


# Contrasting responses of insect communities to grazing intensity in lowland heathlands



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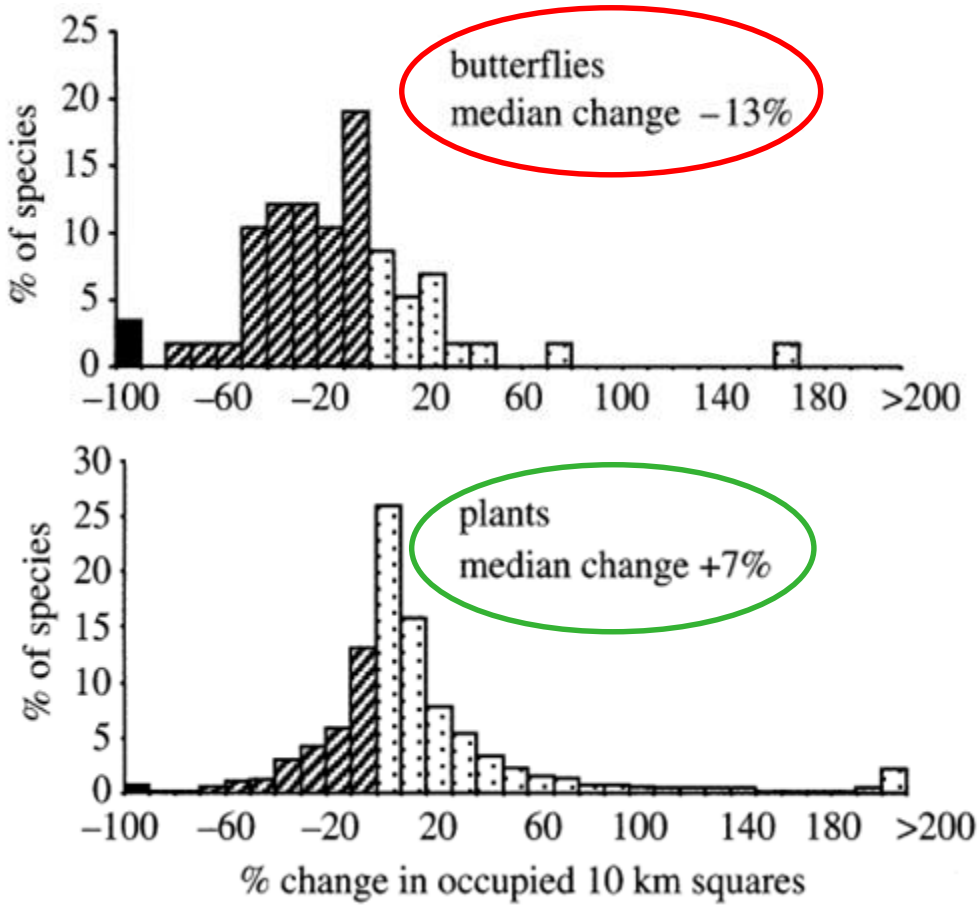
# Do diversity changes match in plant and insect communities?




*Distribution changes in UK 1950 – 2000*

*Thomas et al. (2004) Science 303, 1791-1796*

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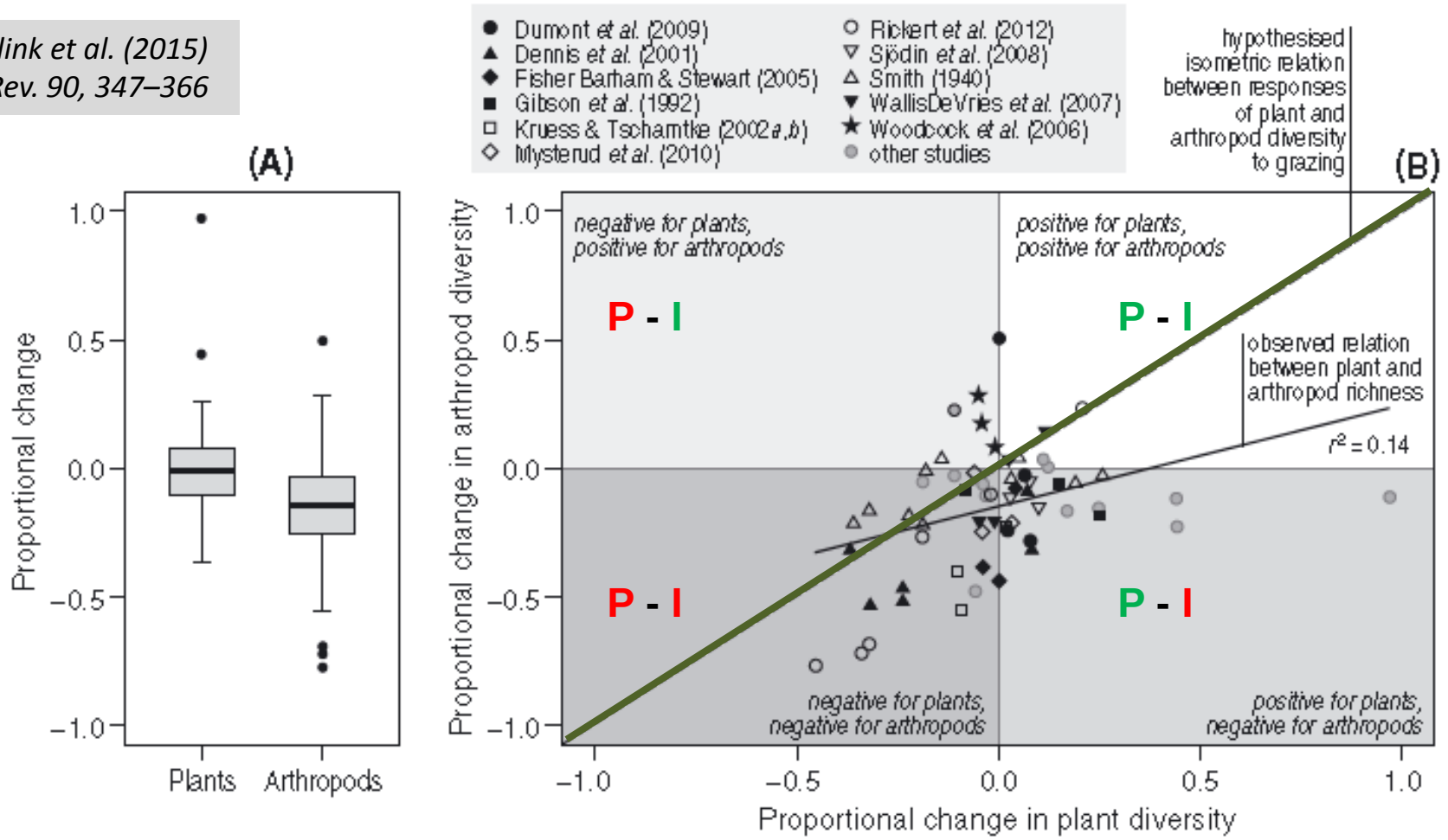
# Insects vs. Plants and grazing intensity

