What determines species distribution limits along an altitudinal gradient in Acacias?

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## **Climate Change**



 Hot extremes will be more frequent and intense with increases in drought and heat waves and less rainfall in Southern Australia.

 Mountain ecosystems particularly vulnerable to higher temperatures with a trend towards drier conditions and increased fire risk.

#### Aim:

To investigate species distribution limits and local adaptation in *Acacia* along an altitudinal gradient

#### **Research Questions:**

- What determines species distribution limits along an altitudinal gradient?
- Are plants locally adapted to different altitudes?



## **Experimental Design**

#### **Reciprocal Transplant**

#### Widespread species Acacia suaveolens, A. ulicifolia



#### **Restricted species**

#### Acacia linifolia (low)

A. obtusifolia (high)

low (< 400m)

mid (450 - 750m)

high (> 800m)

# Species contrasts

#### Widespread



A. suaveolensCollections:2 low, 2 mid, 2 high



A. ulicifoliaCollections:2 low, 2 mid, 2 high

#### Restricted



A. linifolia (low)Collections:2 low, 2 mid



A. obtusifolia (high)Collections:2 mid, 2 high

### **Seed Collection**



## **Site Selection**

- Recently burnt
- Sandstone soil
- Acacia species present
- Similar site characteristics
- >1km apart

## **Site Characterisation**

- Temperature
  - air and soil logged hourly
- Soil analysis

collection and planting sites



## **Seedling preparation**

- Sorted to remove immature/ damaged seed
- Sterilized seed and sand
- Established in a randomised block design
- Grown in nurseries with a constant watering regime to acclimatize
- High sites Katoomba (Wild Plant Rescue)
- Low sites Glenbrook (Native Plant Reserve)



## Transplant

#### **Experimental plantings**

- 3 low, 3 high sites
- 6 plots per site



Scarified seed -Establishment

4 seed cache (10)

Am<br/>See<br/>withTransplantedSeed12,800Seedlings2,880



per seedlot

- Canopy Volume
- Survival

### **Temperature variability**



## **Hypotheses**

- Local origin will have greater fitness than foreign material (i.e. local is best)
- 2. Restricted species have greater fitness than widespread species in their local climate
- 3. Planting beyond the species distribution will result in greater fitness losses than similar distances within species range limits

### **Key outcomes**

- Plant fitness decreased with altitudinal transfer distance providing evidence for local adaptation in low altitudes.
- Seed were able to establish beyond their range indicating dispersal limitation.
- High altitudes may be more vulnerable to climate change with low establishment and reduced local fitness.
- Assisted migration for low to high altitudes would provide enhanced adaptive capacity to climate change.





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