# Climate change induced trends in alpine vegetation over the last 15 years in the Australian Alps


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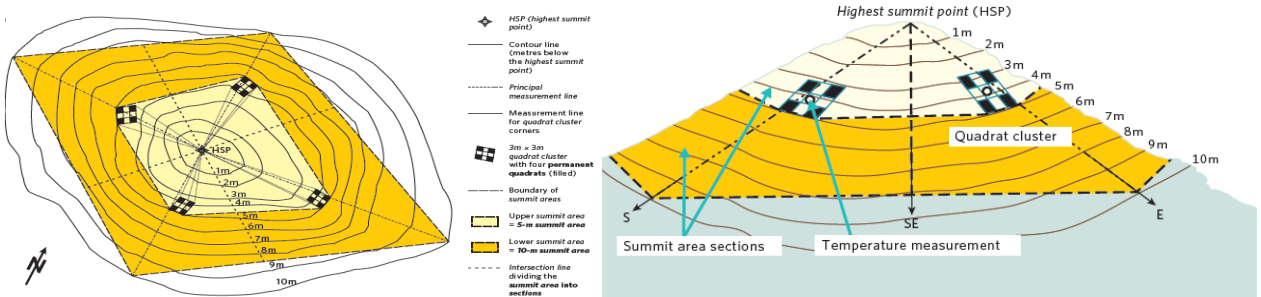
*Workshop 2.2D I: Mountain biodiversity and ecosystems under global change*