- Insects more vulnerable to increasing grazing intensity than plants

*Van Klink et al. (2015)*
*Biol. Rev. 90, 347–366*



# Insects vs. Plants and grazing intensity

- Insects more vulnerable to increasing grazing intensity than plants
- BUT:
  - This only concerns overall species richness
  - What about differences between species?
  - " " " between species groups?
  - Can we identify species with different vulnerability?
  - … on which criteria?

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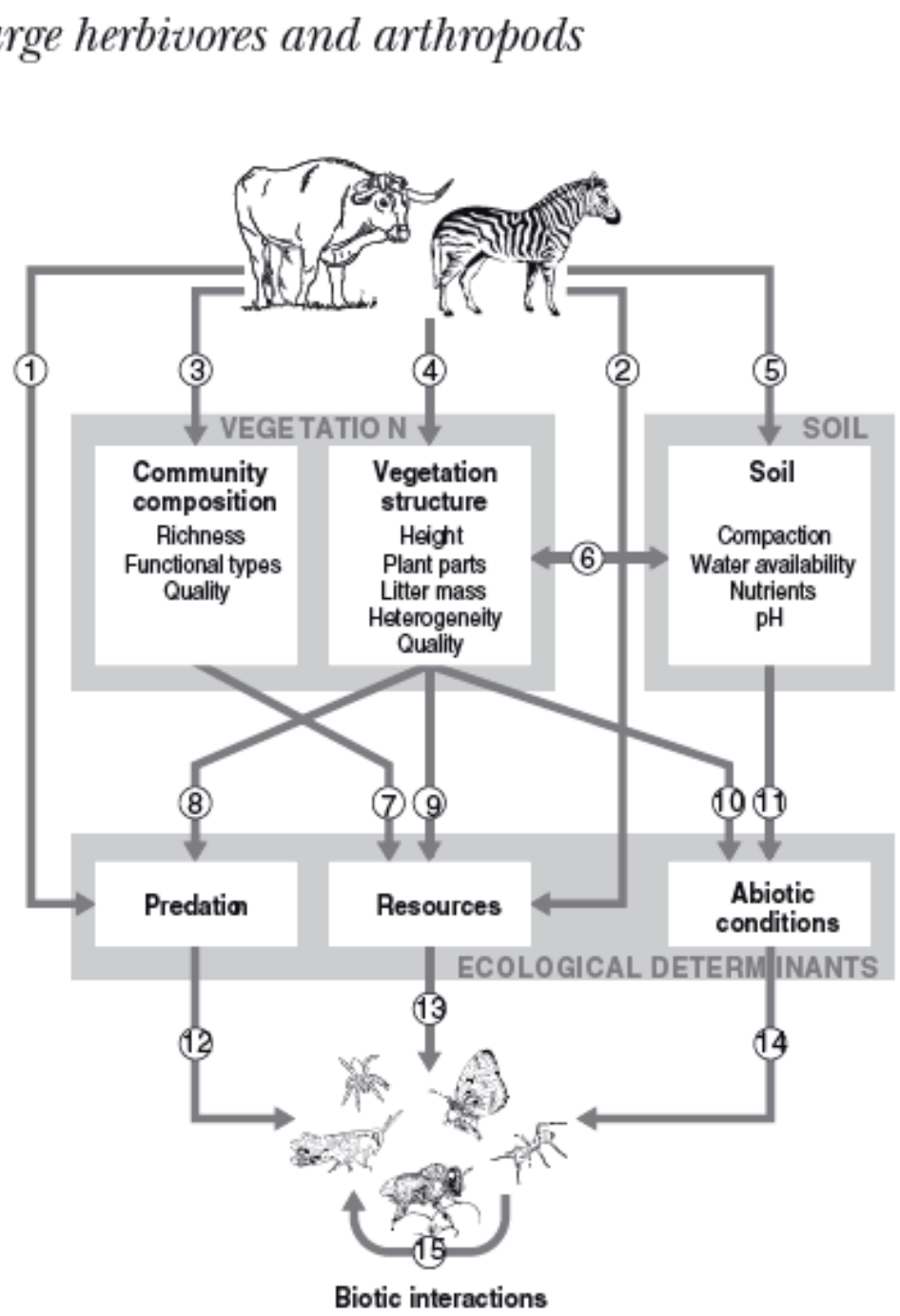
# Pathways of Herbivore Impact




*Van Klink et al. (2015) Biol. Rev. 90, 347–366*

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# Response to Vegetation structure

