Do findings from Malaise traps apply across different components of the flying insect community?

Nicole Remmel, Julian Enss, Viktor Hartung, Peter Haase & James Sinclair

Leibniz Association

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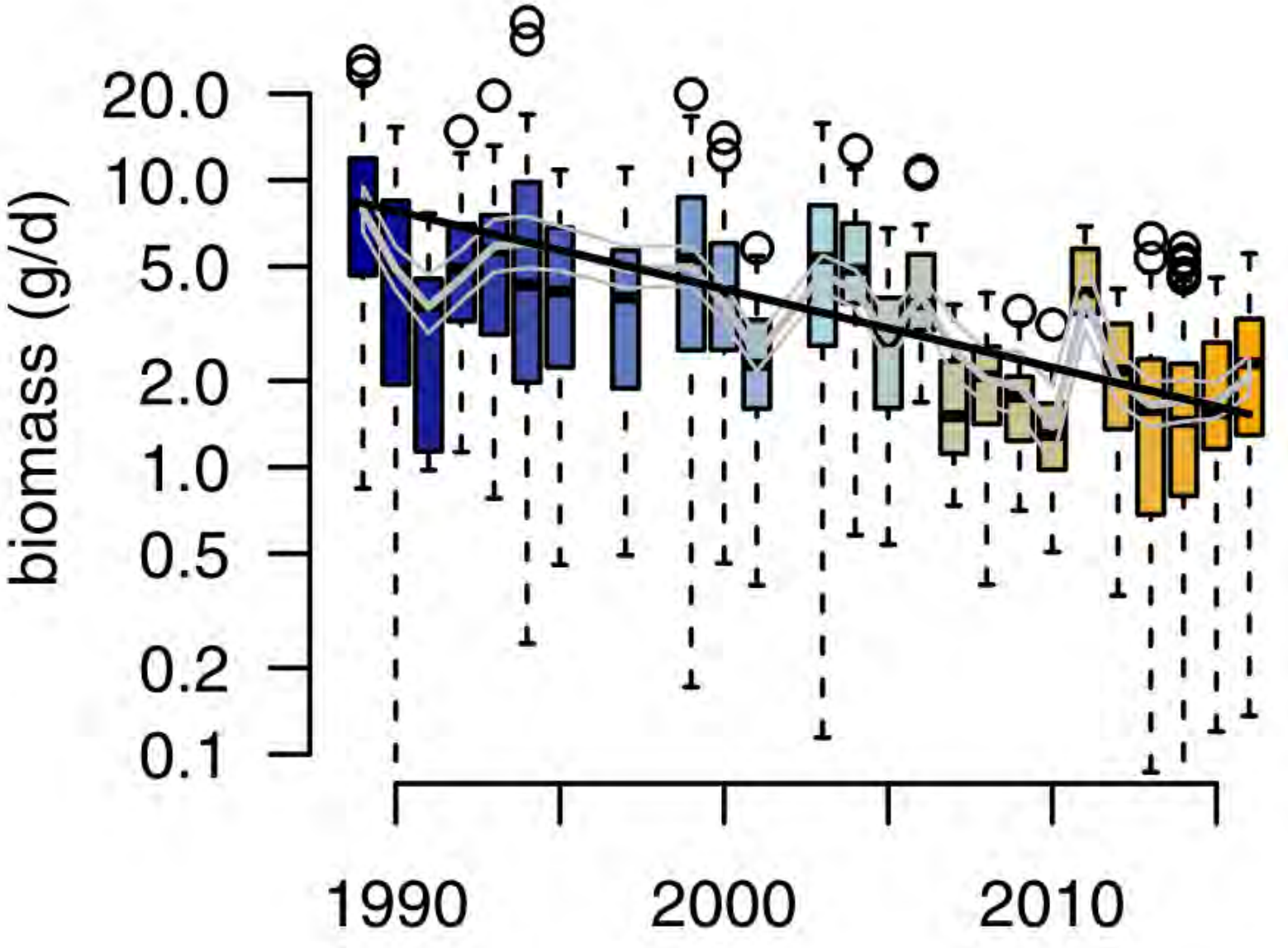
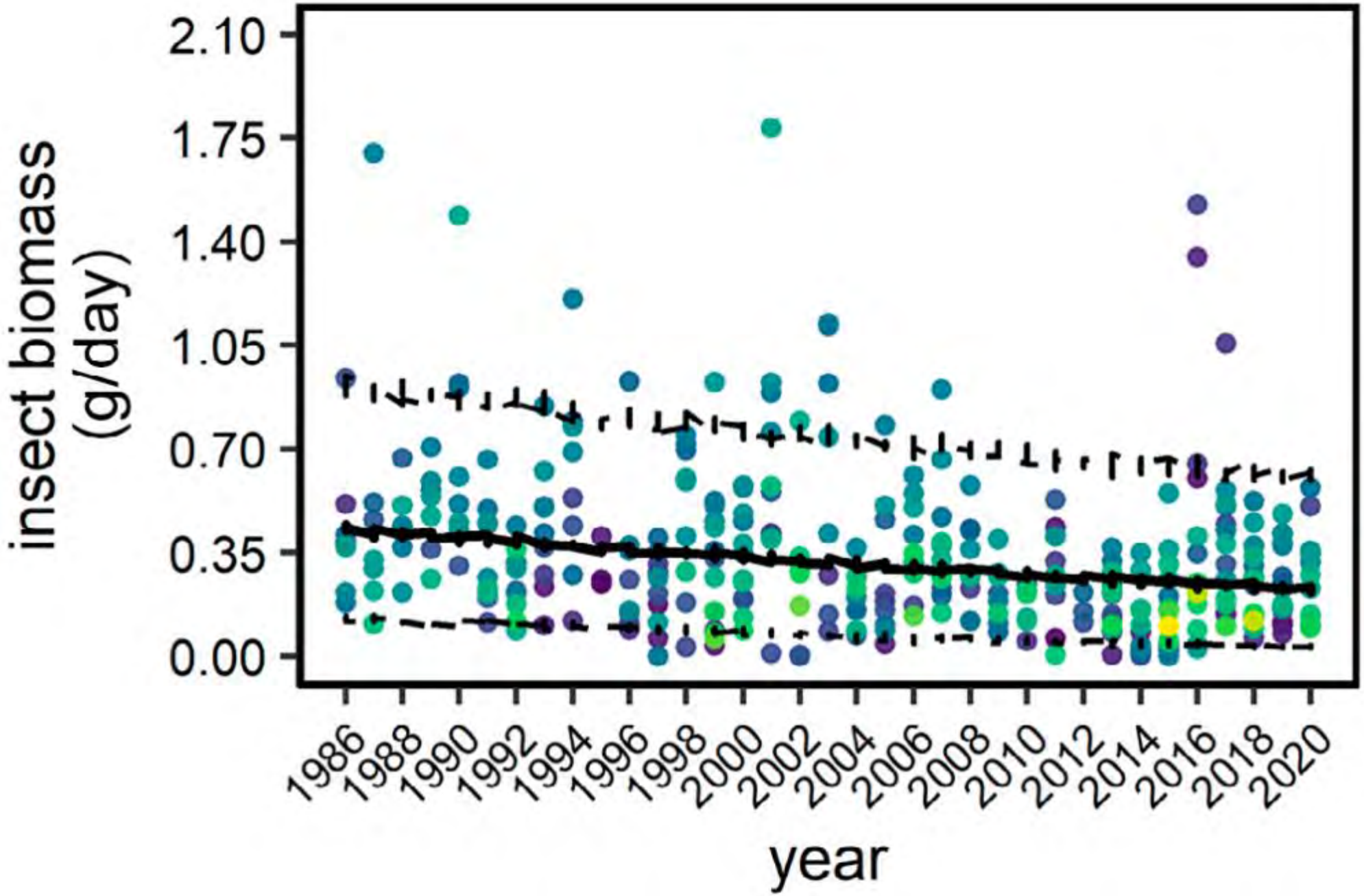
world of biodiversity

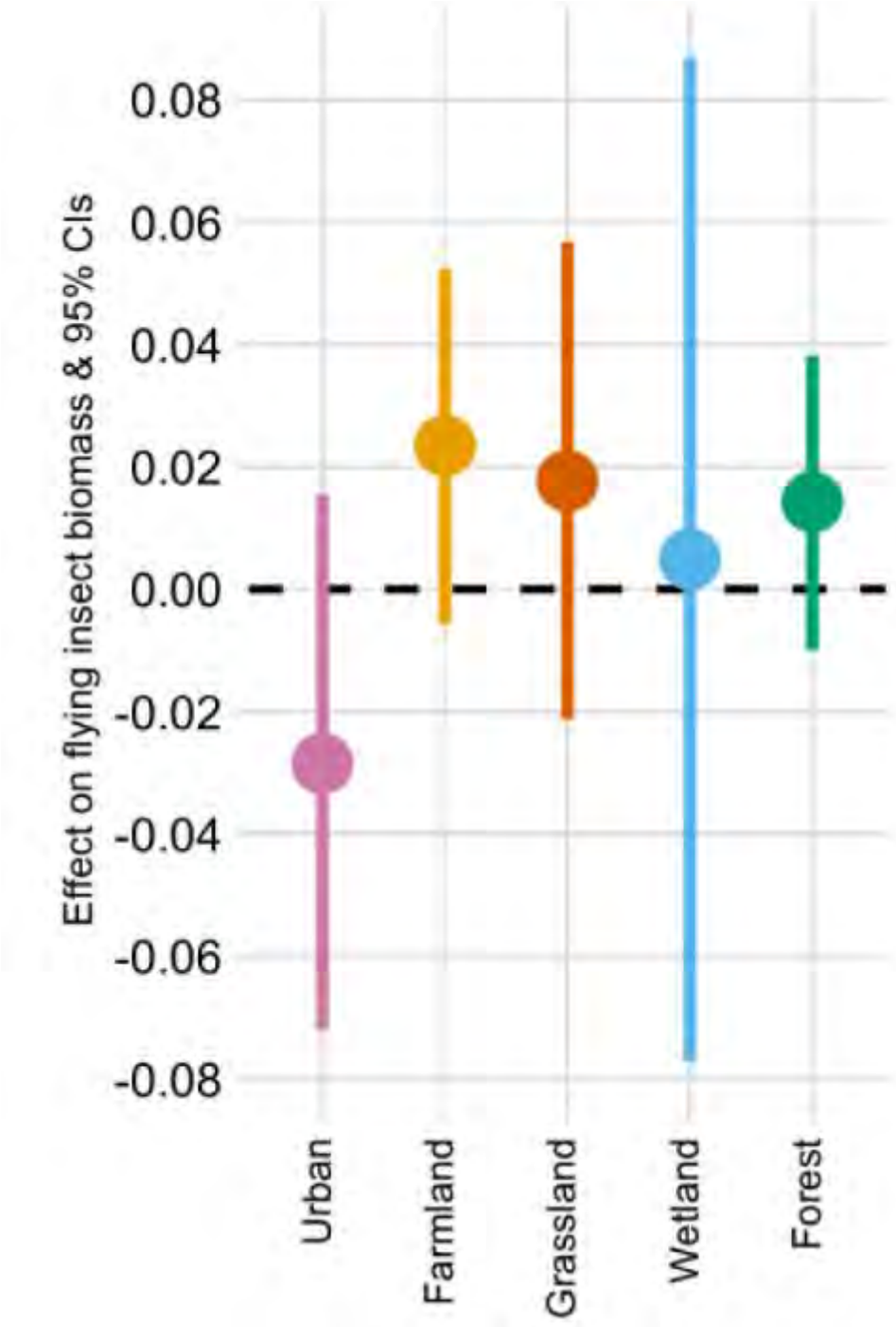
Reported declines in insects



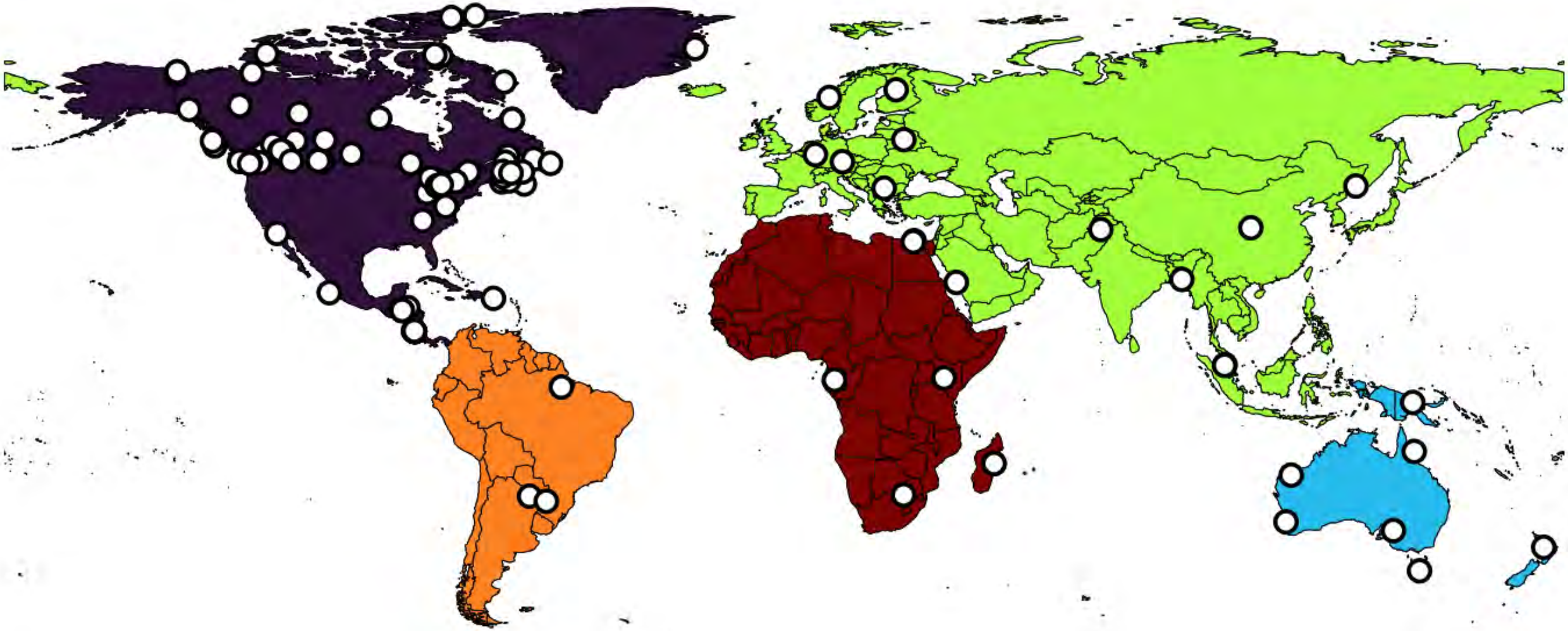
Hallmann et al. 2017



Dalton et al. 2023



Svenningsen et al. 2022

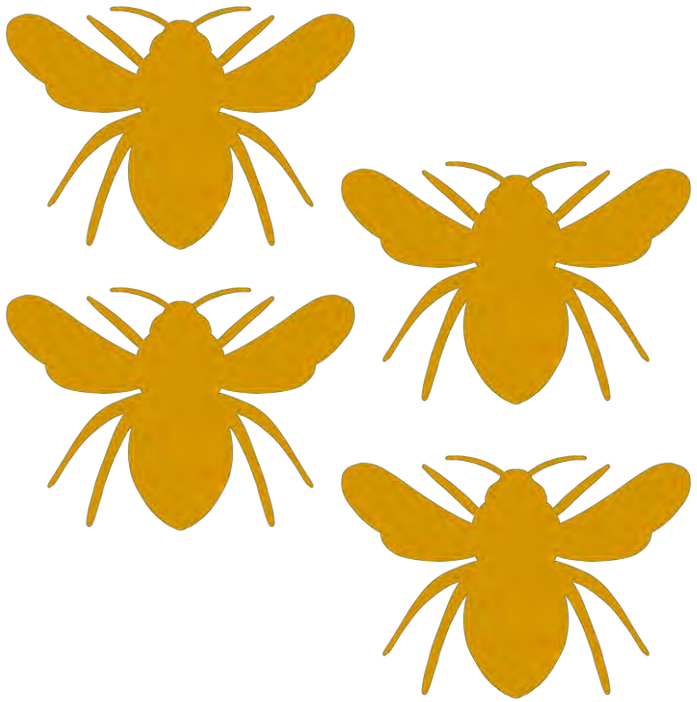


Questions

1. Does biomass tell us anything about other important aspects of biodiversity?

→ E.g., abundance

Which individuals are declining?



