

Land-use type changes the belowground food-web in an arid, urban ecosystem.

1. Introduction

- Arid, urban ecosystems experience high rates of land-use change including the installation of managed xeriscapes and irrigated turfgrass lawns in residential and commercial areas^[1].
- Regular use of water and fertilizers in mesic, turfgrass lawns modifies soil microbial community structure, distribution, and function, which can alter N cycling pathways in arid cities^[1,2].
- It is unclear how land-use modifications affect belowground microflora and fauna in urban areas.

2. Research Question and Hypothesis

- Who are the major groups of soil flora and fauna in an urban belowground ecosystem and how do populations change during the dry and monsoon seasons and across landscape type?
- We hypothesize that increased resources (water and fertilizer) in mesic lawns will lead to an increase in soil food web biomass and functional groups relative to arid systems.

3. Methods

- In the summer of 2011, we collected 48 soils at 10cm depth from 4 different land-use types (Fig. 1) within the Phoenix Metropolitan Area during dry and monsoon seasons^[3].
- Soils were extracted for biomass counts of the major belowground feeding groups and were analyzed using a proc GLM in SAS for seasonal and site differences^[3].

Fig. 1

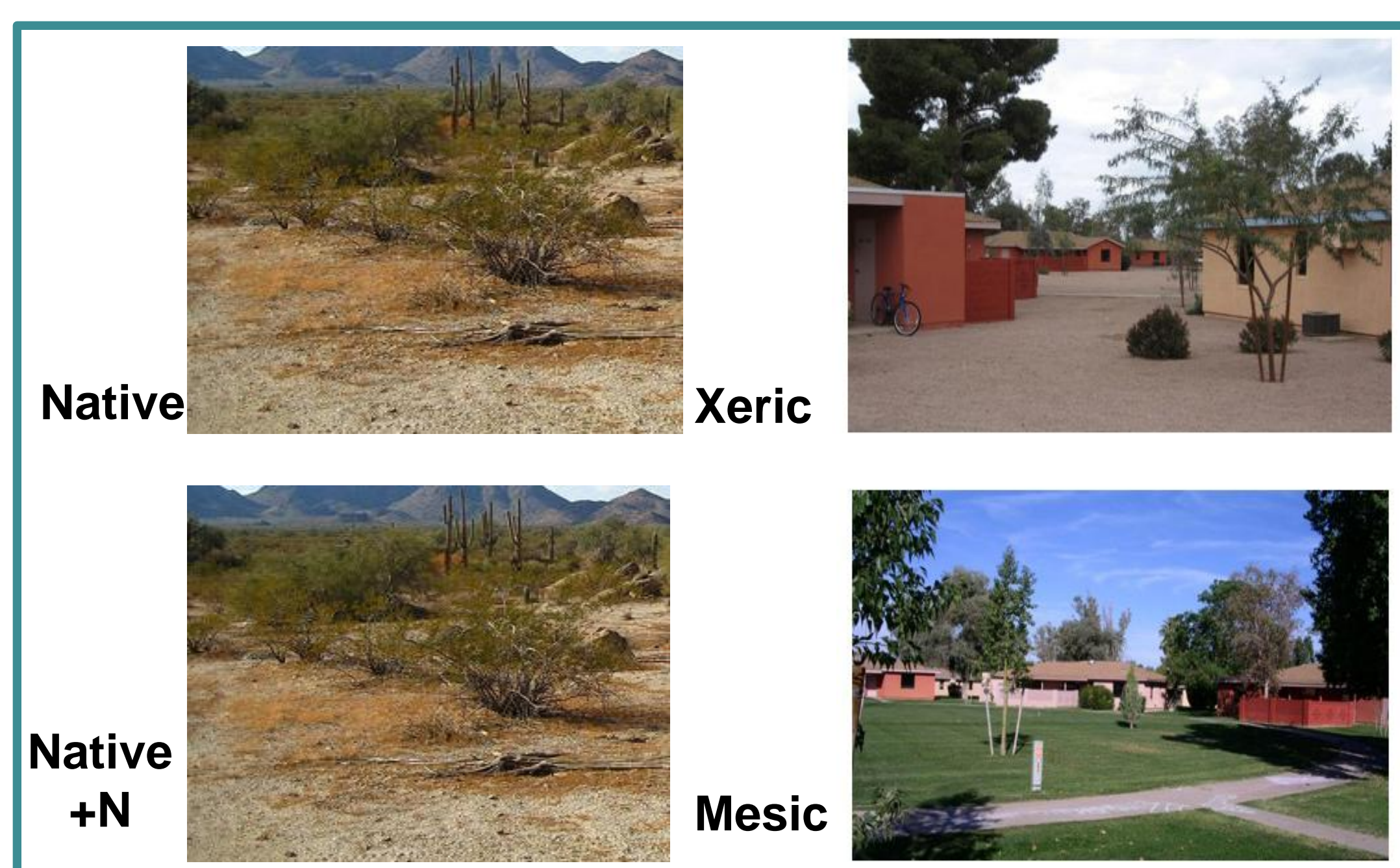


Fig. 2A-D – Brackets indicate significant seasonal difference within a site. Letters indicate a significant difference between sites for each season ($p < 0.05$).

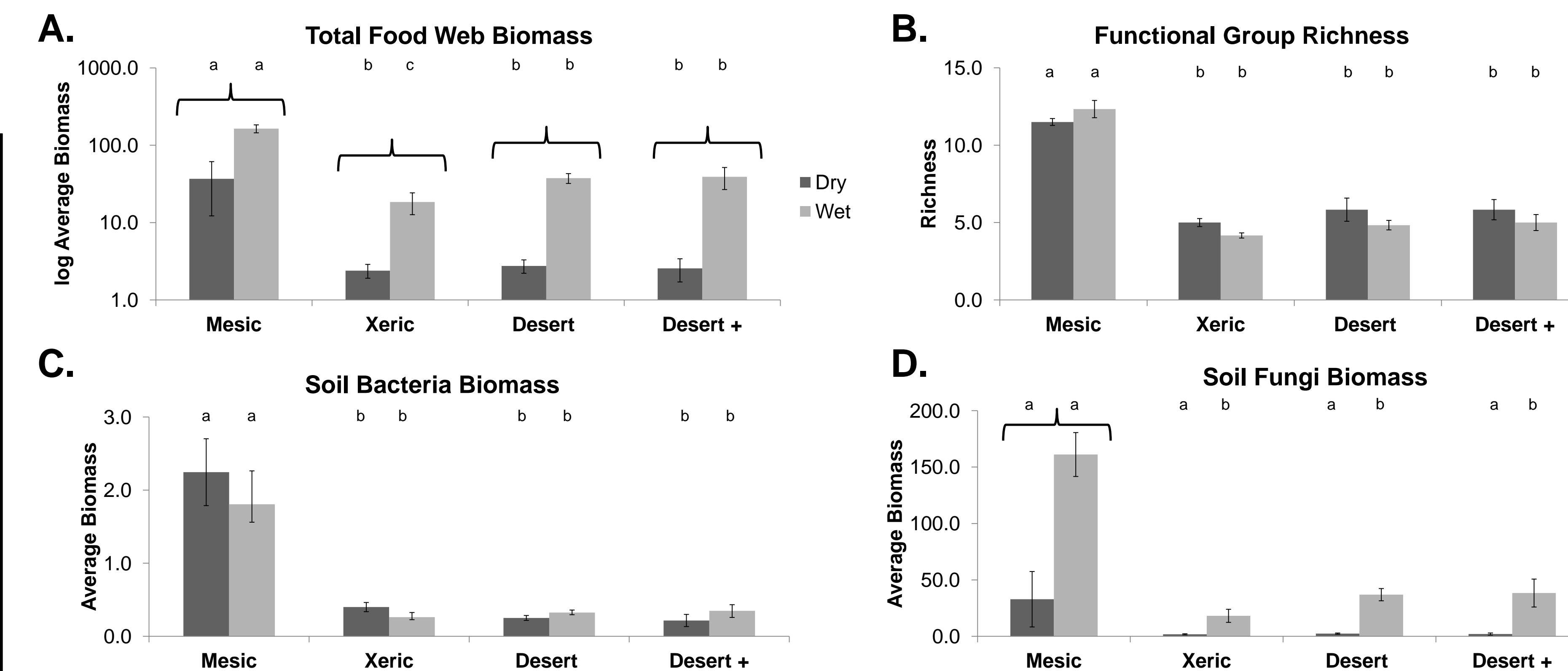


Fig. 3 – Visual depiction of food webs.