- Salt marsh arthropods under sheep grazing

*Van Klink et al. (2013) Biol. Conserv. 164: 150-157*

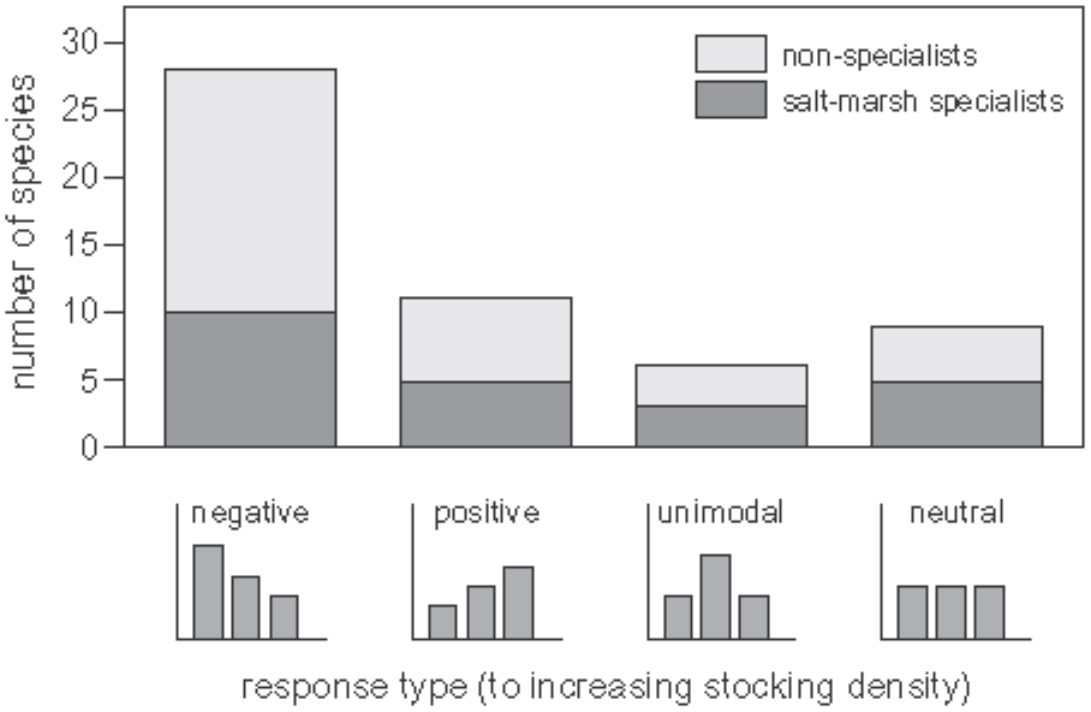


**Fig. 1.** Number of arthropod species (total abundance >10) representing each of four response types to increasing stocking densities (no grazing, 3–4 sheep ha $^{-1}$, and 10 sheep ha $^{-1}$) on three salt marshes in the German Wadden Sea. Bars are subdivided in salt-marsh specialists (grey) and non-specialists (mostly ubiquitous and common species; white). All species, their habitat classification and response type are listed in Table S1 (online supporting material).

# A Successional Framework

- The ‘good old’ Intermediate Disturbance Hypothesis:

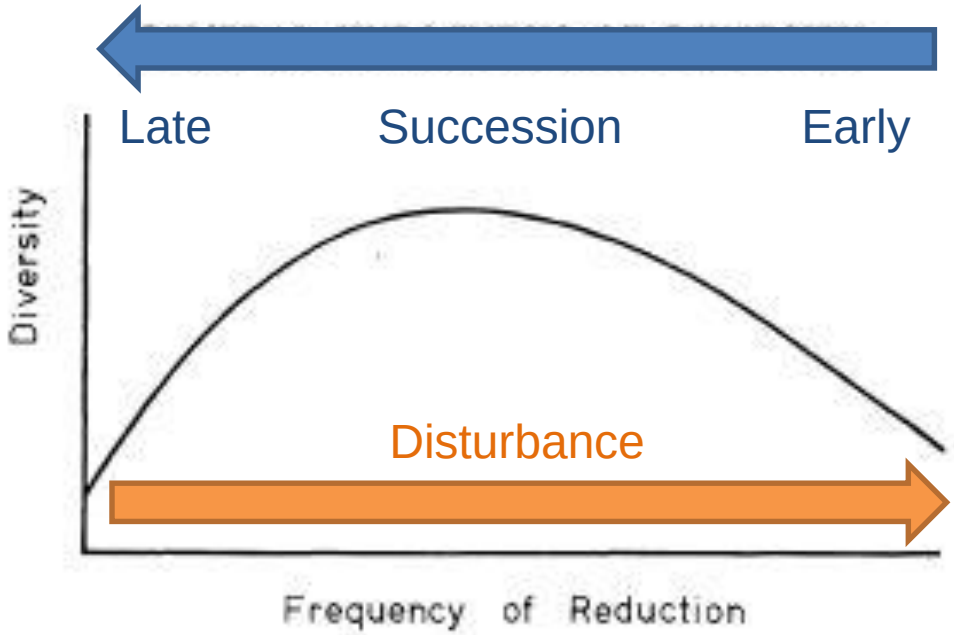


FIG. 4.—Predicted relationship of diversity and frequency of population reduction; the magnitude or intensity of reduction (i.e., whether populations are reduced by .1, .5, or .9) has the same relationship to diversity.

*Huston (1979)* Dynamic Equilibrium Model – *Amer. Nat. 113: 81–101*

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# A Successional Framework

- Species classification based on Habitat characteristics:

Late Succession Early

| | | |
|---|---|---|
| *Plant canopy:* | tall | short |
| *Heterogeneity:* | vertical (canopy structure) | horizontal (patchiness) |
| *Microclimate:* | cool | hot |

Low Grazing intensity High

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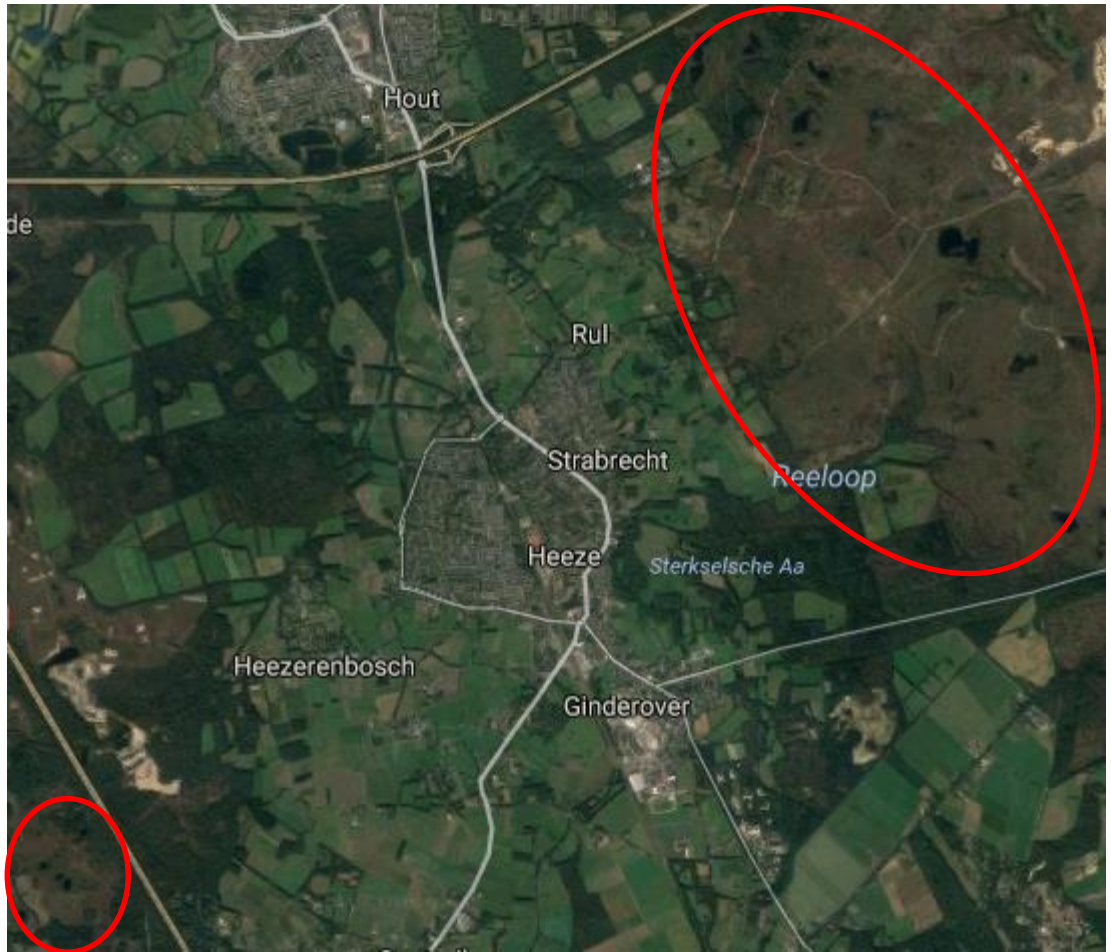
# A case study with heathland insects

