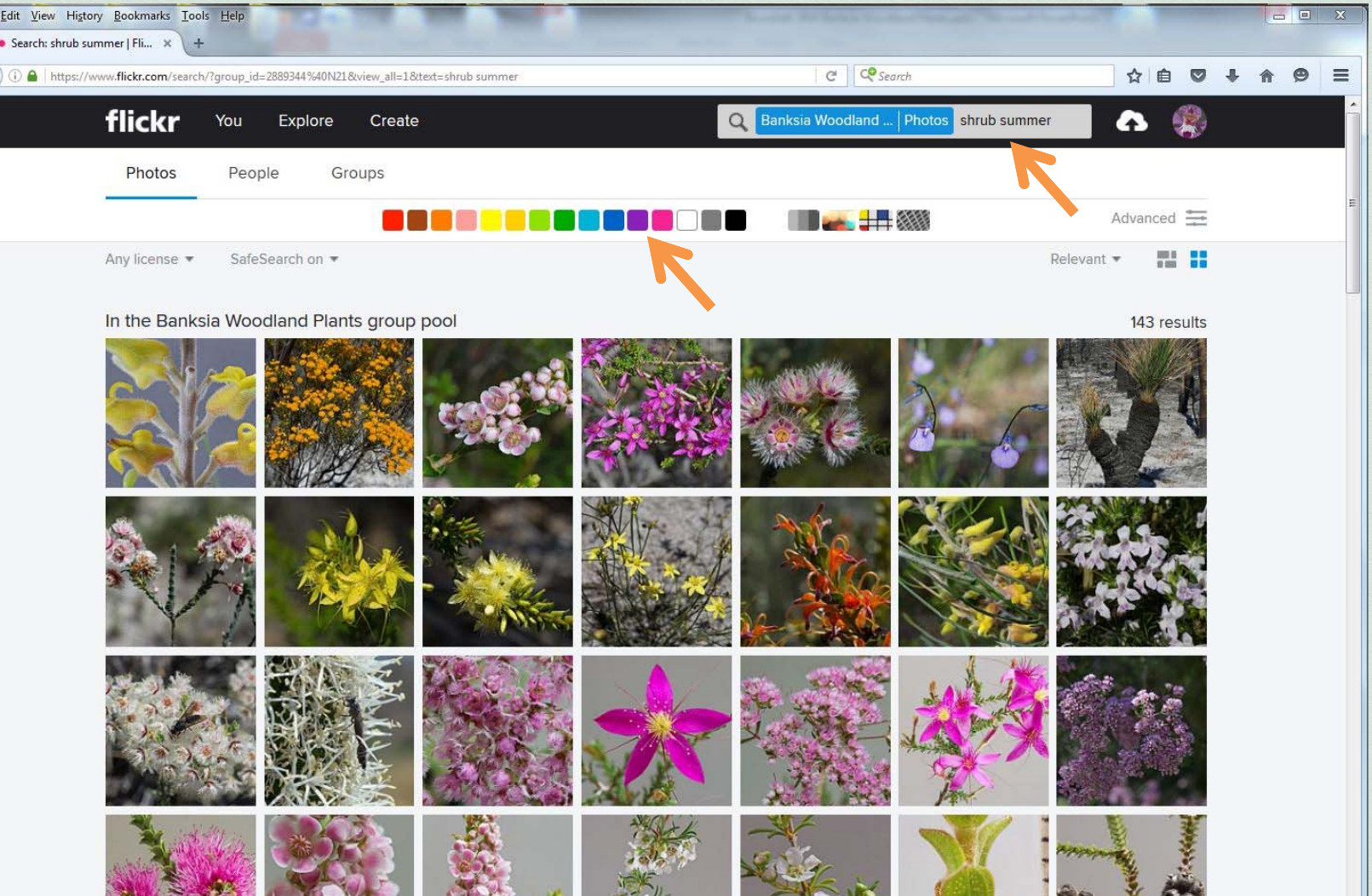
Ecological datasets

- ✧ Fire recovery strategies and frequencies
- ✧ Fire recovery trend data for species
- ✧ Weed management impacts on species
- ✧ Restoration potential for species