↓ Biomass ↓ Abundance ↓ Biomass ~ Abundance

Questions

1. Does biomass tell us anything about other important aspects of biodiversity?

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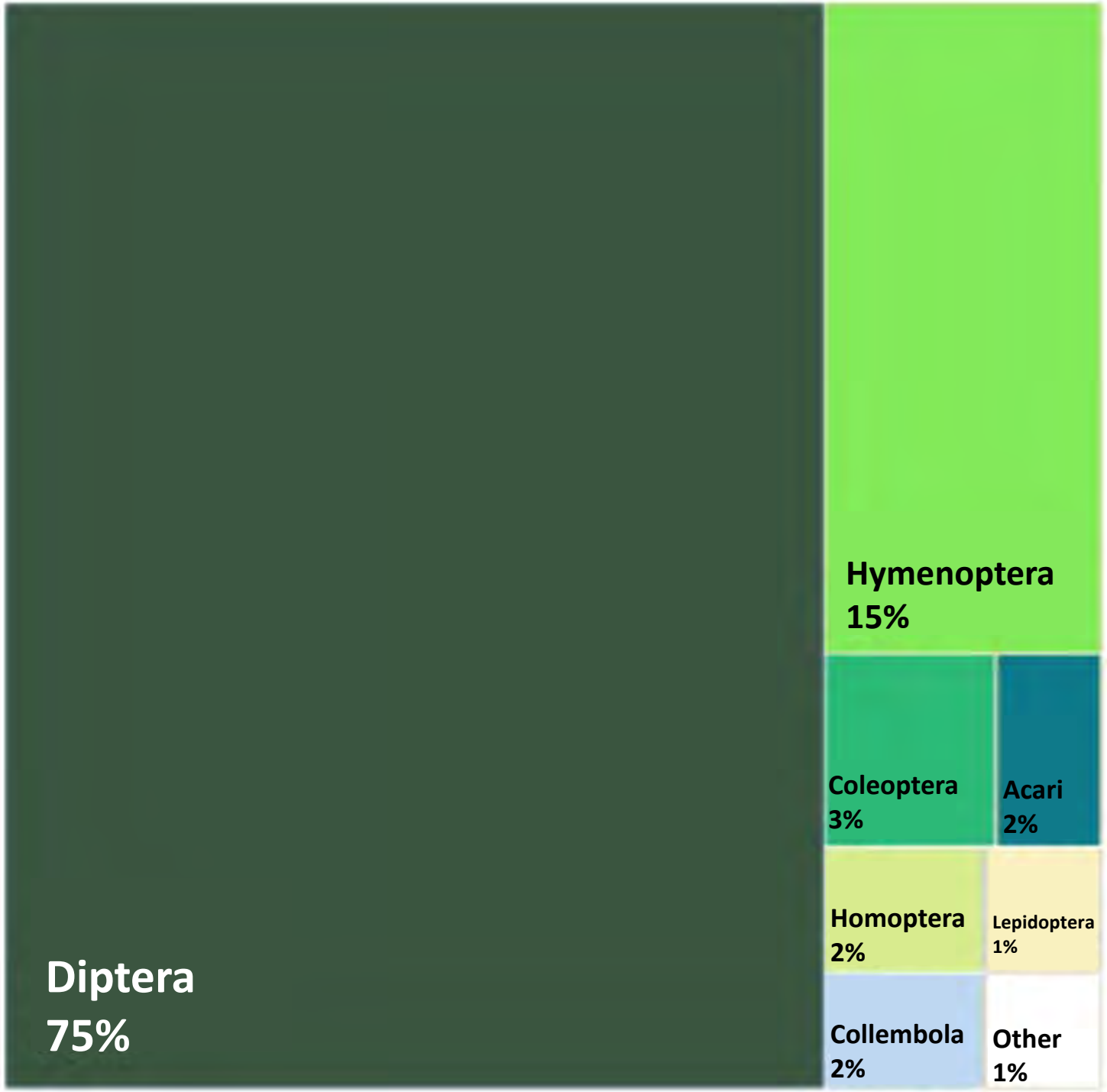
2. Do drivers of change in the broader community apply to other key taxa?



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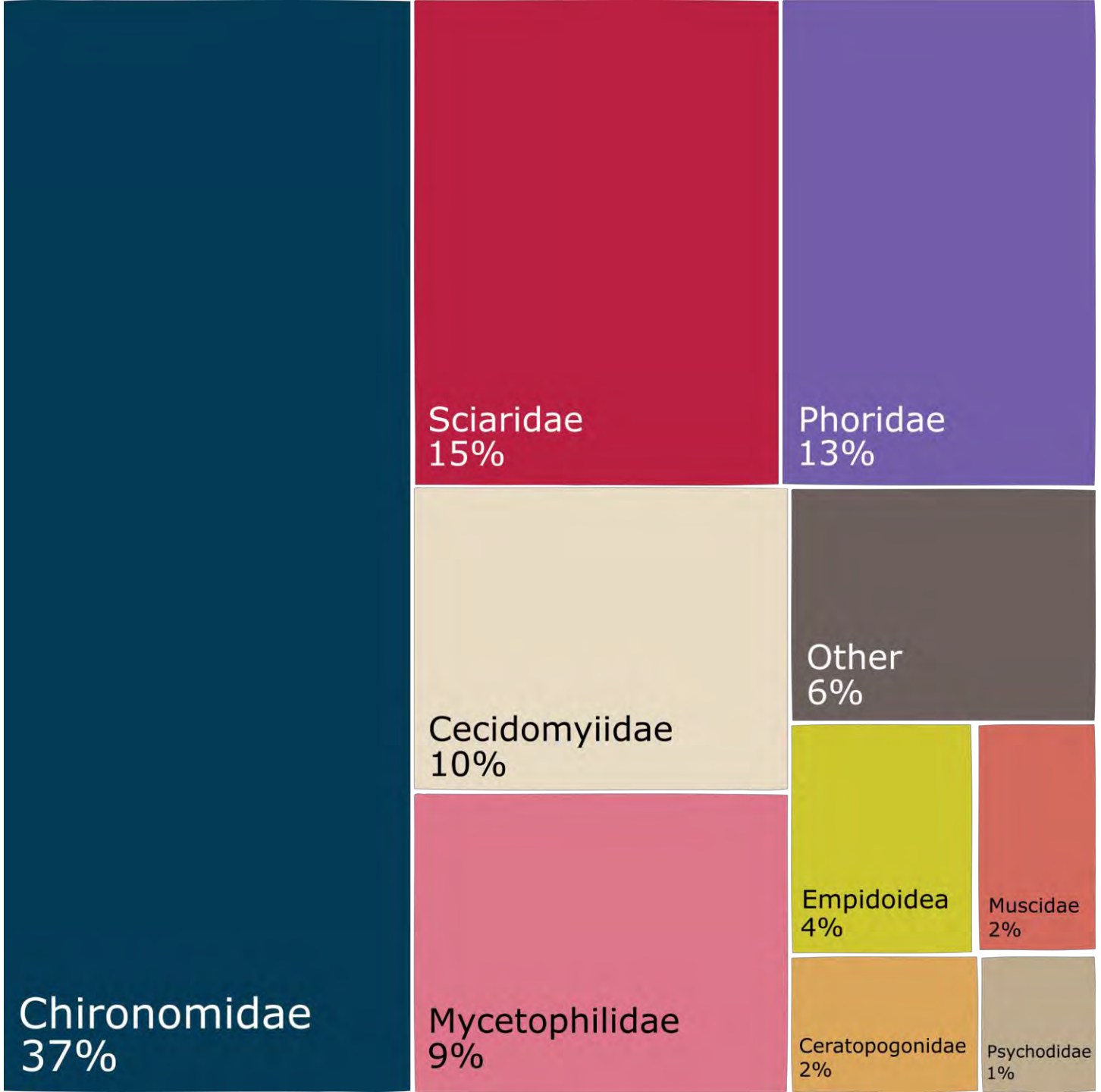

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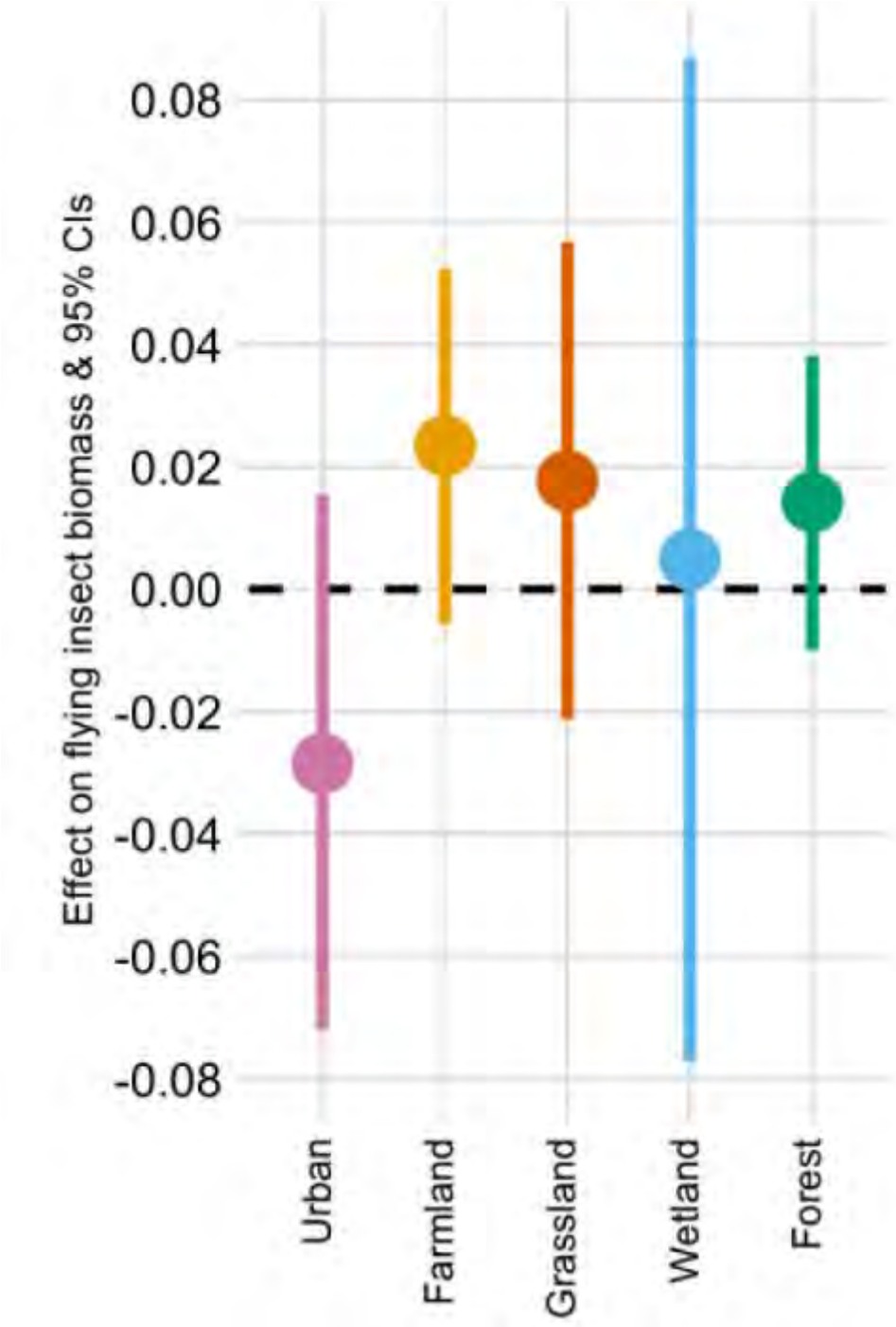

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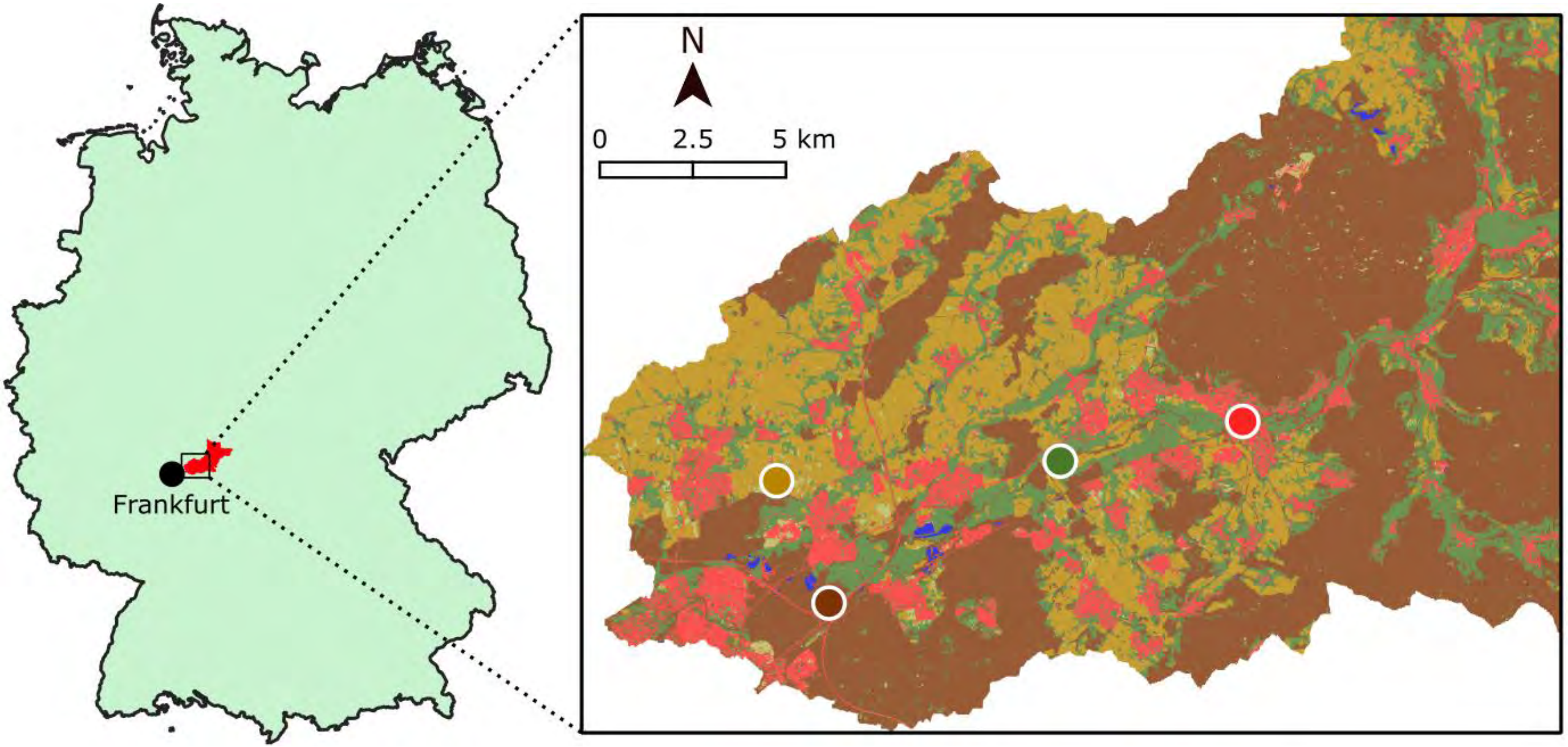