- 16 plots (50x50 m) Strabrechtse Heide

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# A case study with heathland insects

- 16 plots (50x50 m) Strabrechtse Heide
  - Grazing intensity: ungrazed – low-intensity – high intensity
  - Hydrological gradient: wet & dry
- Vegetation survey
  - Botanical composition & Canopy height / bare ground
  - Dung density
- Time effort counts for:
  - Butterflies & day-active moths
  - Grasshoppers & crickets
  - Ants

*WallisDeVries et al. (2016) AGEE 234: 72-80*

# A case study with heathland insects

# PCA on Habitat Conditions

- PC1: wet-dry
- PC2: ungrazed-heavy grazing

| | PC1 | PC2 |
|---|---|---|
| Eigenvalue | 6.02 | 2.45 |
| % Explained variation (rotated) | 36.0 | 34.6 |
| % Cumulative explained | 36.0 | 70.6 |
| *Erica tetralix* | -0.94 | -0.24 |
| *Trichophorum cespitosum* | -0.75 | -0.13 |
| *Gentiana pneumonanthe* | -0.74 | 0.24 |
| *Agrostis vinealis* | 0.76 | 0.35 |
| *Deschampsia flexuosa* | 0.75 | 0.05 |
| *Calluna vulgaris* | 0.71 | 0.08 |
| *Molinia caerulea* | -0.66 | -0.63 |
| *Rumex acetosella* | 0.65 | 0.70 |
| *Corynephorus canescens* | 0.46 | 0.20 |
| *Festuca ovina* | 0.40 | 0.76 |
| %Cover Tall Vegetation (H >50 cm) | 0.06 | -0.87 |
| Faecal Grazing Intensity Index | 0.03 | 0.89 |
| %Cover Short Vegetation (H< 25 cm | 0.14 | 0.92 |

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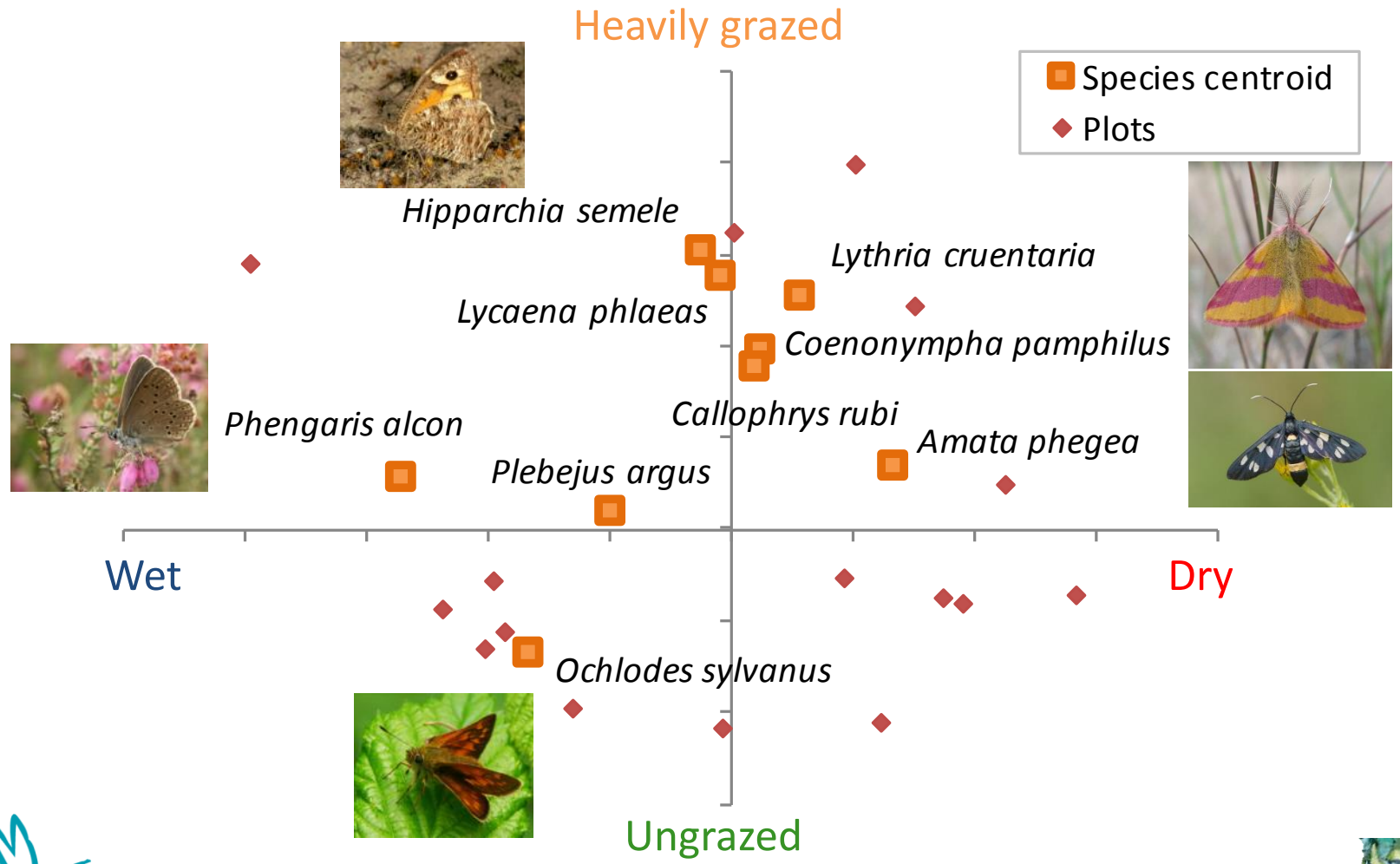
*WallisDeVries et al. (2016) AGEE 234: 72-80*