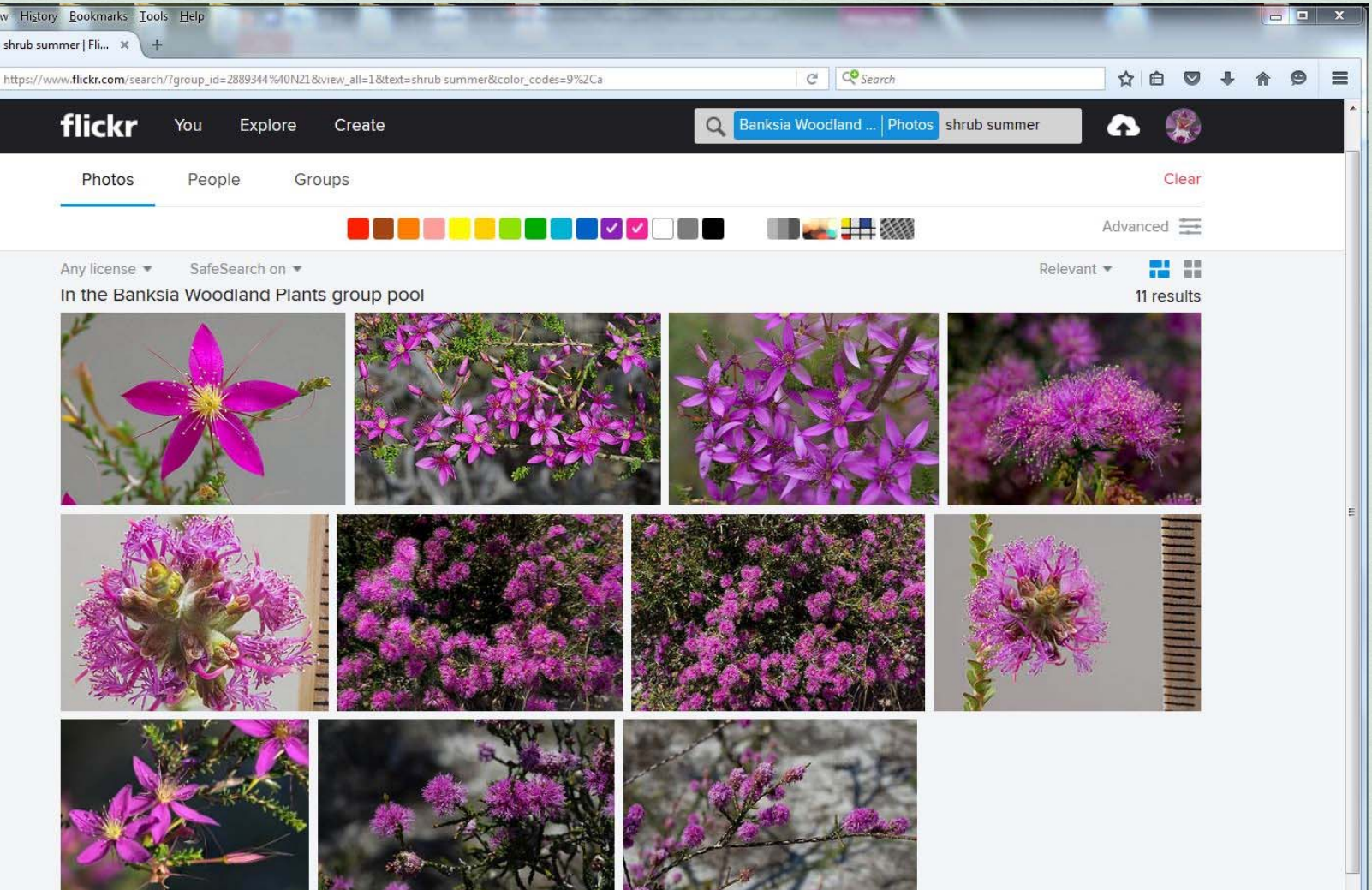
Department of Parks and Wildlife

WOODLAND RESTORATION

nksia Woodland Plant Identification Tool



Purple Summer Shrubs



Functional Traits Data

Growth form (tree, shrub, grass, etc.)

Lifeform (annual, perennial)

Storage organs, regeneration type

Landforms, soils, hydrology

Vegetation types

Distribution pattern (e.g. near edge of range)

Mineral nutrition strategy (mycorrhizas, nitrogen fixing)

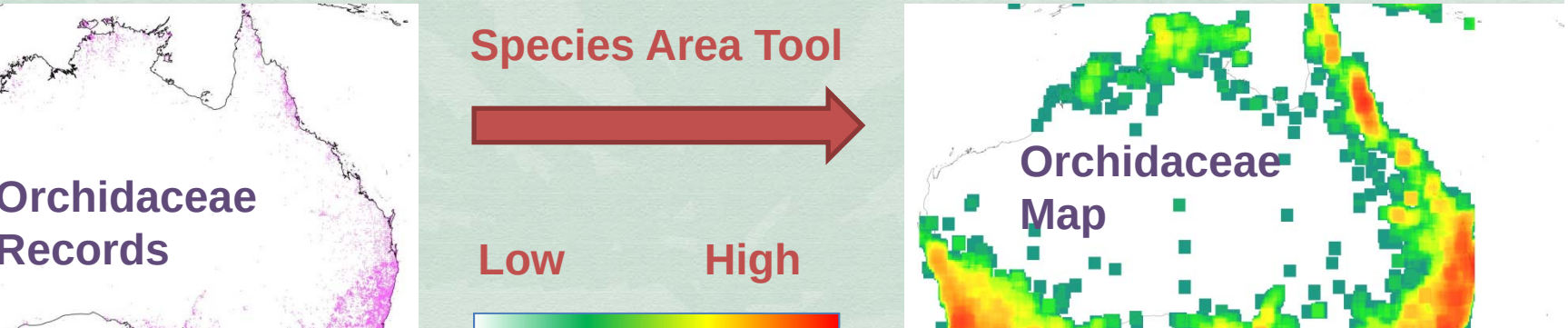
Other strategies (carnivores, parasites, etc.)