Methods

April 15
(early spring)

May 27
(late spring)

July 22
(mid summer)

Sept 16
(early autumn)

Questions

1. Do changes in total biomass reflect changes in total abundance?

2. Do drivers of change in the broader community apply to other key taxa?

Biomass and abundance

1. Total wet weight biomass (g/day)

2. Total abundance summed across 18 taxonomic groups

→ "Focal pollinators" (3): Bees, butterflies, and hoverflies to family-level



→ "Other insects" (15): Blattodea, Coleoptera, Dermaptera, non-Syrphidae Diptera, Ephemeroptera, Hemiptera (Auchenorrhyncha), Hemiptera (Heteroptera), non-Apiformes Hymenoptera, Lepidoptera (moths), Mecoptera, Neuroptera, Odonata, Orthoptera, Plecoptera, and Trichoptera

Questions

1. Do changes in total biomass reflect changes in total abundance?

2. Do drivers of change in the broader community apply to other key taxa?

Drivers

1. Land cover

→ % forest, open land, agricultural, urban within 1 km

2. Weather & climate

→ Temperature, precipitation, humidity

→ Weather: daily during each survey period

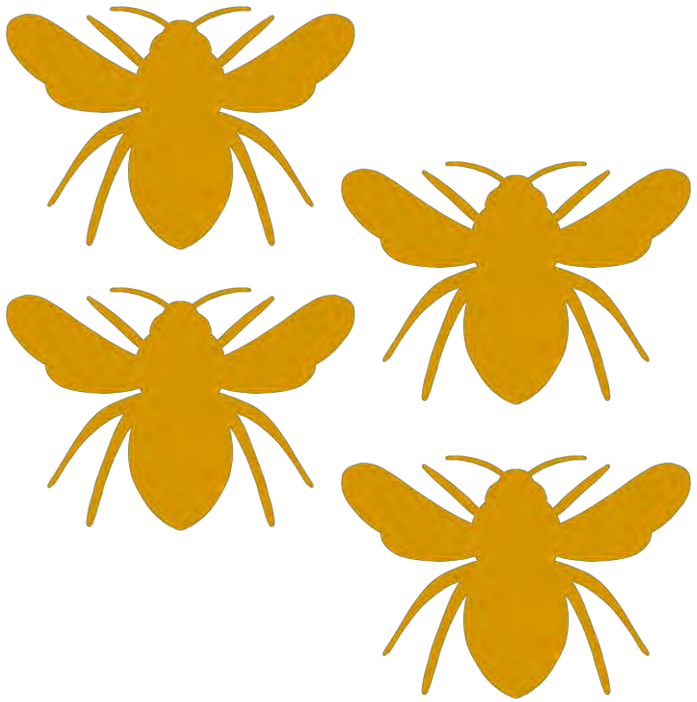
→ Climate: anomalies compared to 30-yr mean, including prev. winter

3. Flowering plants

→ All species in flower within 100 m around each trap

→ Raised to family level

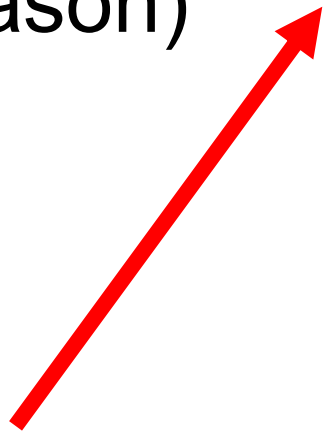
Biomass-abundance relationship



↓ Biomass ↓ Abundance ↓ Biomass ~ Abundance

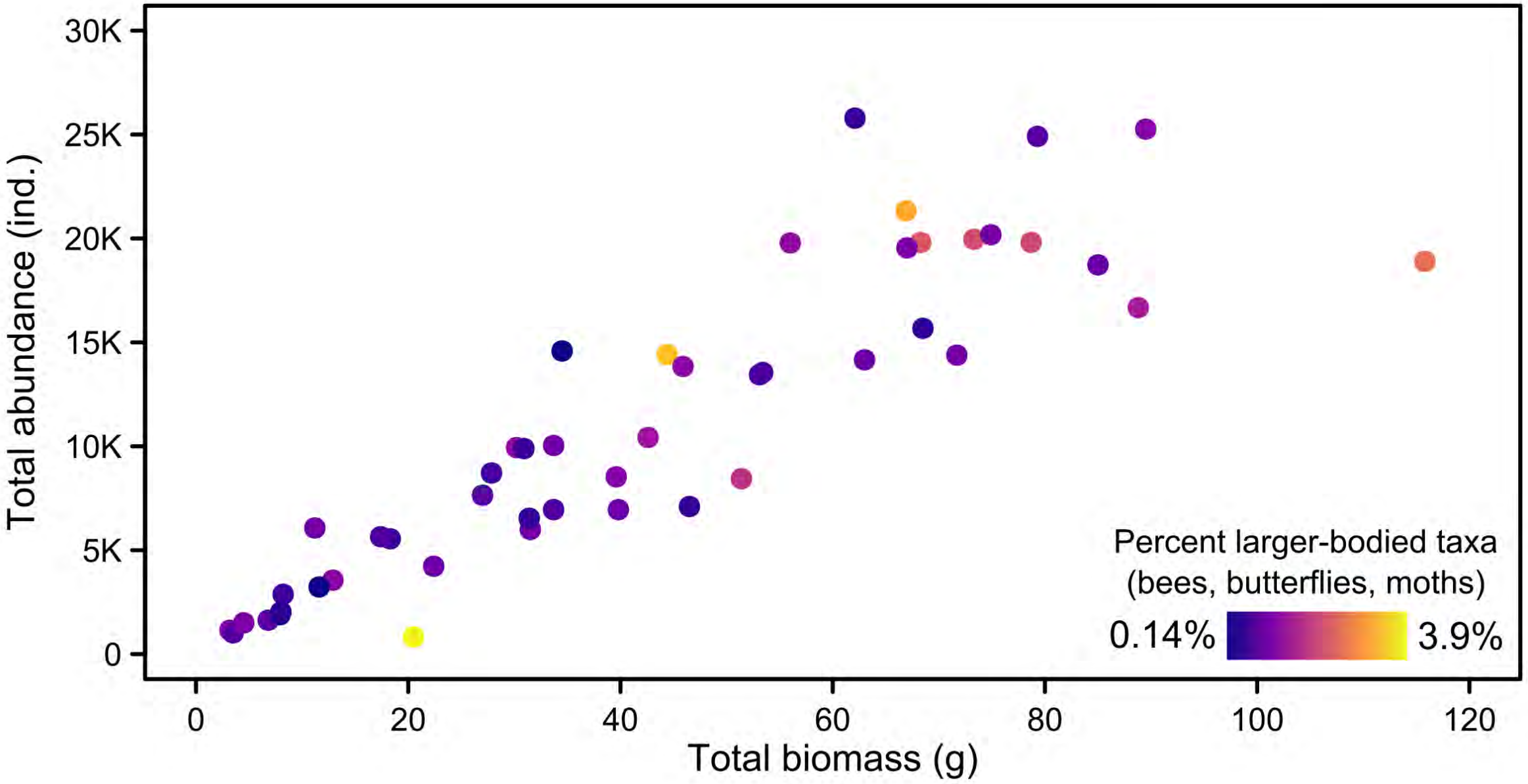
Biomass-abundance relationship

Abundance ~ Biomass * Community body size
+ (1|site) + (1|season)



% of bees, butterflies,
and moths

Biomass-abundance relationship



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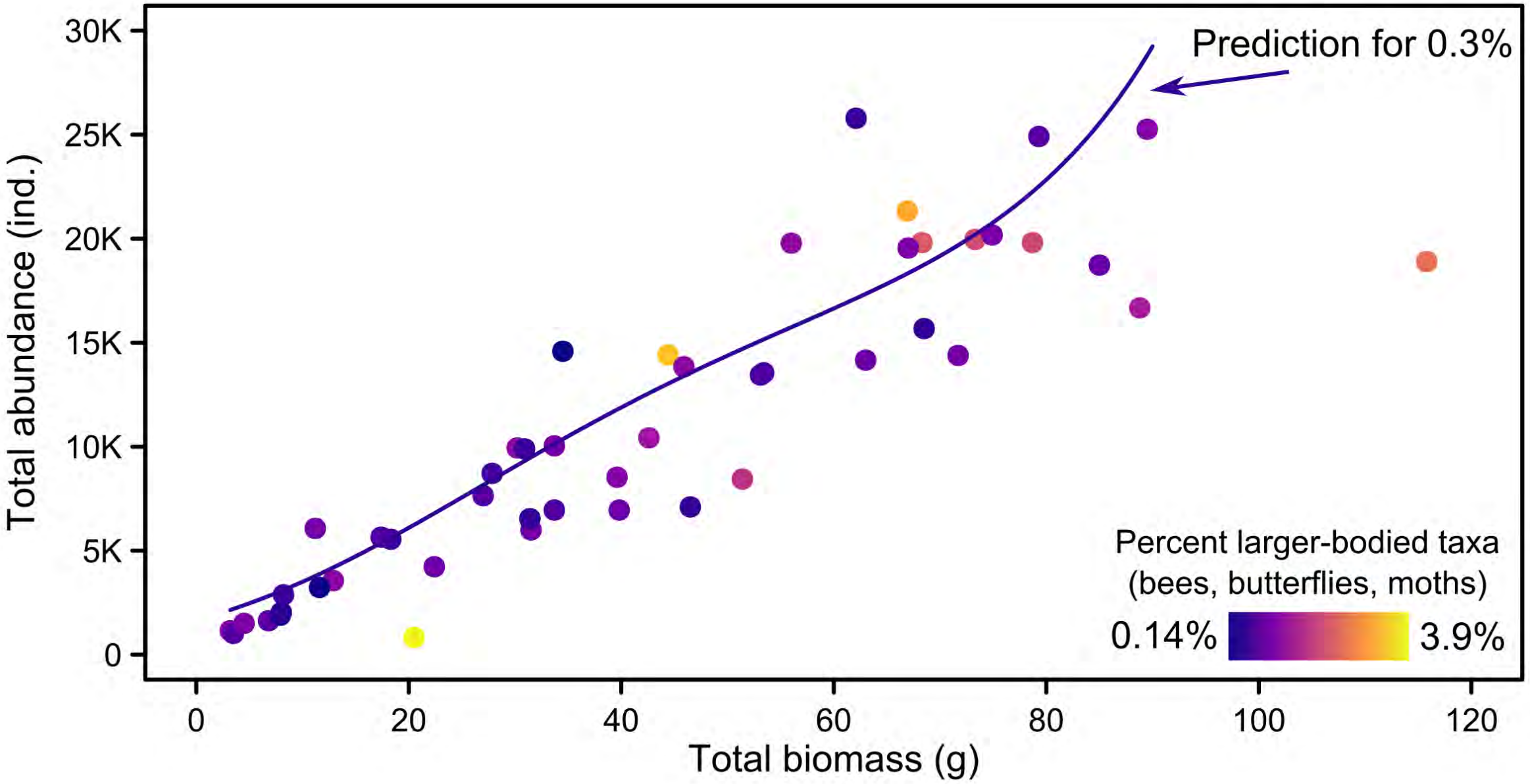

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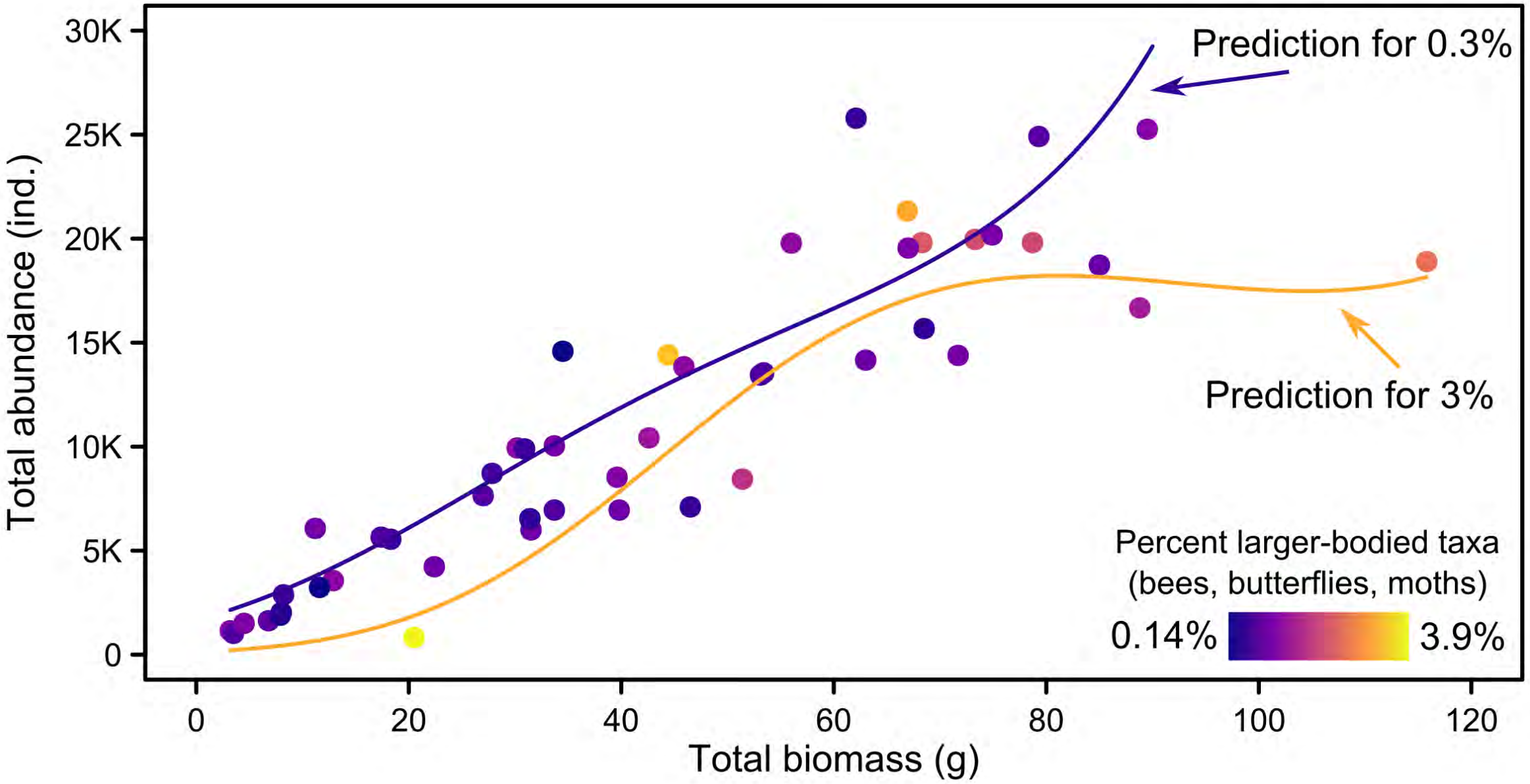