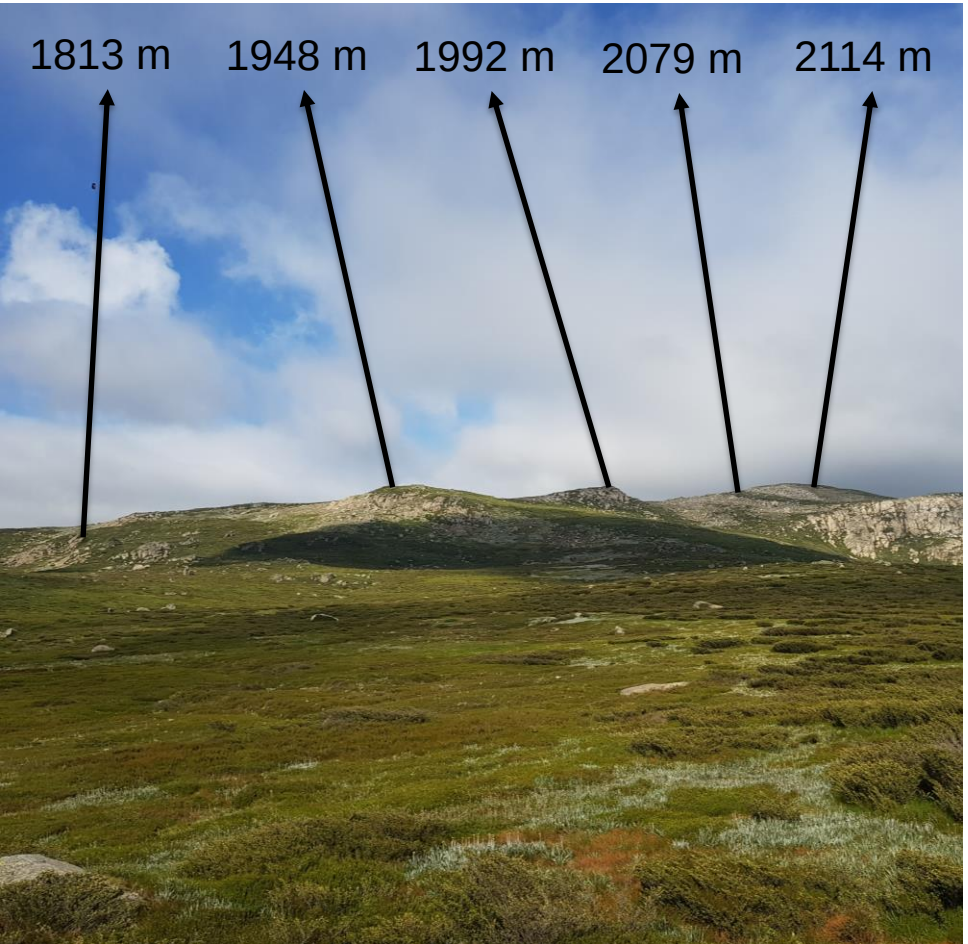
# GLORIA in the Australian Alps

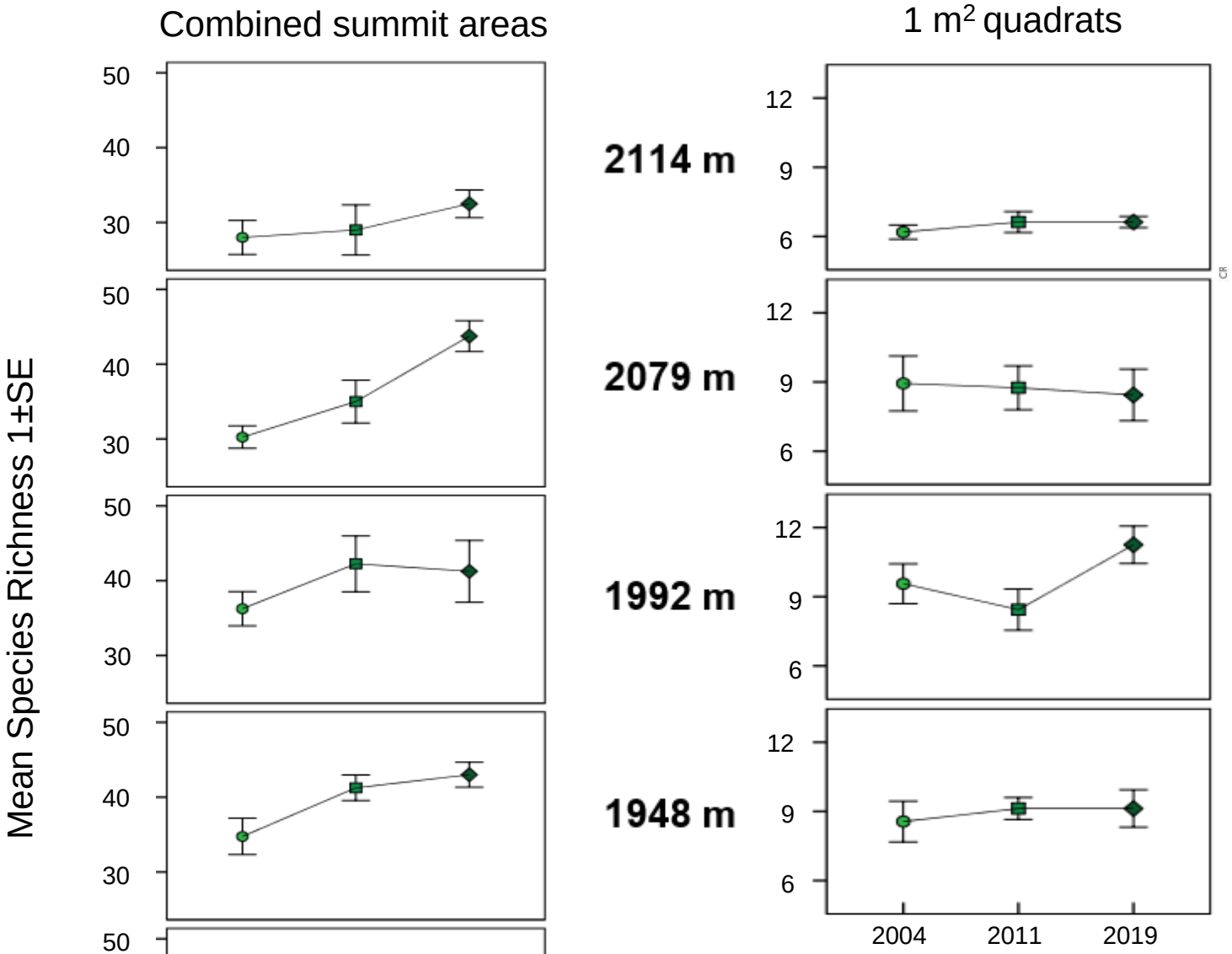
- Australian Alps - deep, aeolian soils support biodiversity, high endemism
- Near complete vegetation cover on alpine summits
- Restricted geographically and altitudinally – no nival zone
- One of three most threatened ecosystems from CC in Australia
- ↑ Temperatures ~1.2 degrees & ↓ snowpack and precipitation
- Long-term monitoring of alpine ecosystem – bioindicator of CC
- GLORIA AU-KNP:  5 summits, 3 censuses (2004, 2011, 2019)