# Species ordination: *Lepidoptera*

(5 Early, 3 Late successional species, 3 unknown)

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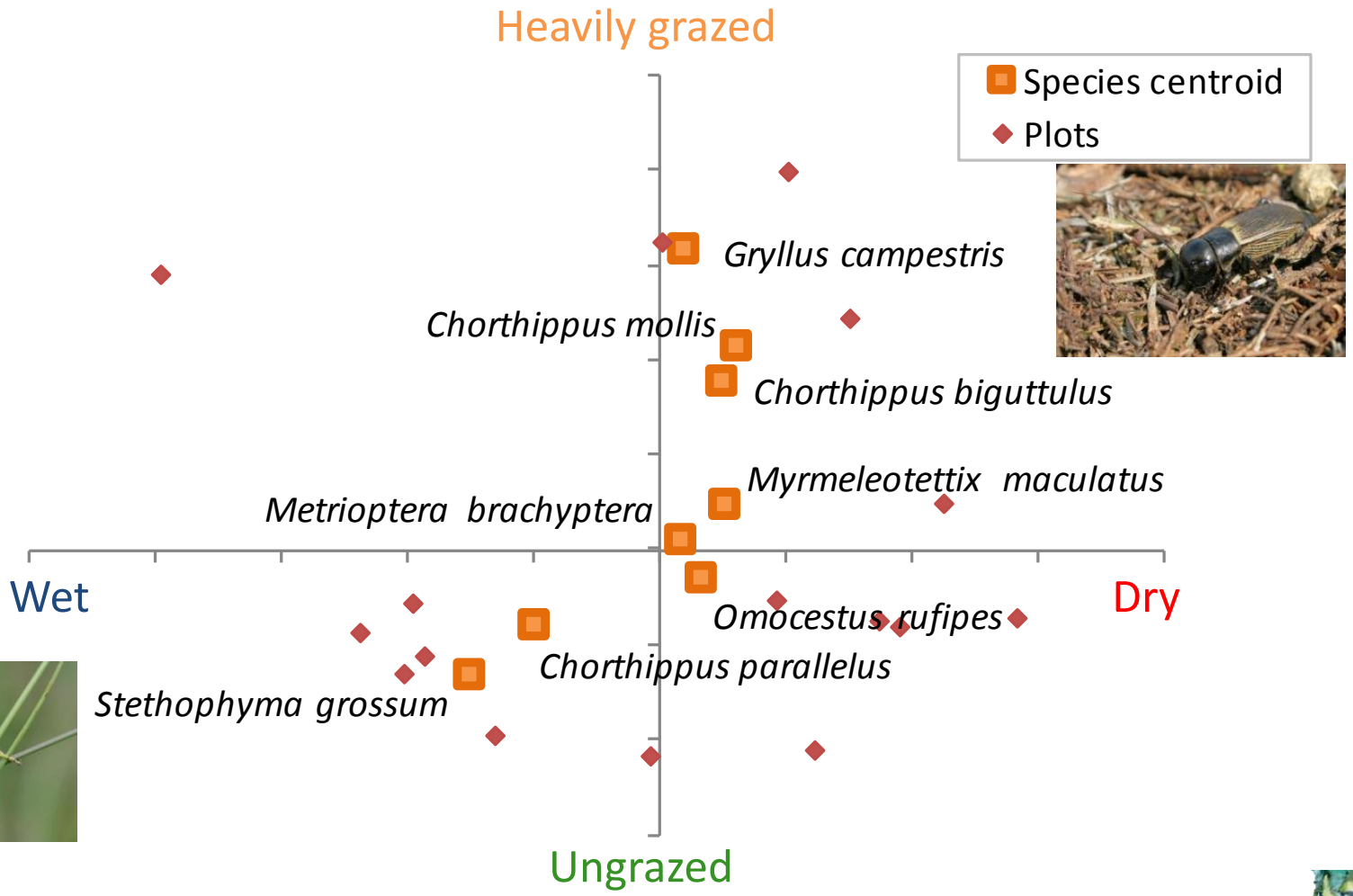
*WallisDeVries et al. (2016) AGEE 234: 72-80*

# Species ordination: *Grasshoppers*

(6 Early, 5 Late successional species)