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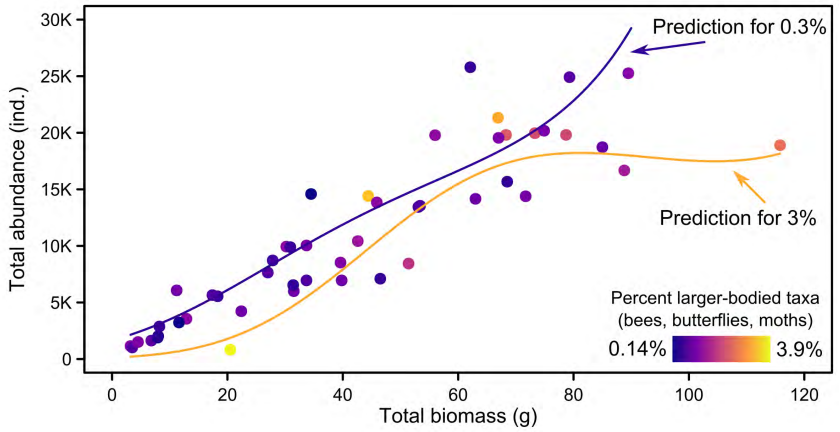
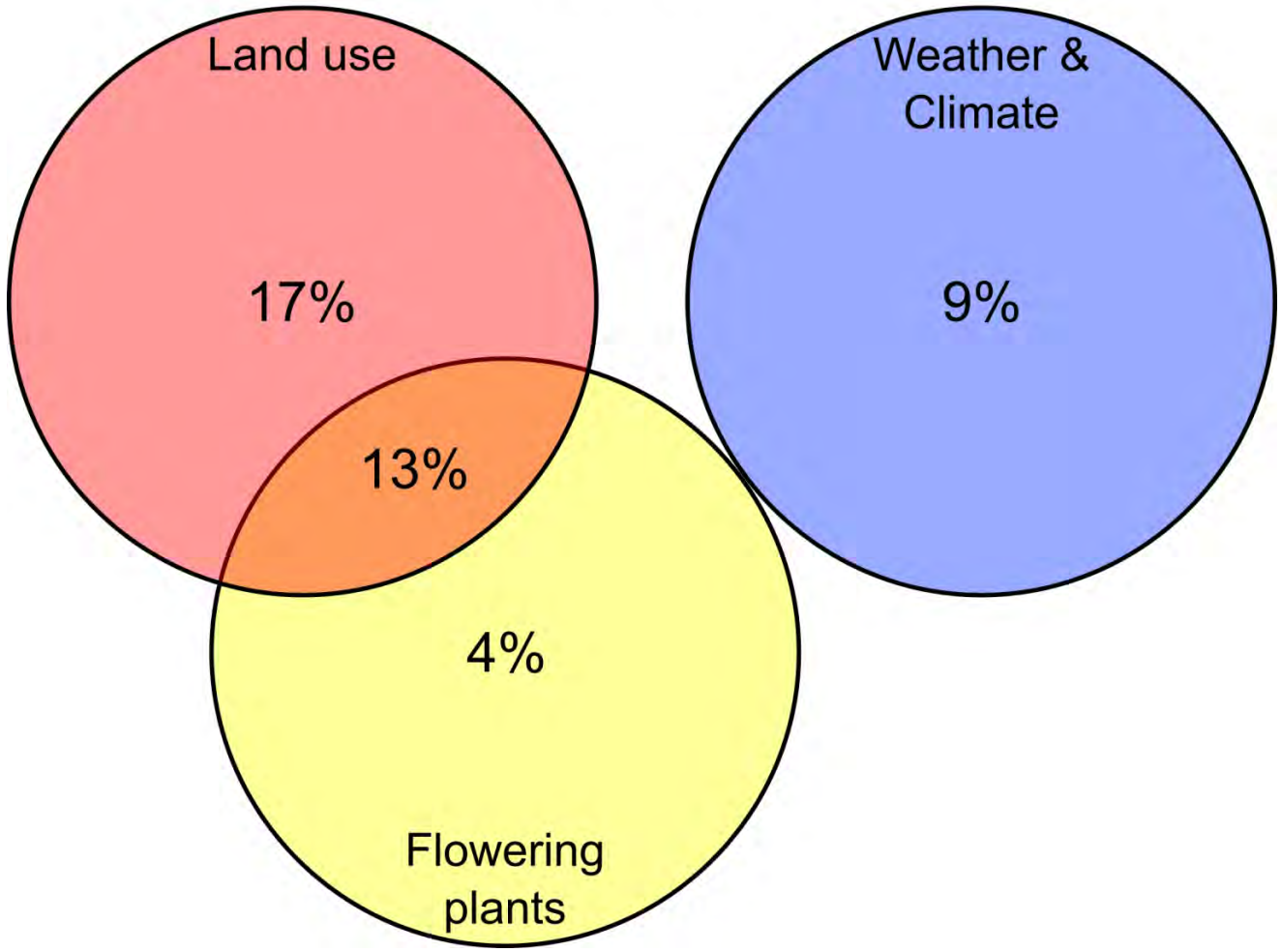
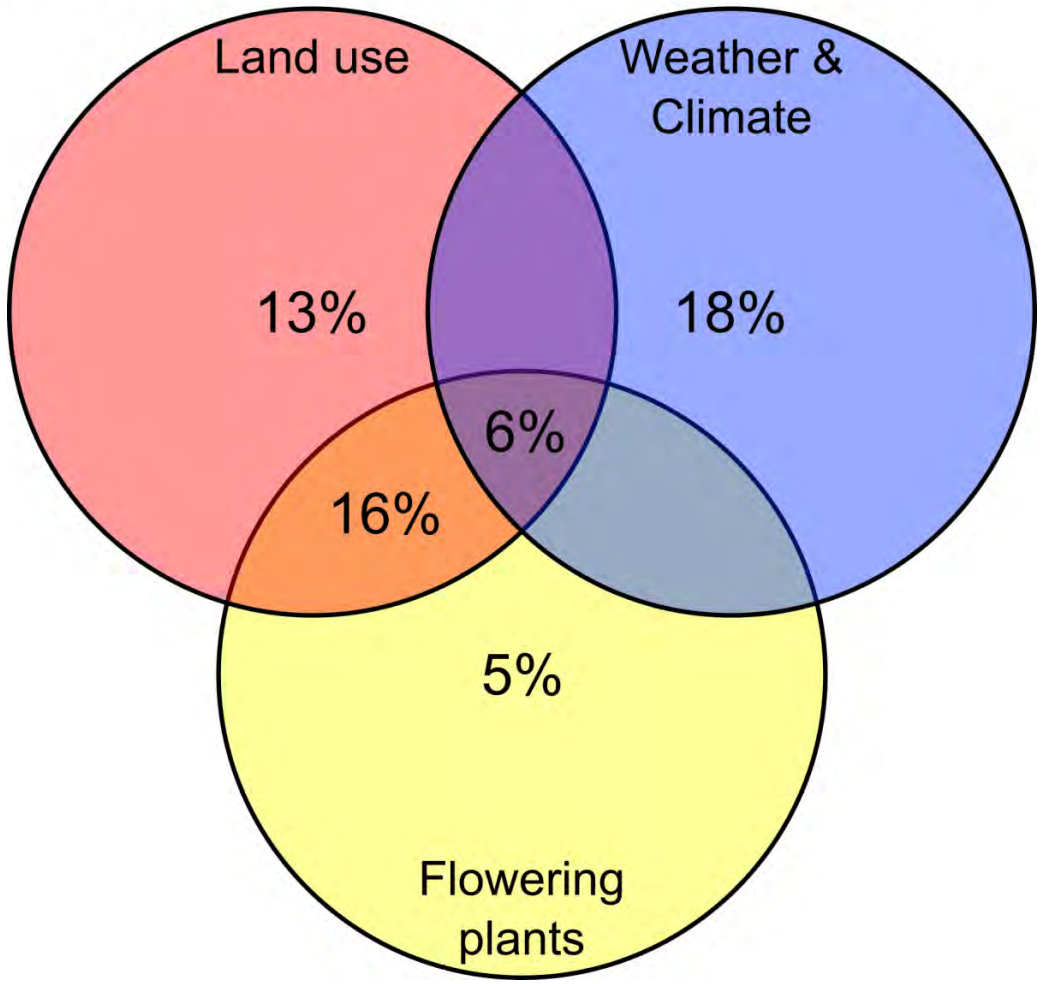


Drivers

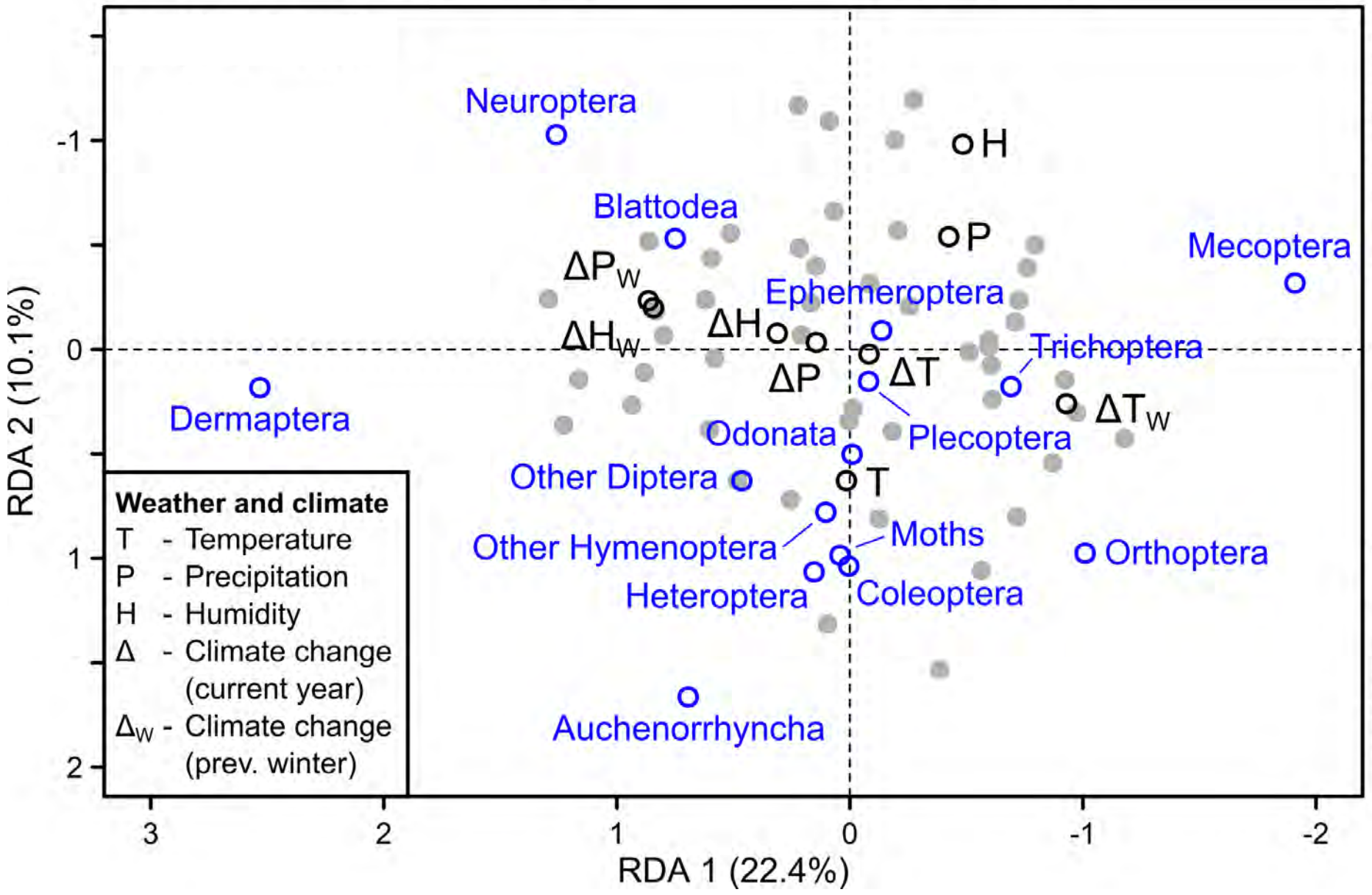
Other insects abundance (43% total)



Focal pollinator abundance (58% total)



Weather & climate – Other insects



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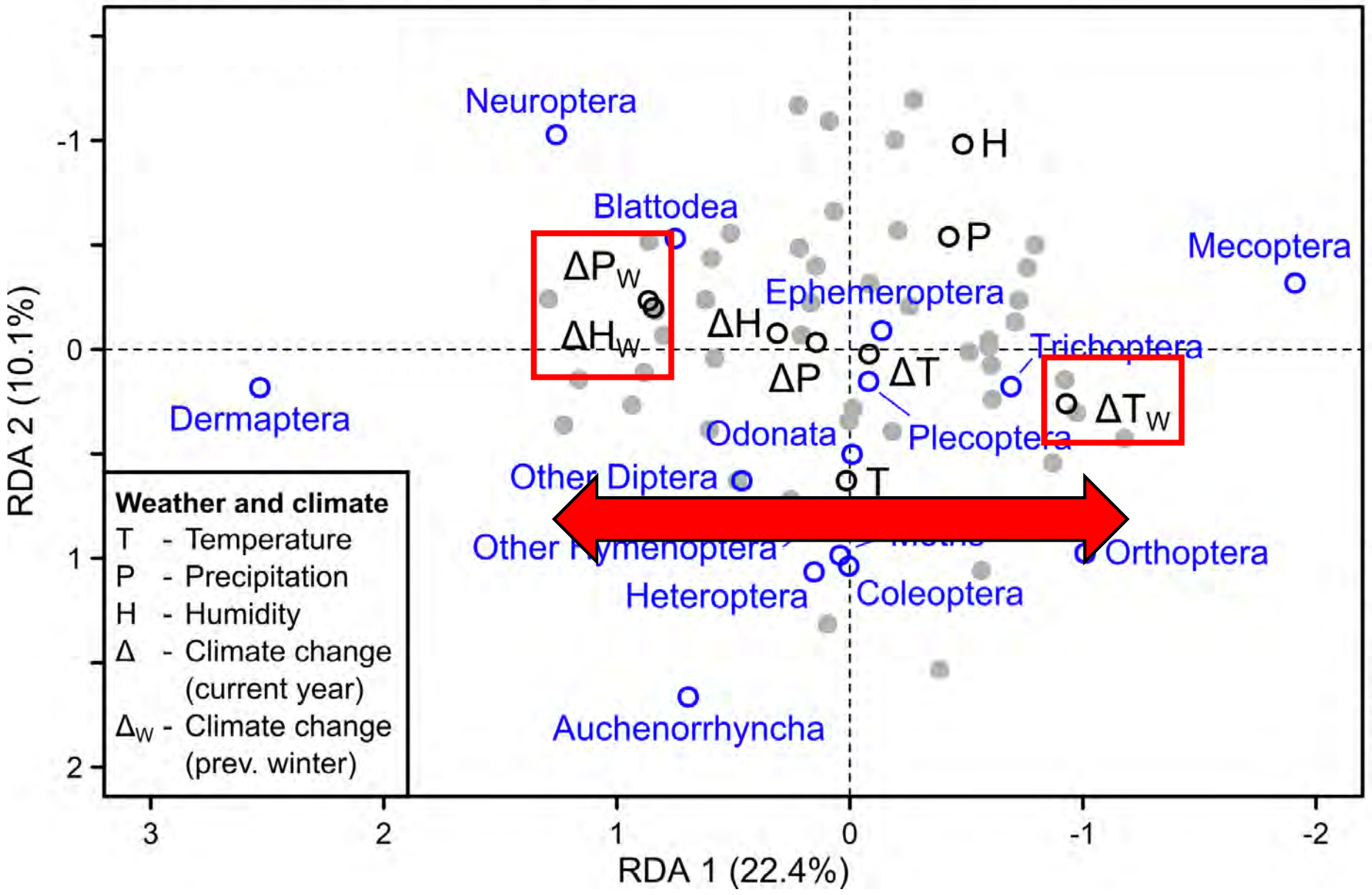