Diversity of Mycorrhizal Plants at a Continental Scale

Diversity maps for nutrition strategies map species richness of defined groups of species for Australia (EM hosts, orchids, Ericaceae, N^2 fixers and types of NM plants)

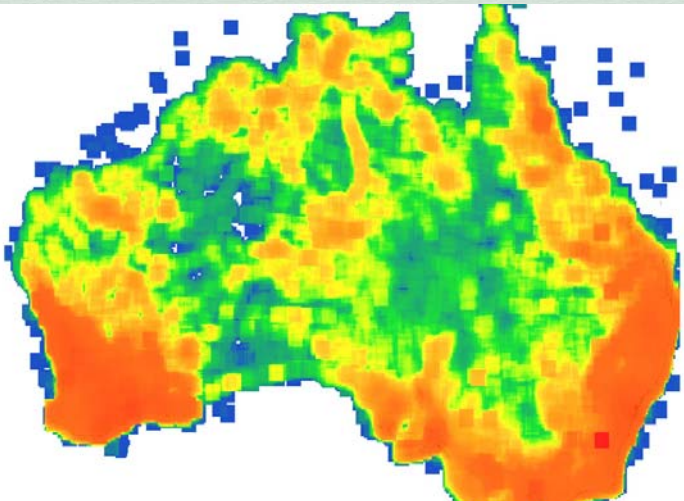
Species Area tool using data from all collections and records in the Atlas of Living Australia (www.ala.org.au)

Sampled diversity is affected by sampling effort

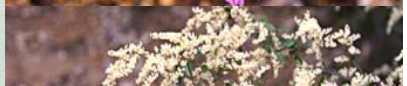


Ectomycorrhizal Plants

versity estimates:
spp. in Australia
spp. in West
lia
spp. global estimate
genera & 26 families

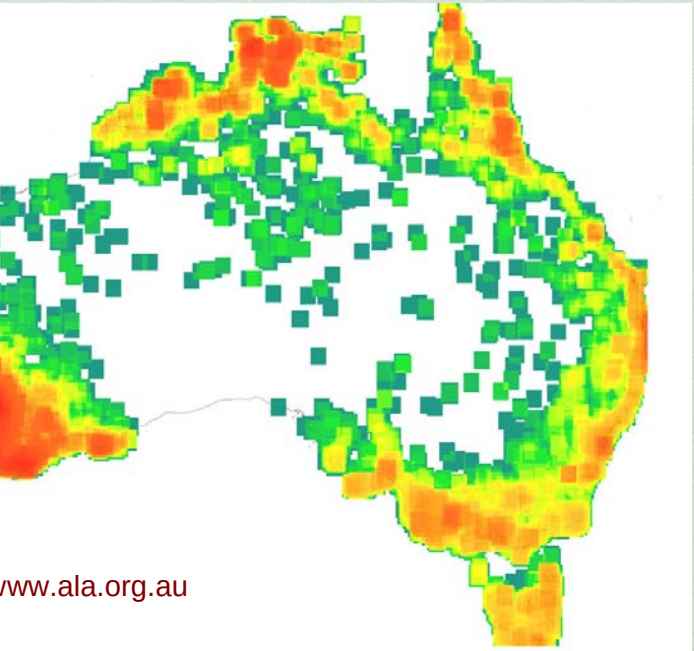


Diversity of host plants



ceae	*Agonis*, Allosyncarpia, Angophora, Asteromyrtus*, Callistemon*, Corymbia, Eucalyptus, Kunzea*, Leptospermum, Melaleuca**
uarinaceae	*Allocasuarina*
osoideae	*Acacia** (some only)
ceae	*Dillwynia, Gastrolobium, Gompholobium, Mirbelia,*

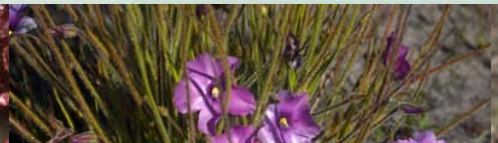
Carnivorous Plants

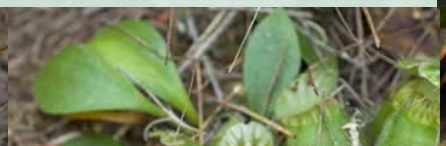


Host diversity estimates:

- 600 spp. globally
- 212 spp. in Australia
- 150 spp. in Western Australia*

uthwest Floristic Region is the global centre of
rsity for carnivorous plants with ¼ of all
wn species!





Acknowledgements

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