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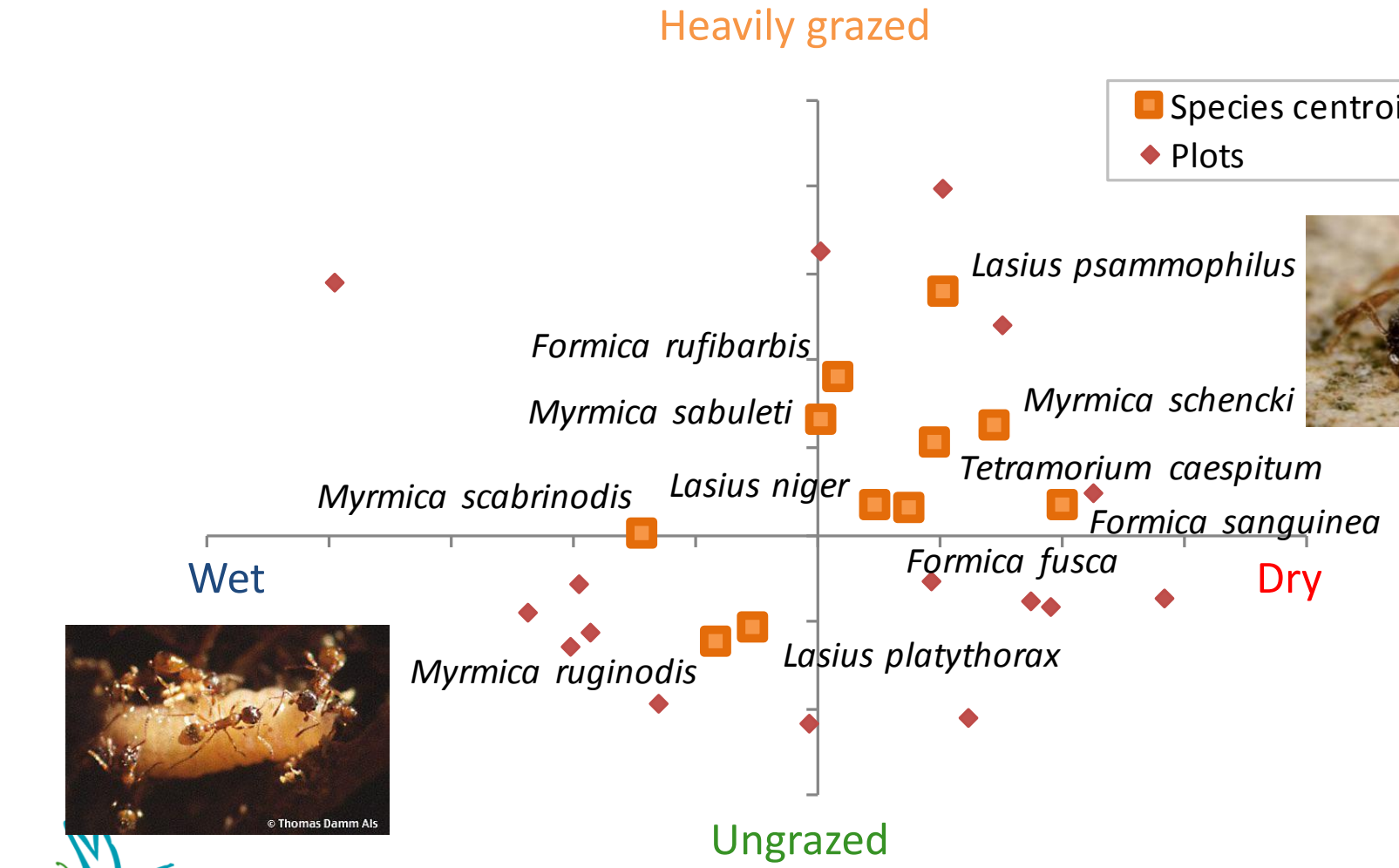
*WallisDeVries et al. (2016) AGEE 234: 72-80*

# Species ordination: *Ants*

(13 Early, 5 Late successional species)







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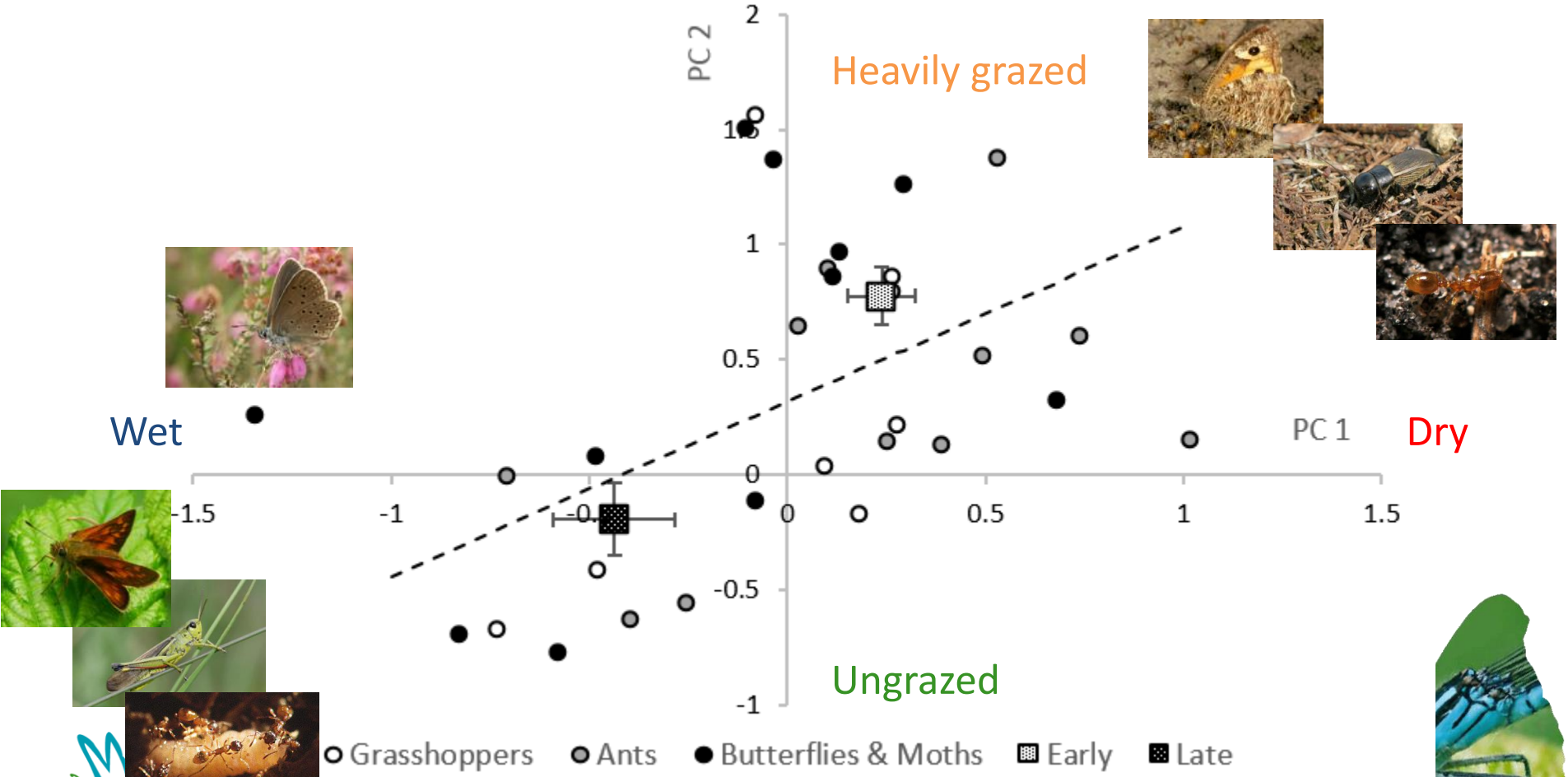
*WallisDeVries et al. (2016) AGEE 234: 72-80*