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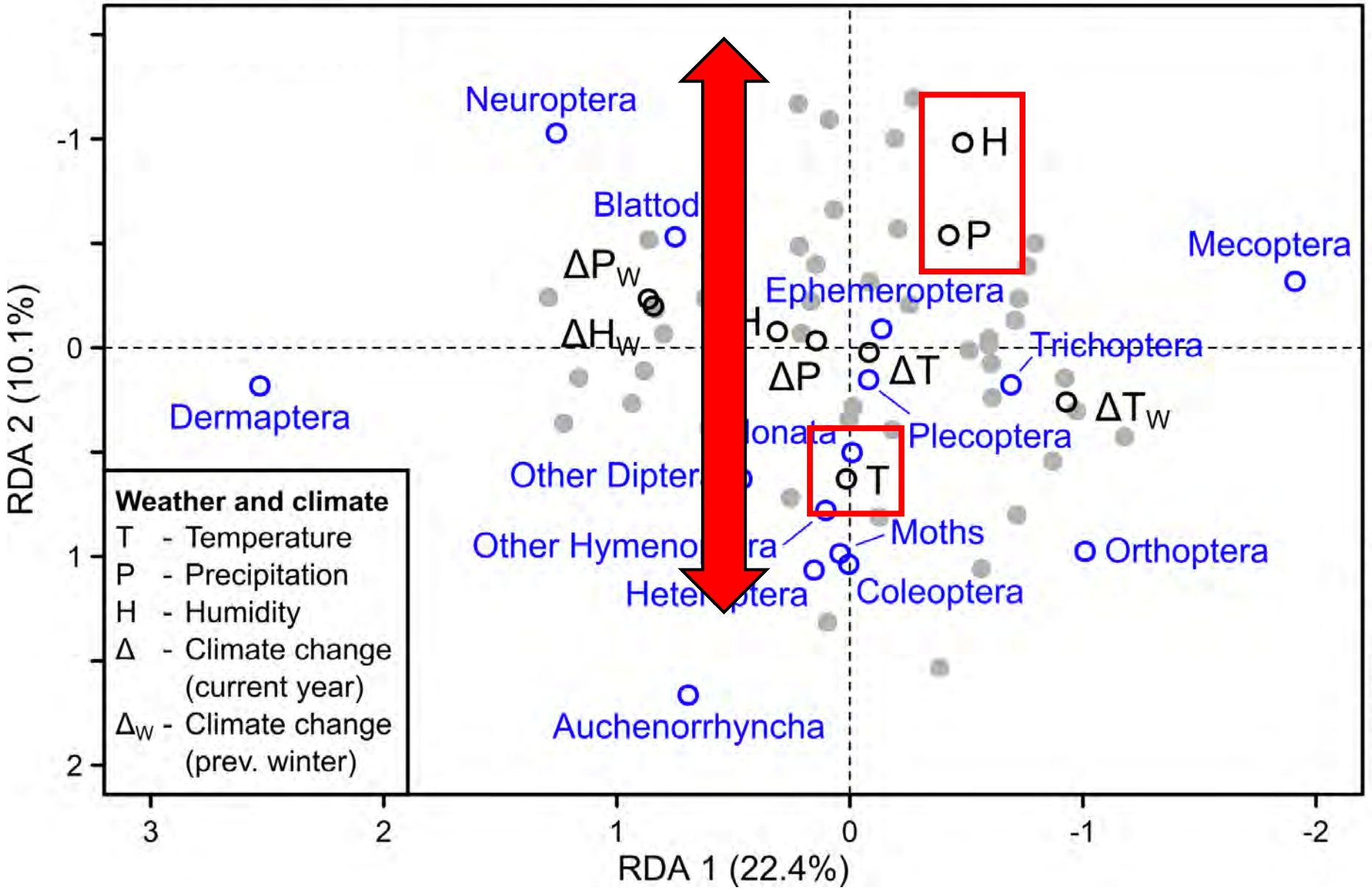

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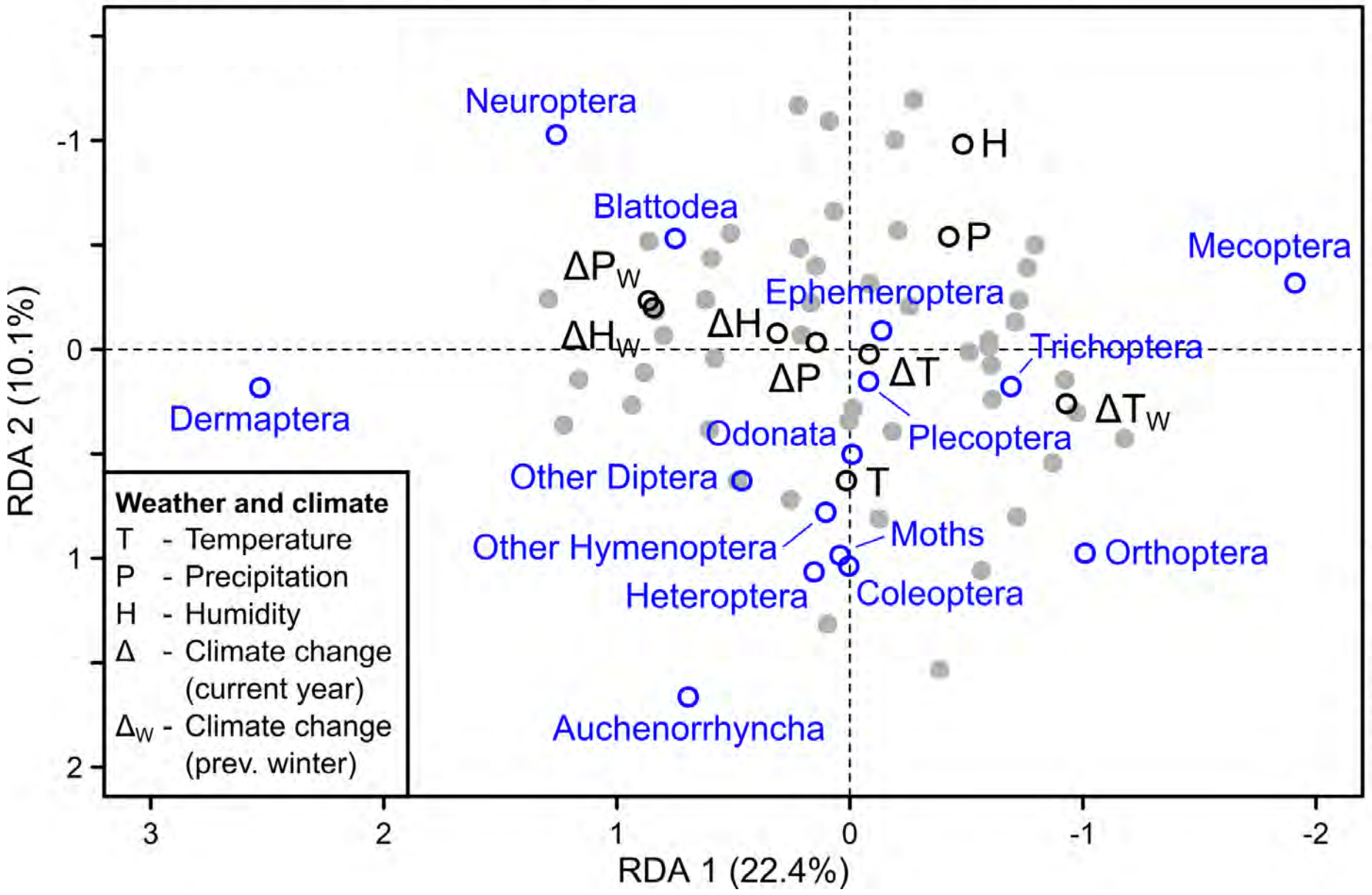

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"Insect biomass was lower after winters with higher temperatures or lower precipitation than long-term averages... decreasing winter snow depth, more frequent thaw events, late snowfall and earlier winter melts...increasing exposure to low temperatures, desiccation and predation.“ - Müller et al. 2023

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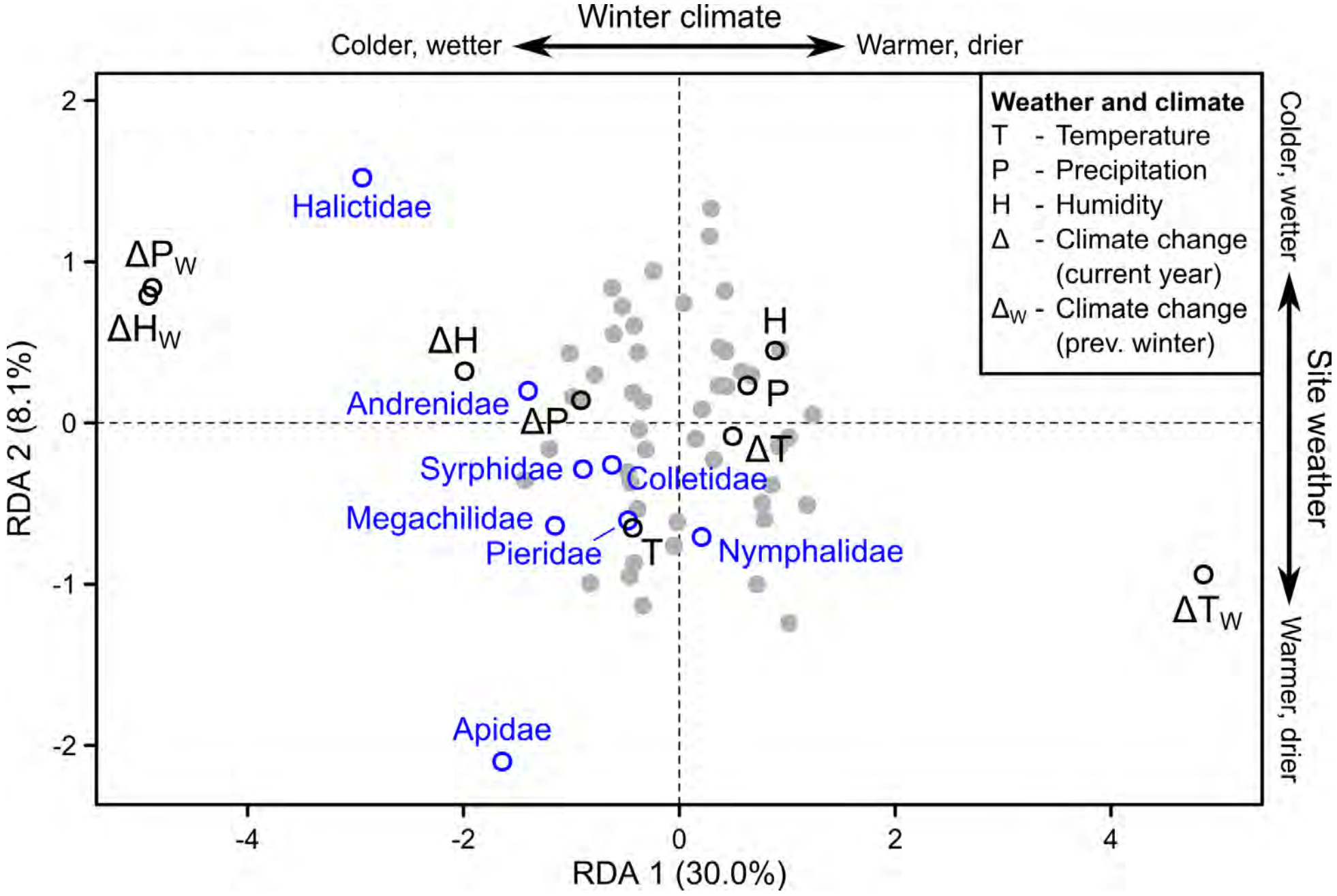
Weather & climate – Focal pollinators



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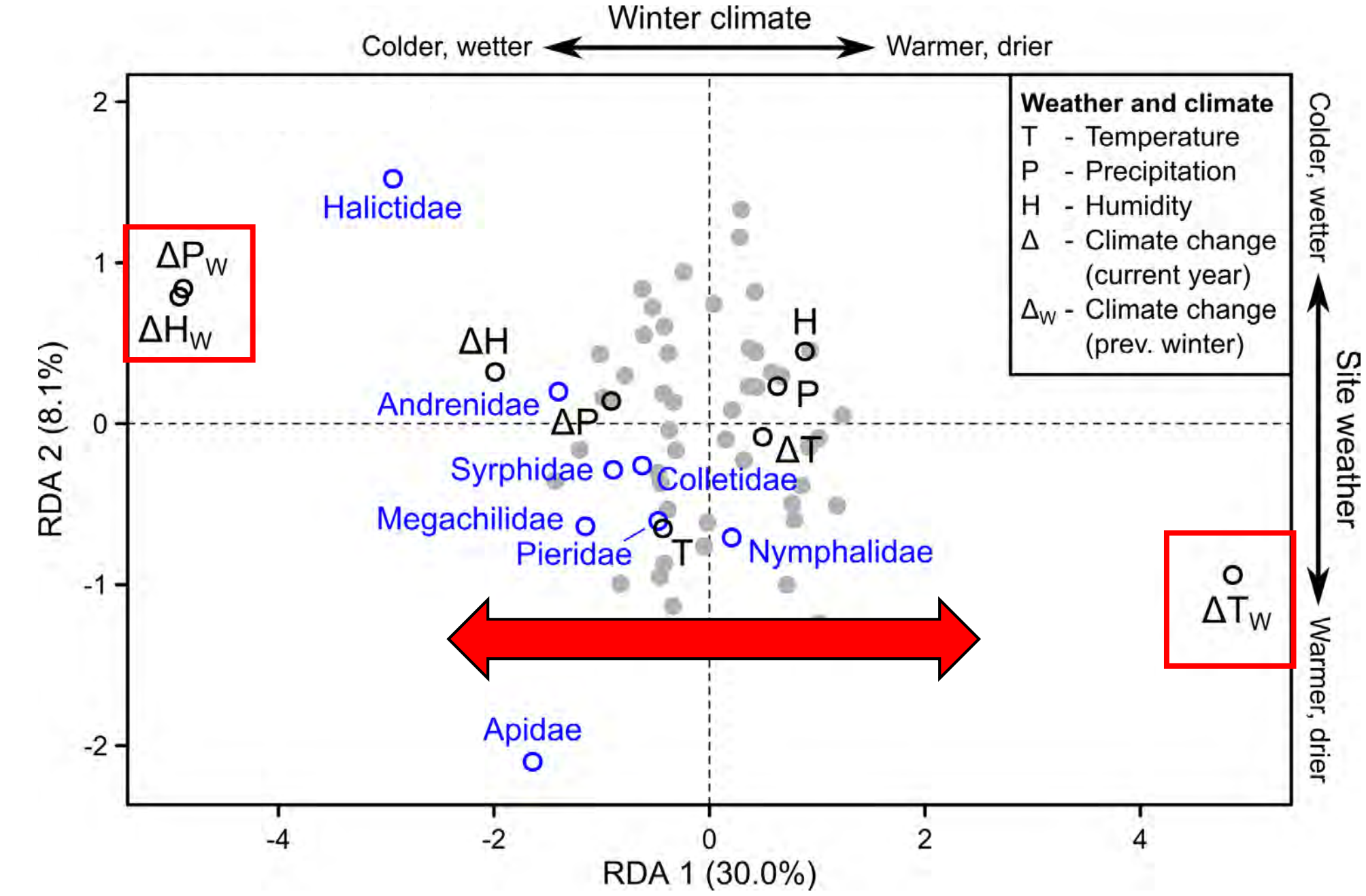