# Increased Species Richness

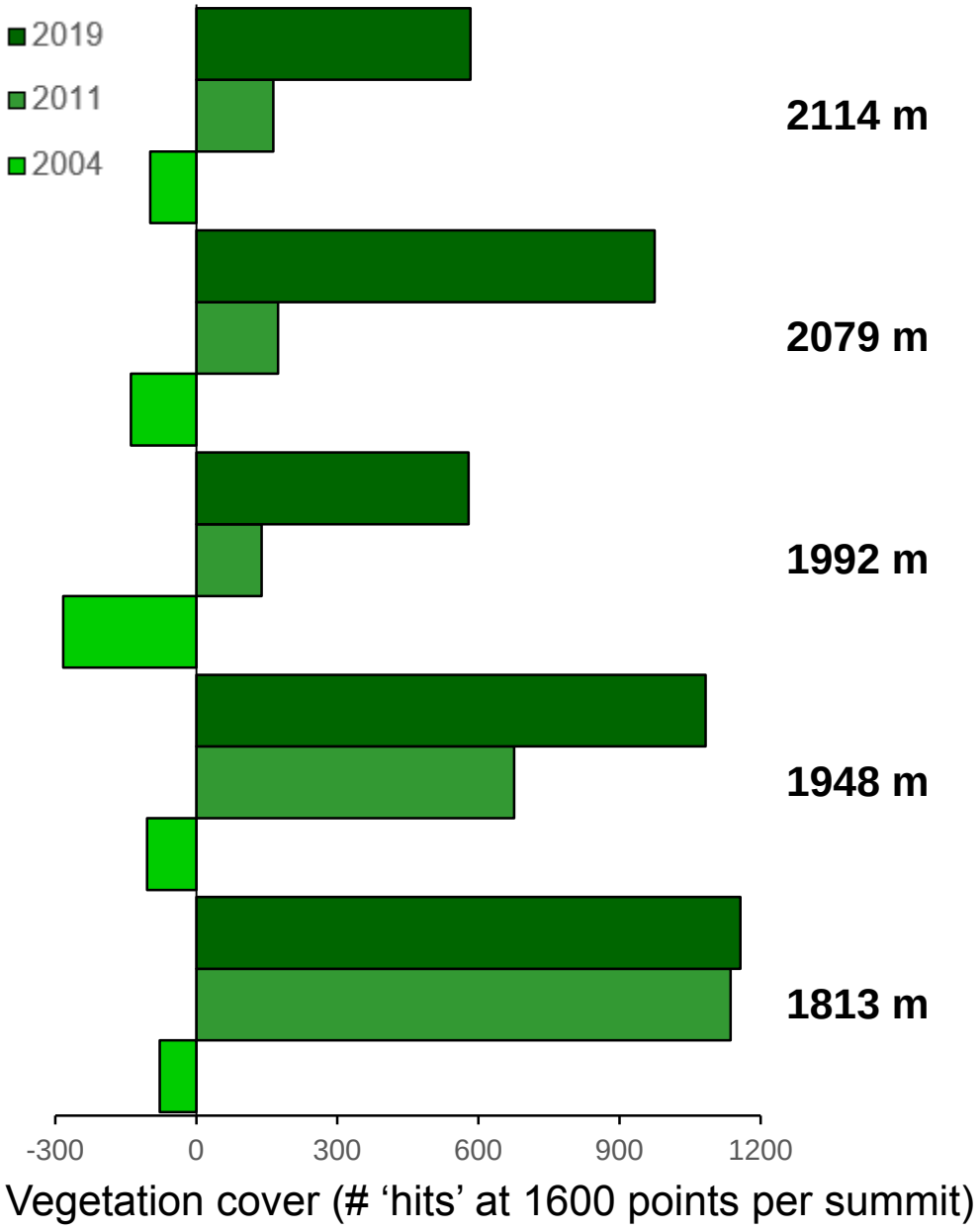
| I | J | Contrast Estimate (I-J) | SE | P-value |
|---|---|---|---|---|
| 2011 | 2004 | 3.91 | 1.87 | **0.029** |
| 2019 | 2011 | 3.87 | 1.97 | **0.031** |
| 2019 | 2004 | 7.78 | 1.92 | **<0.001** |