# Overall species ordination

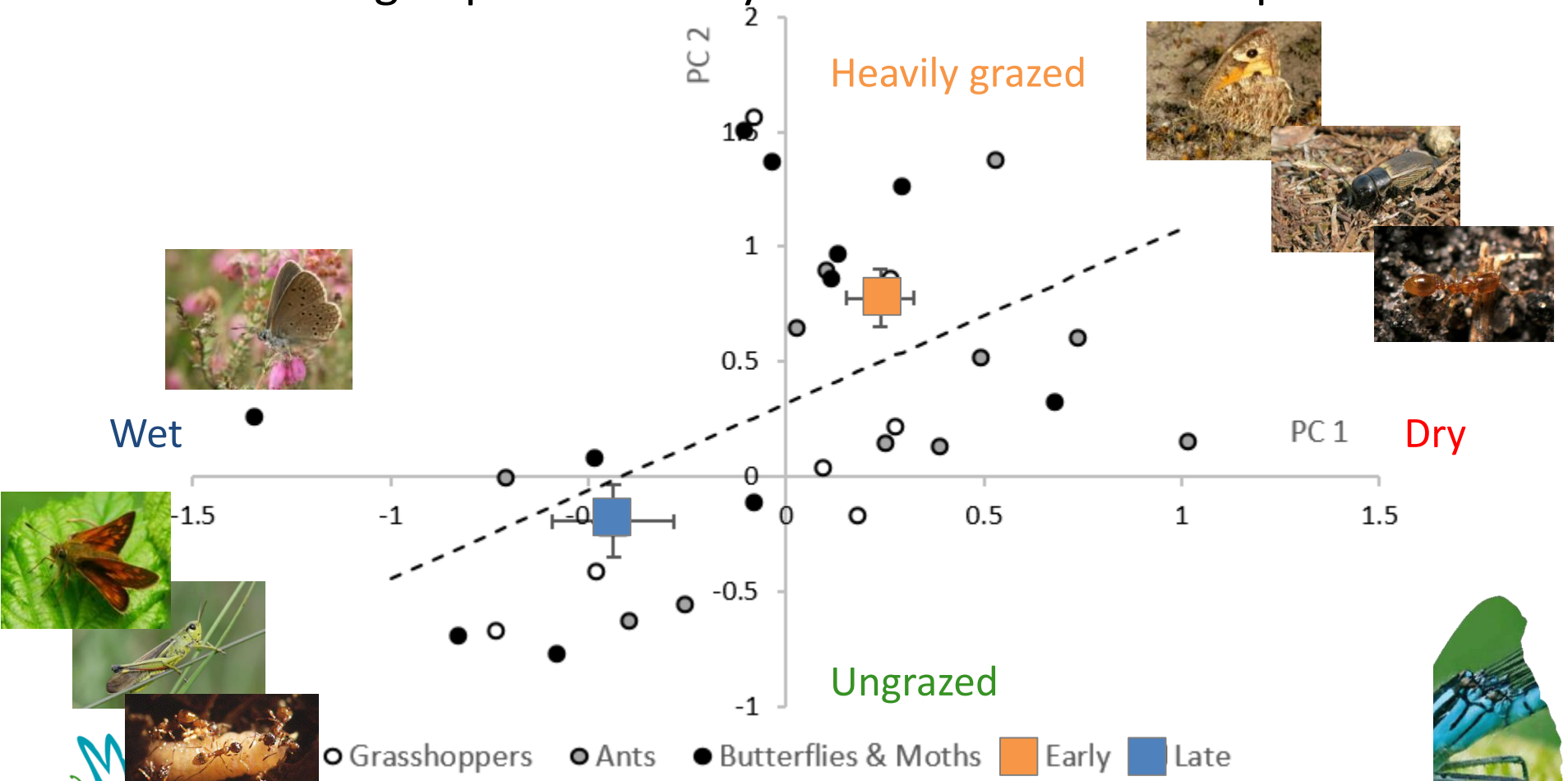
- Contrasting impacts on early and late successional species




*WallisDeVries et al. (2016) AGEE 234: 72-80*

# Responses in Successional Framework

- Contrasting impacts on early and late successional species





















*WallisDeVries et al. (2016) AGEE 234: 72-80*

# An outlier: *Phengaris alcon*

- Compatible with high grazing intensity due to temporary exclusion of grazing during flight period and early larval development

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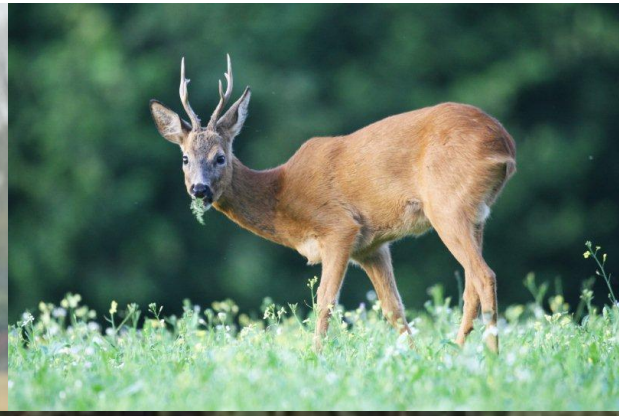
# Could it work with Wild Ungulates?

- Case study on Hoge Veluwe (8 heathland plots)
- Time effort counts of butterflies & grasshoppers (2012-2016)



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*WallisDeVries & Bokdam (2016)*