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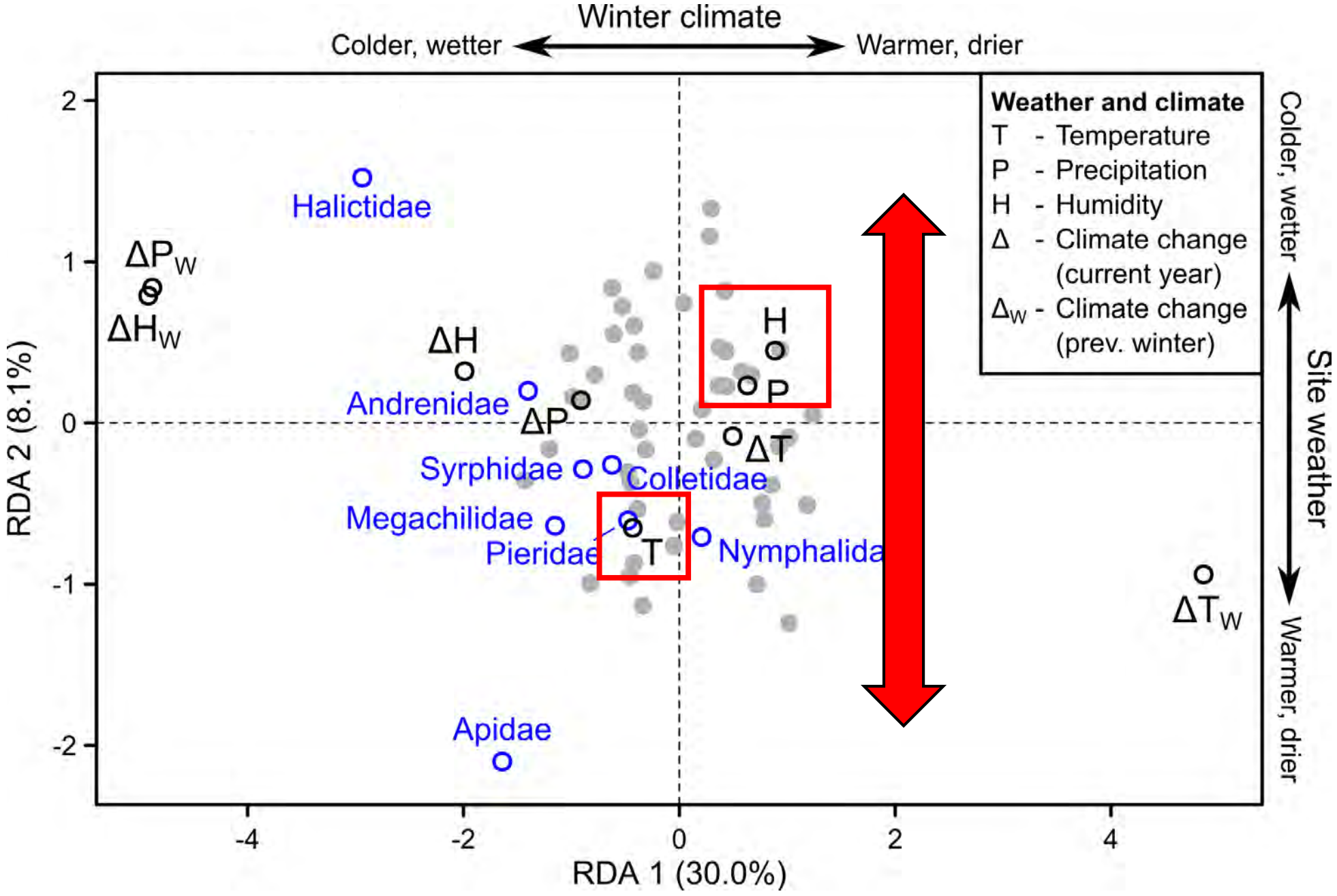

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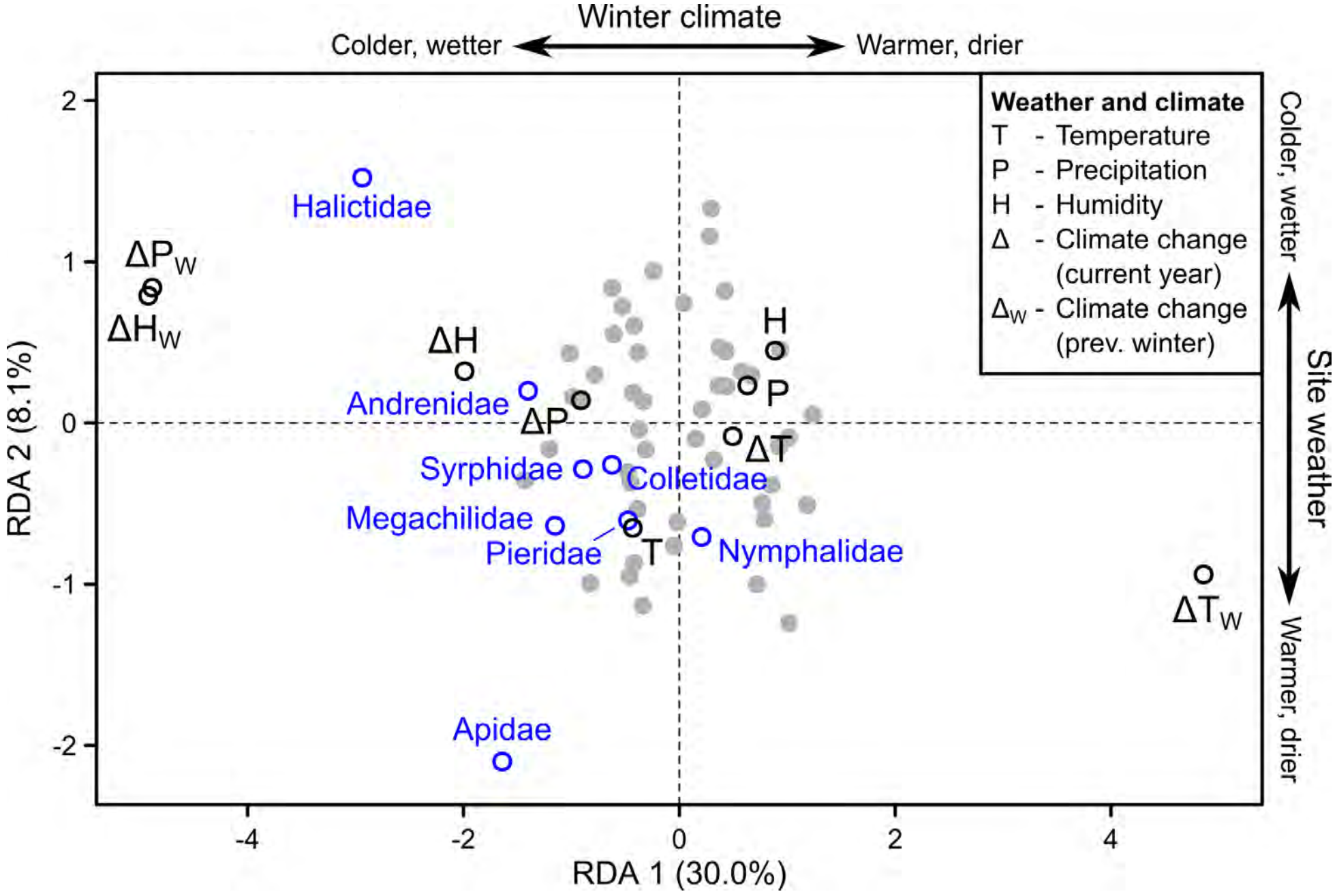

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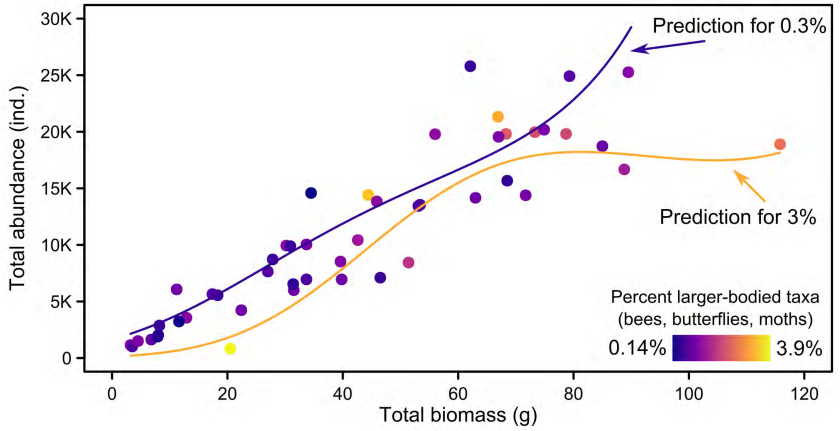

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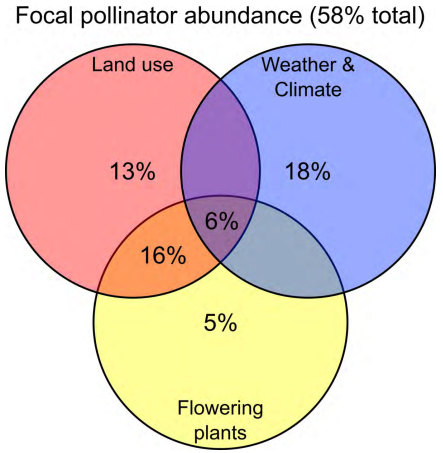
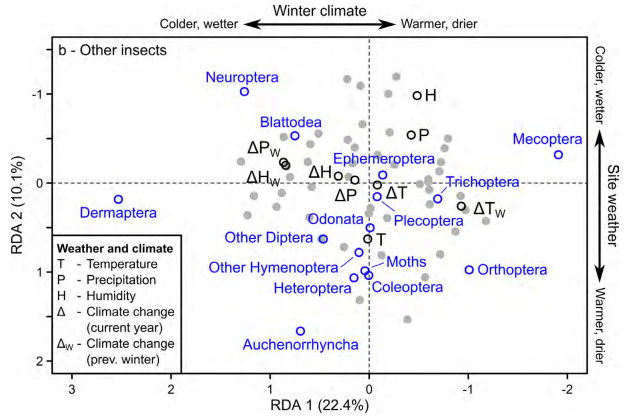
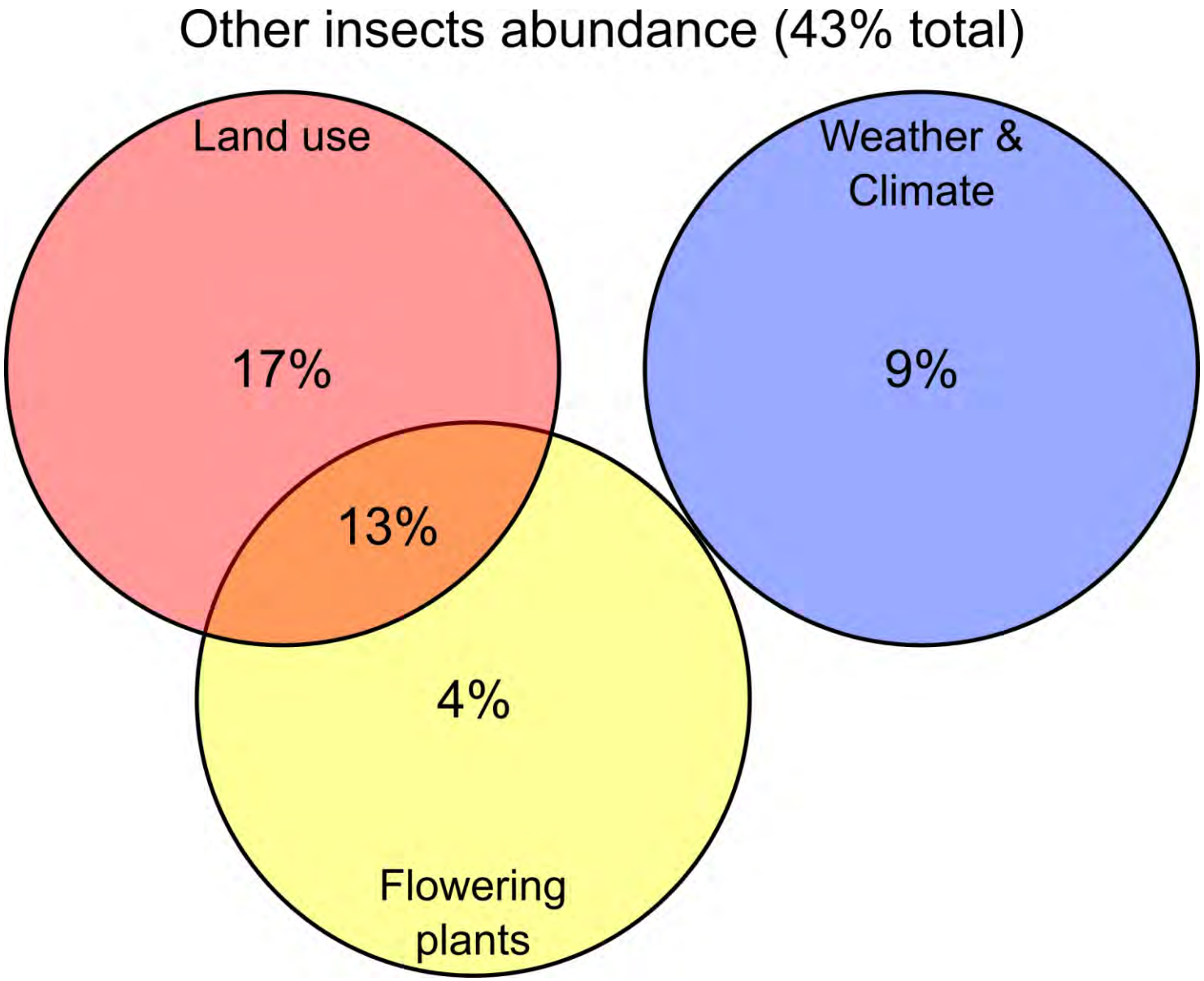