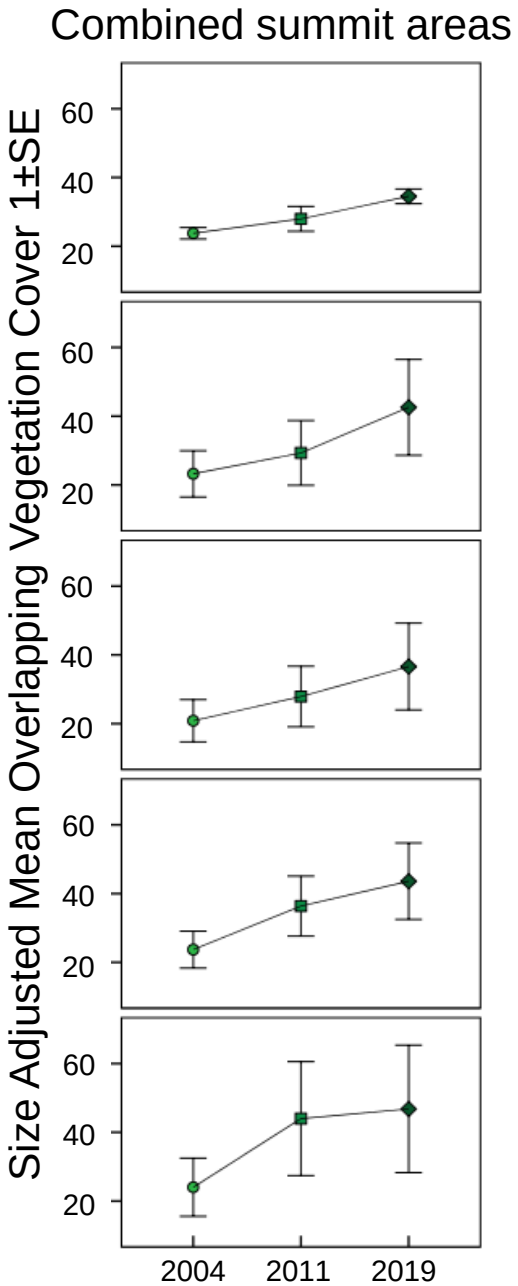


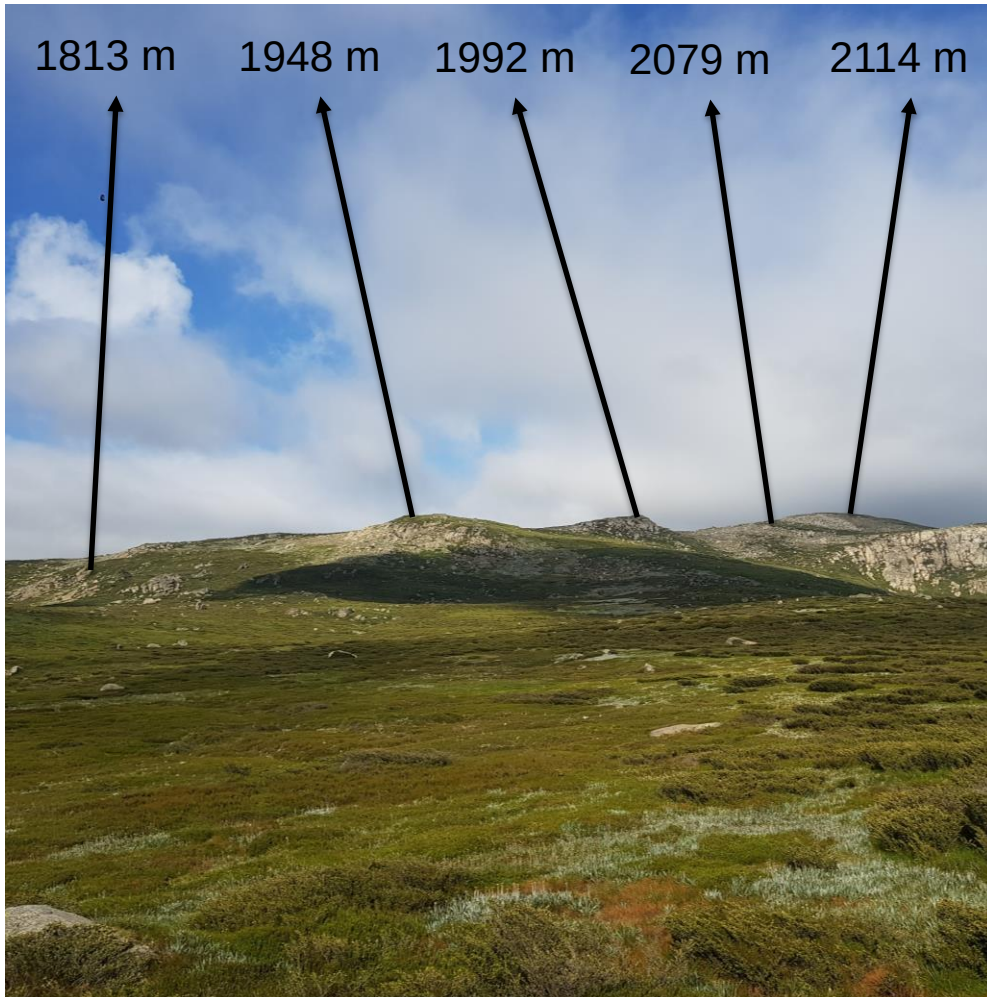

| Fixed Effects | F | P-value |
|---|---|---|
| Census | 0.601 | 0.549 |
| Aspect | 1.306 | 0.274 |

# Densification of Summit Vegetation




| I | J | EMM Difference (I-J) | SE | P-value |
|---|---|---|---|---|
| 2004 | 2011 | -9.985 | 2.236 | **0.001** |
| 2011 | 2019 | -7.714 | 1.518 | **<0.001** |
| 2004 | 2019 | -17.699 | 2.877 | **<0.001** |



# Drivers of Climate Change Induced Trends

- Climate has changed (less snow, warmer temperatures and less precipitation)
- Vegetation is denser – possibly taller and greater biomass
- Increase in graminoids and shrubs through time
- High species turnover (38%) from 2004 – 2019 at small scale (1 $m^2$ quadrats)
- But significant shifts in species composition across all spatial scales may require more time
- What next? GLORIA IV – scheduled for 2026

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