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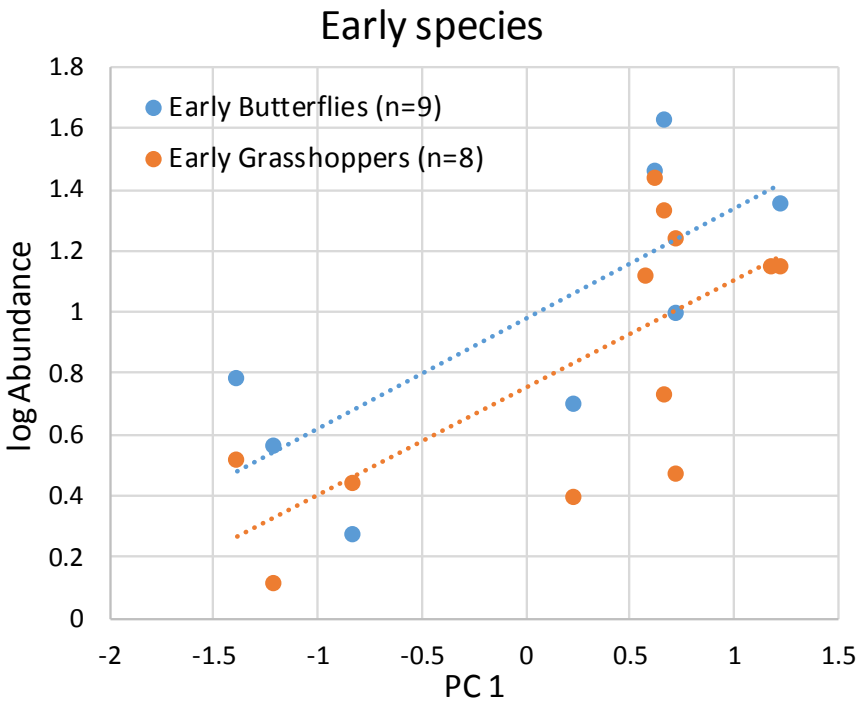
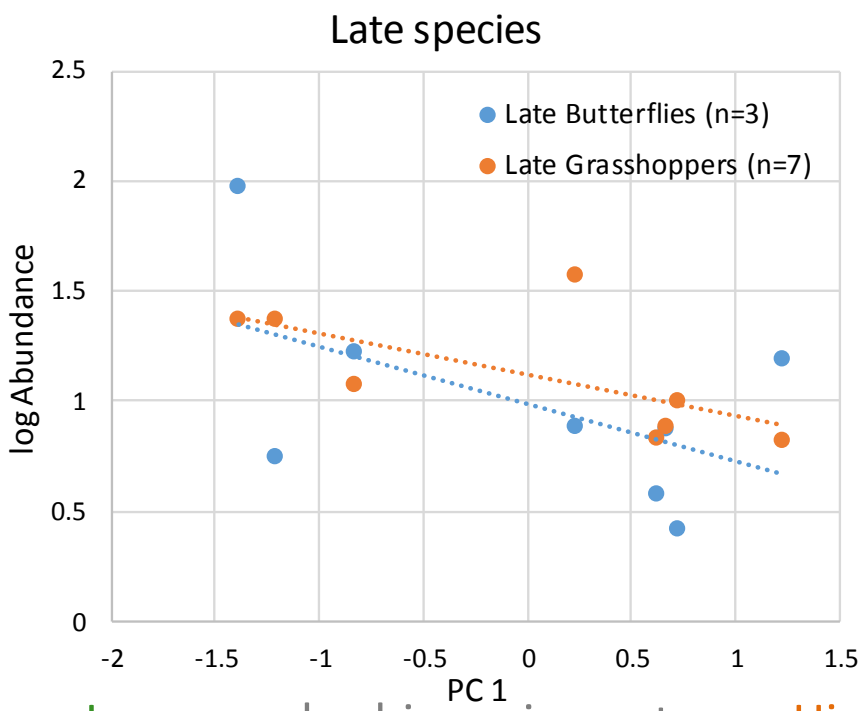



Low herbivore impact High




Low herbivore impact High

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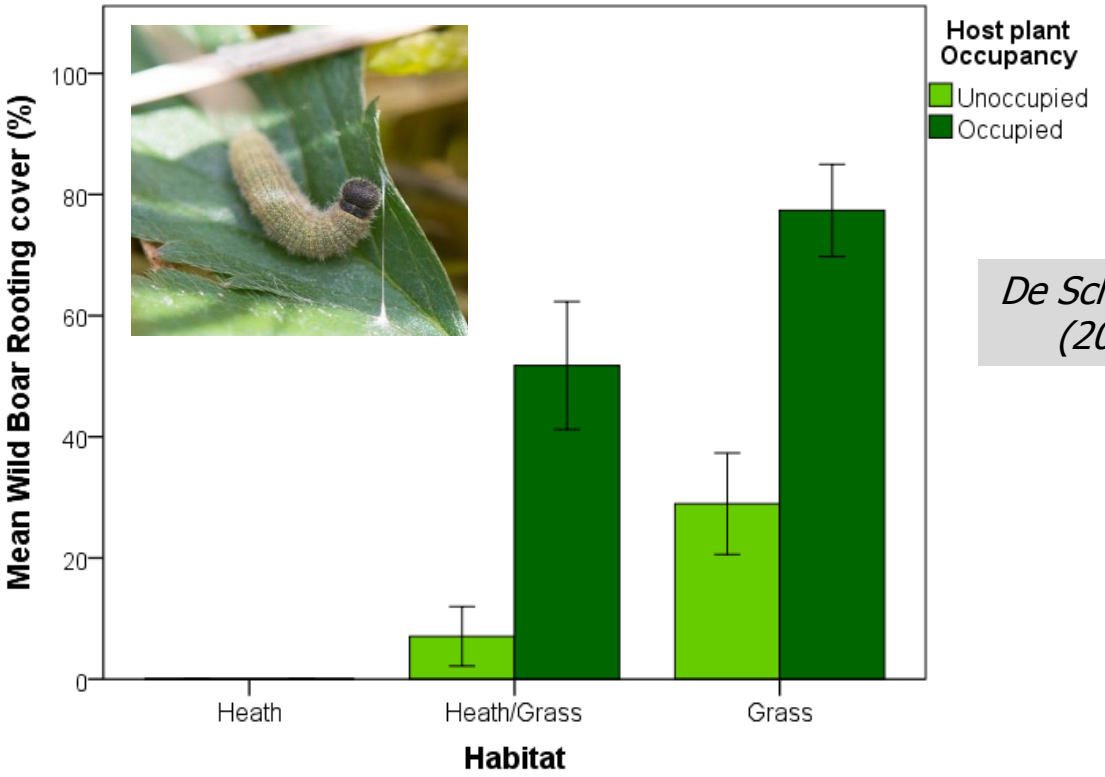
*WallisDeVries & Bokdam (2016)*

# Wild boar have a different impact!

- *Pyrgus malvae*: larvae on hostplants with higher rooting impact of wild boar




*De Schaetzen (2017)*

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# Conclusion

- The successional framework proved useful to assess variation in species responses to grazing intensity
- Grazing tolerant species are mostly early successional
- There appears to be a link between grazing tolerance and dry habitats
- These insights can be used to interpret changes in insect communities
- Not all ungulates are equal: impacts of wild boar deserve special attention!

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# Next step: manipulating grazing intensity

- Experimenting with:
  - intensification under grass encroachment
  - Temporary exclosures from high grazing intensity

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# Questions?...