Land use & flowers – Other insects



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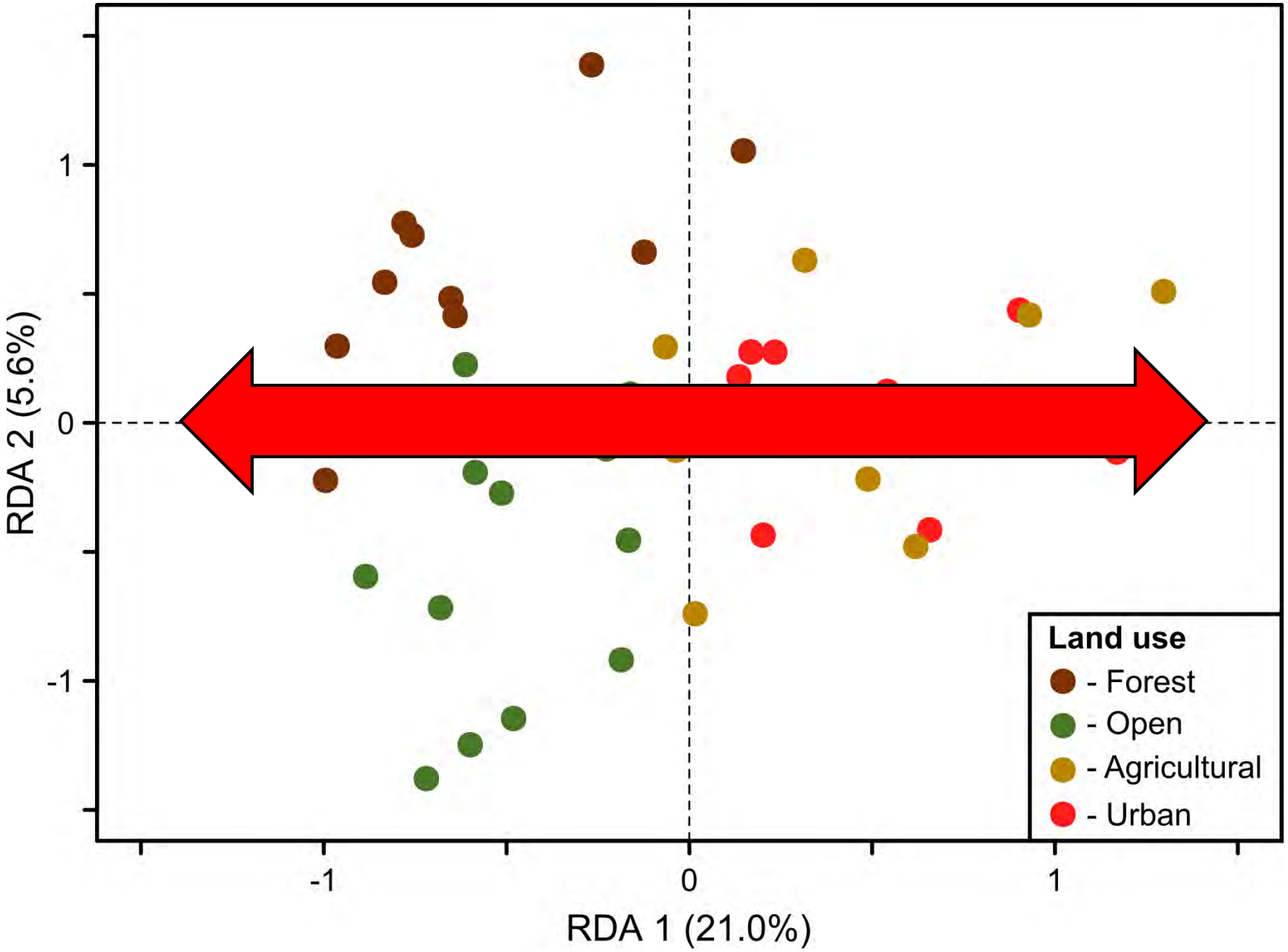
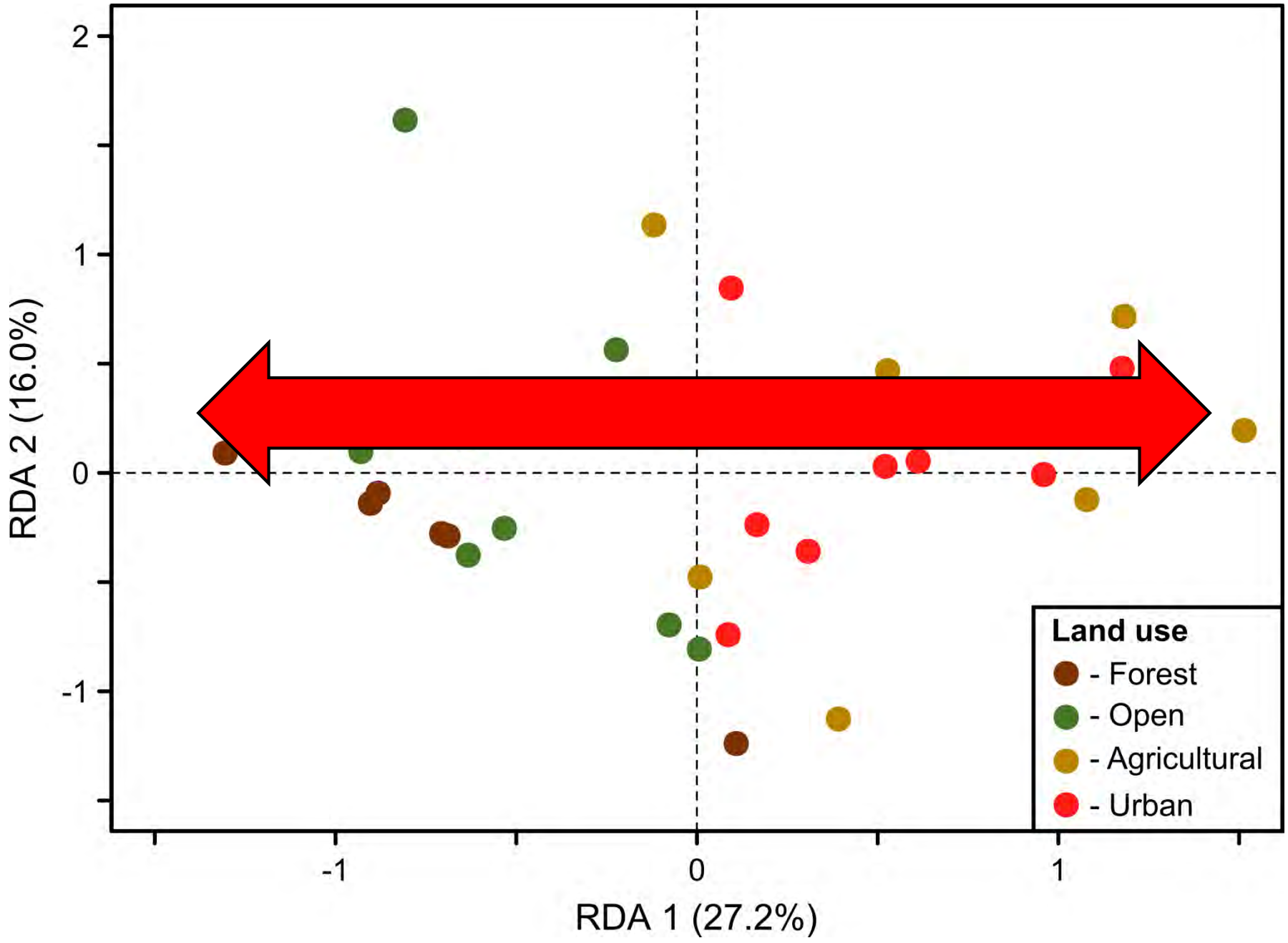


Flowering plants – Other insects



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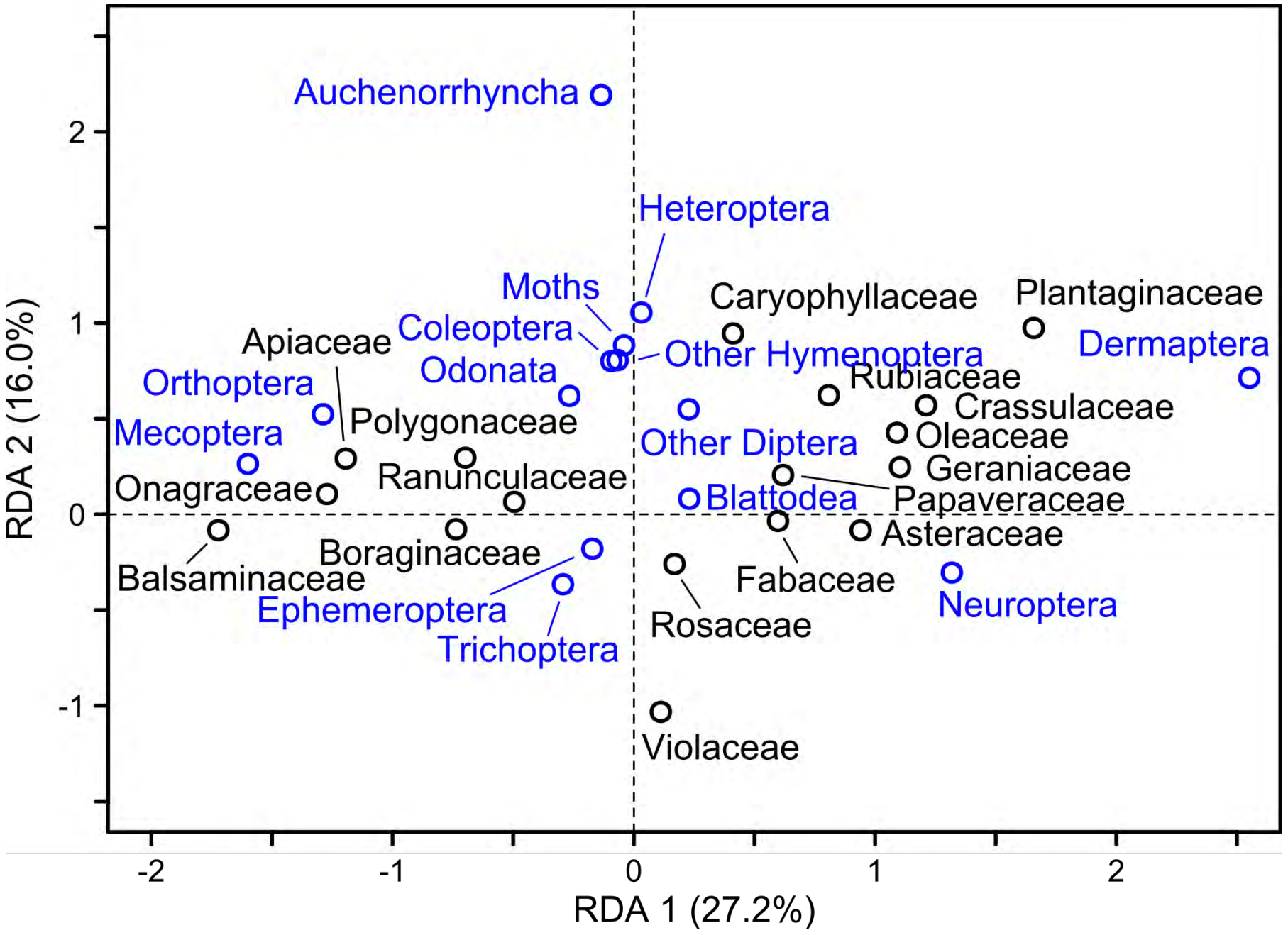

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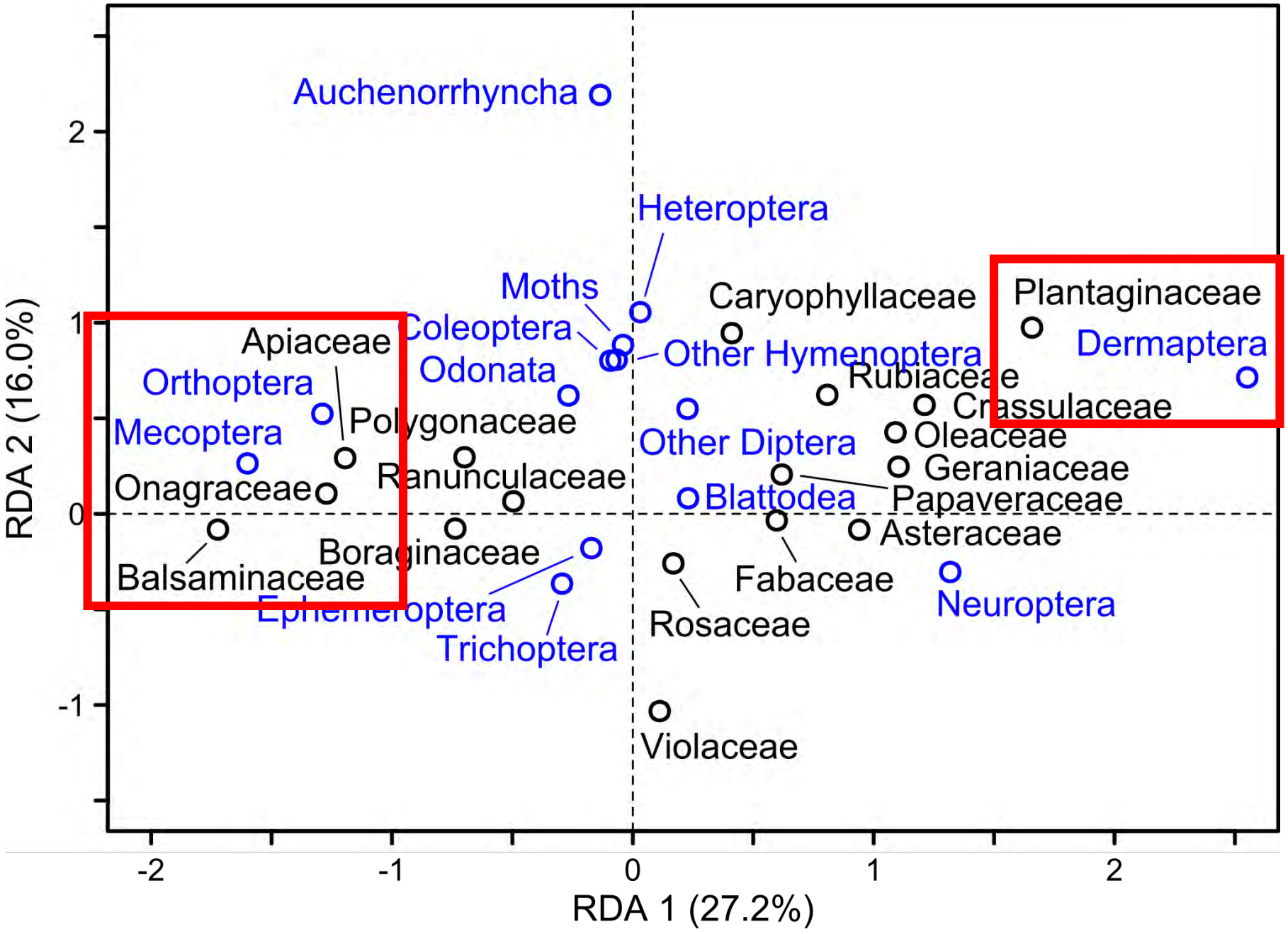

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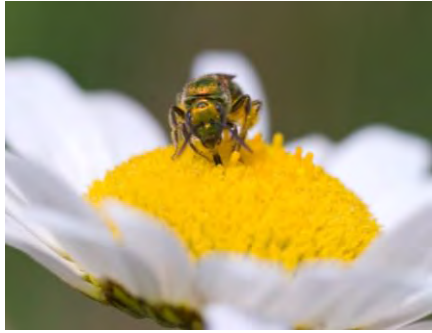

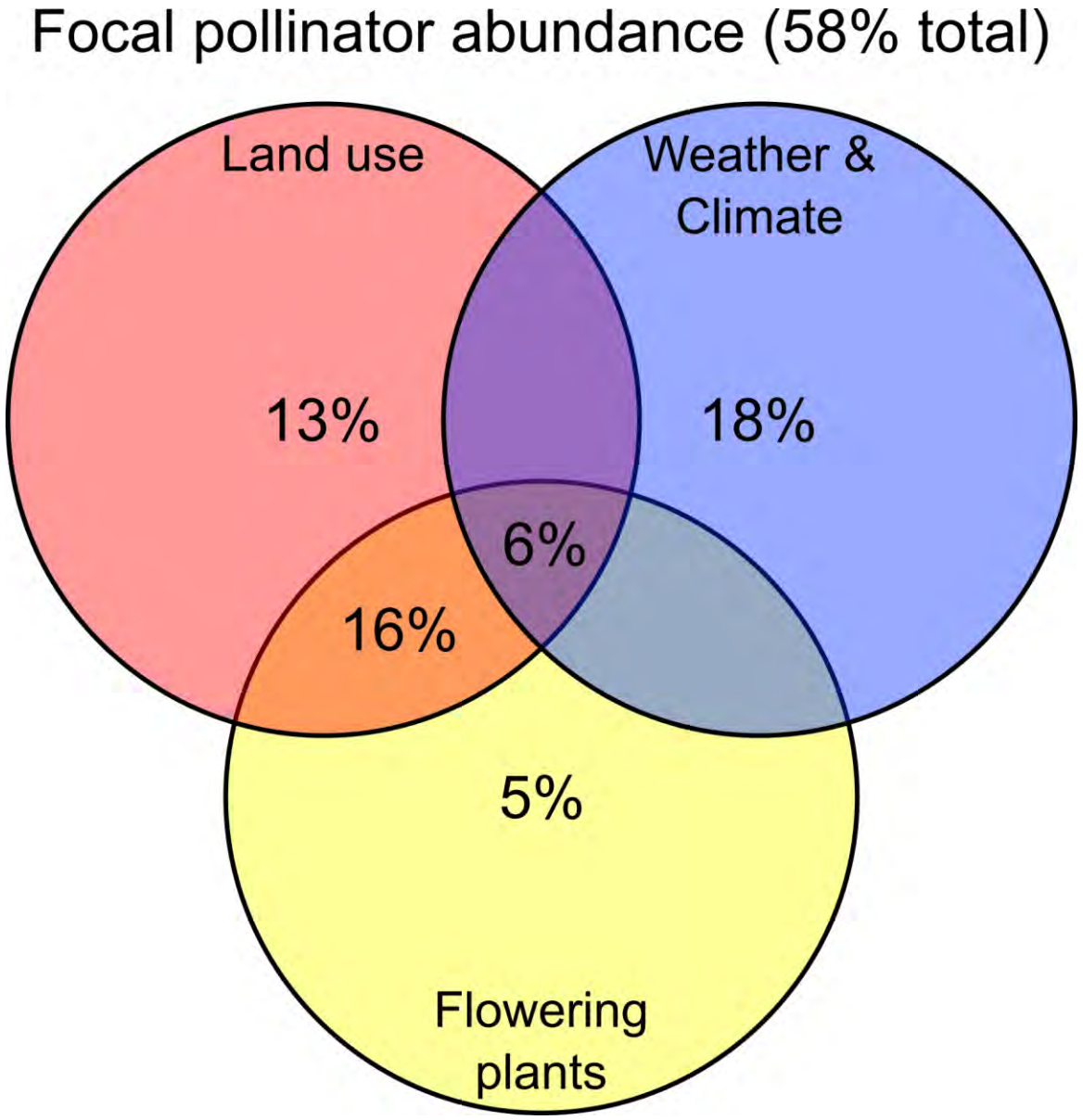

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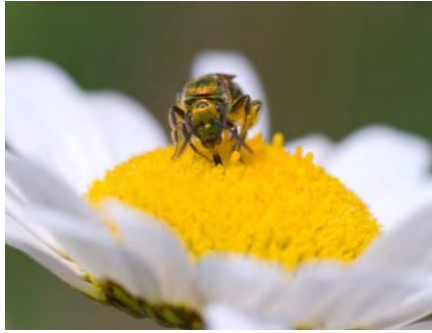

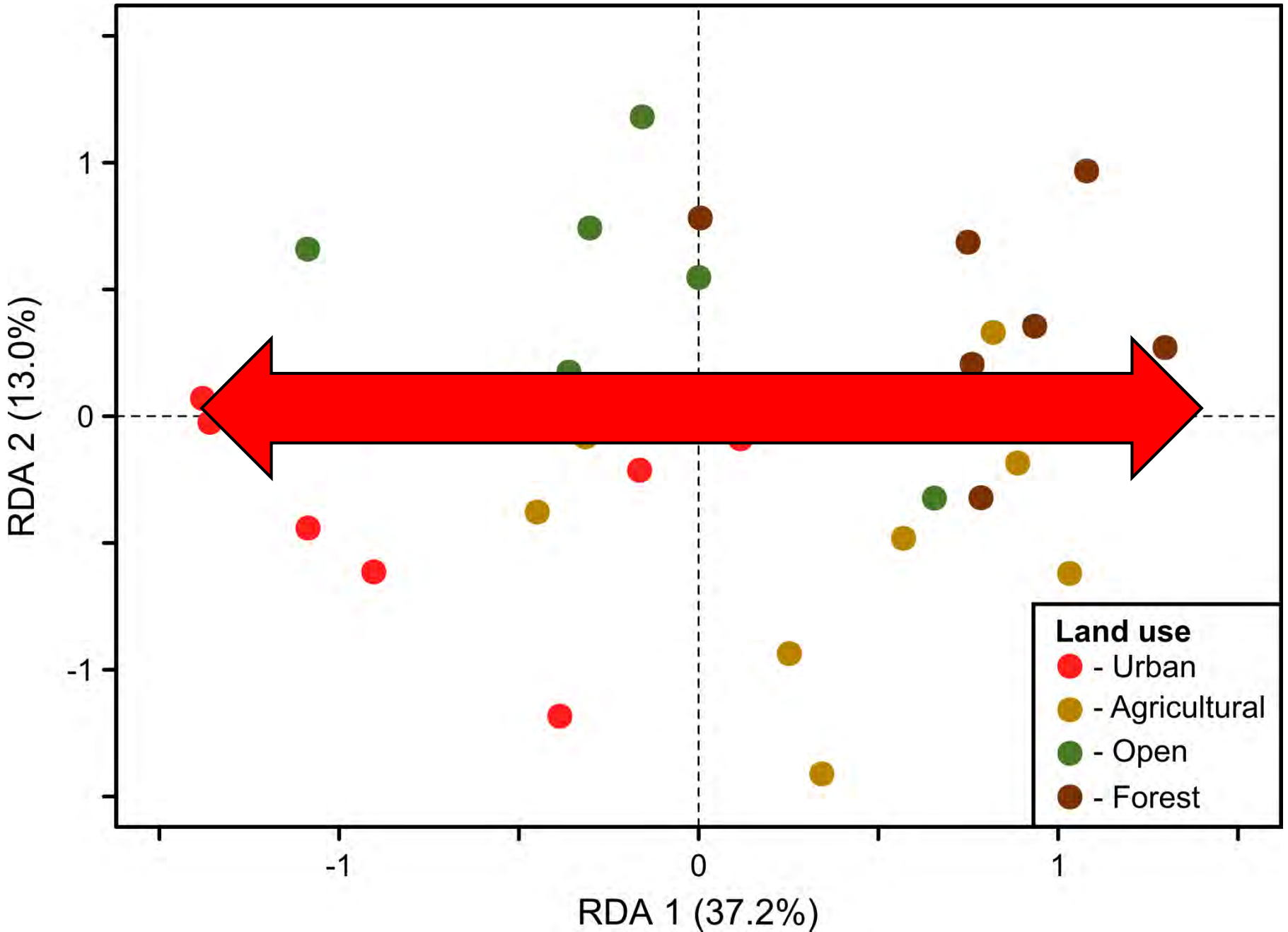

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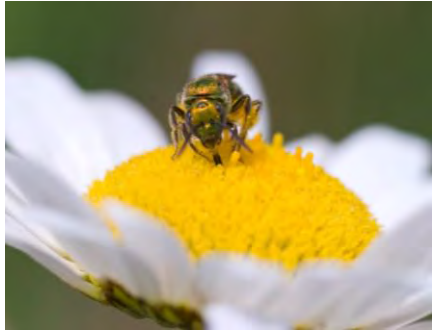

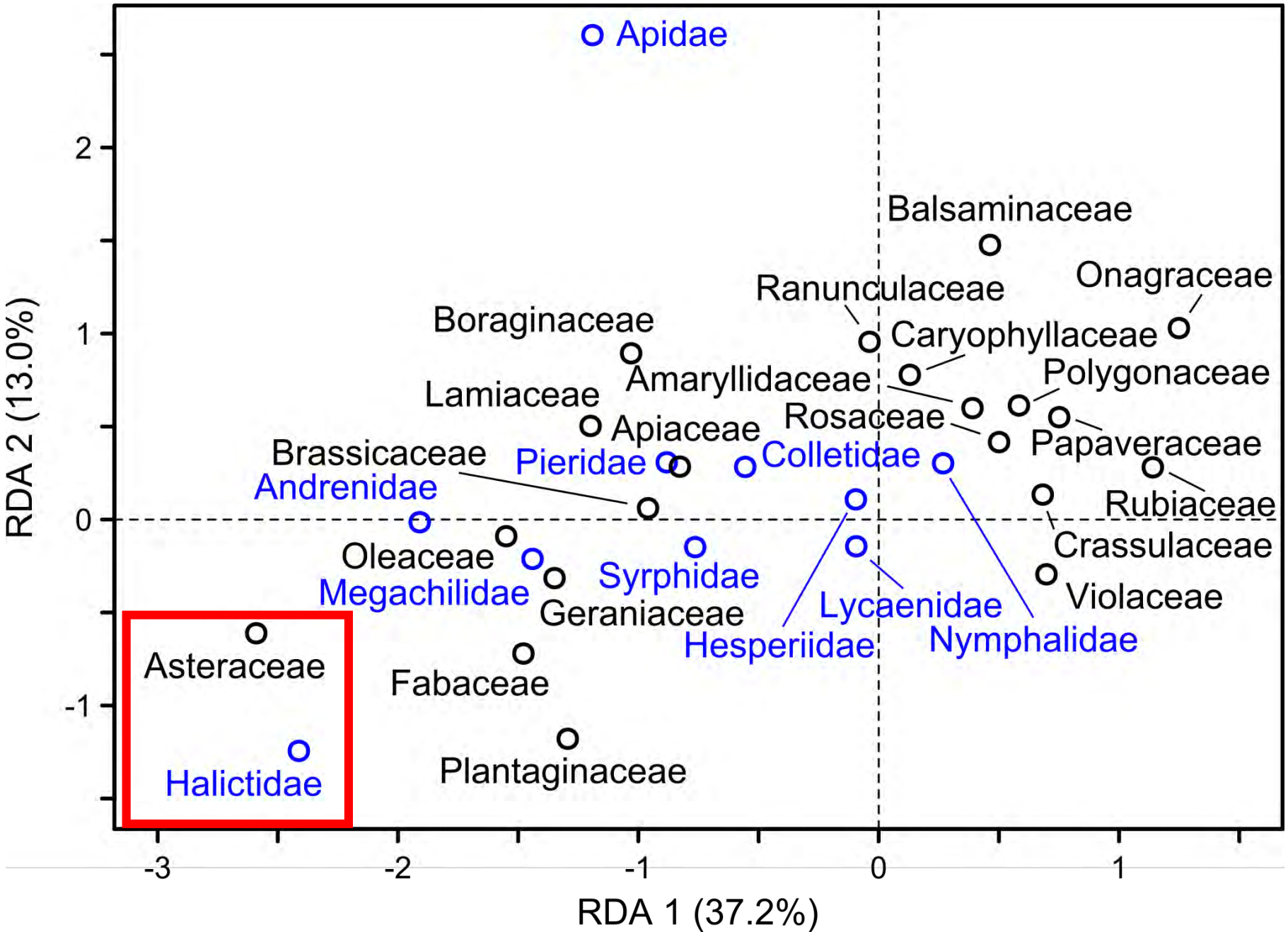

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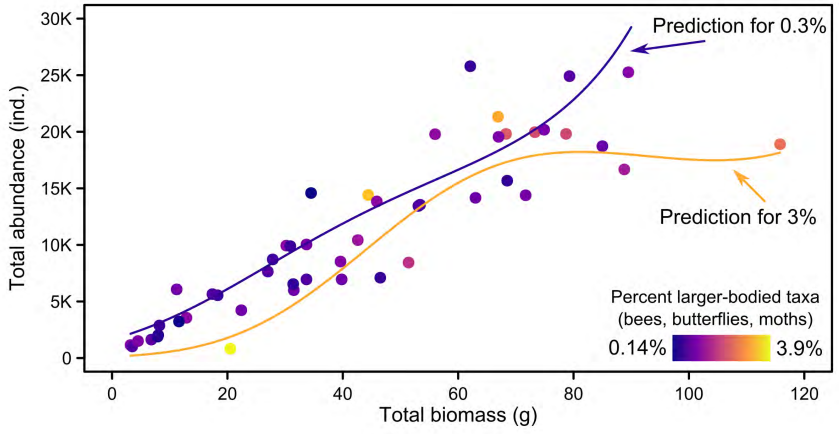

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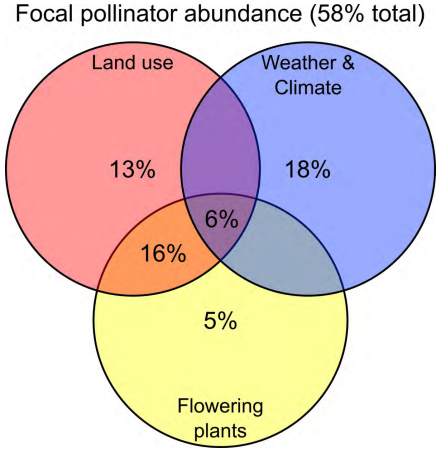
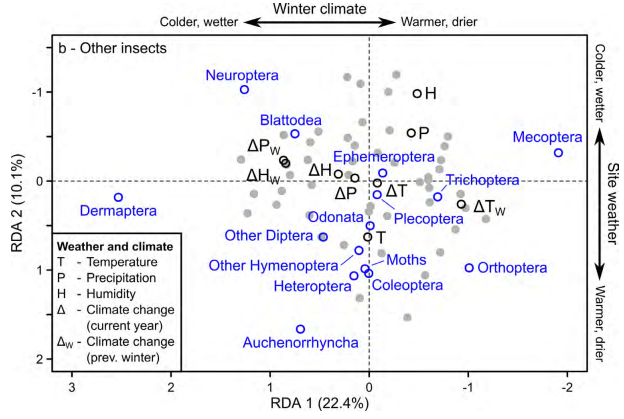
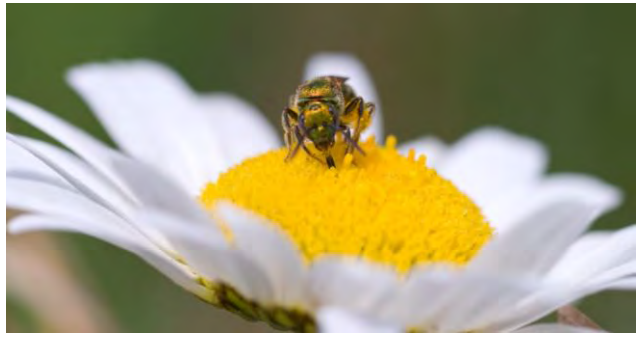




3. Land use & flowering plants

→ Similar overall drivers (forest - urban)

→ But the underlying mechanisms likely differ



Take home messages

- Malaise traps can provide insights beyond just total biomass of primarily Diptera

→ Indicate change in other metrics (e.g., abundance)

→ Main drivers can apply across the community

- But…

→ Won’t apply in every instance (e.g., larger-bodied communities)

→ Underlying mechanisms are not necessarily the same

Questions?

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