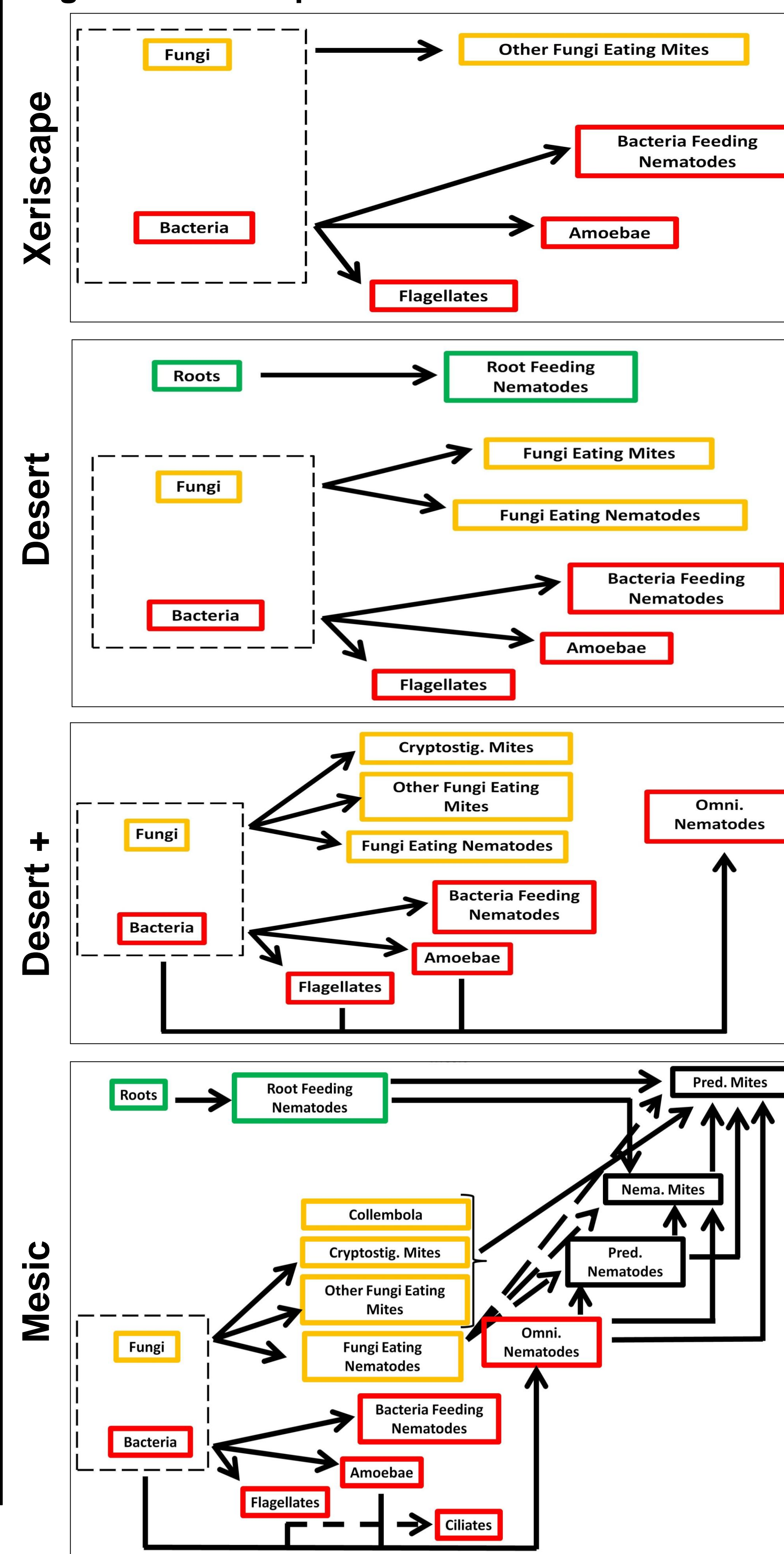


Fig. 4A-B – Biomasses of microarthropods and nematodes during the wet season.

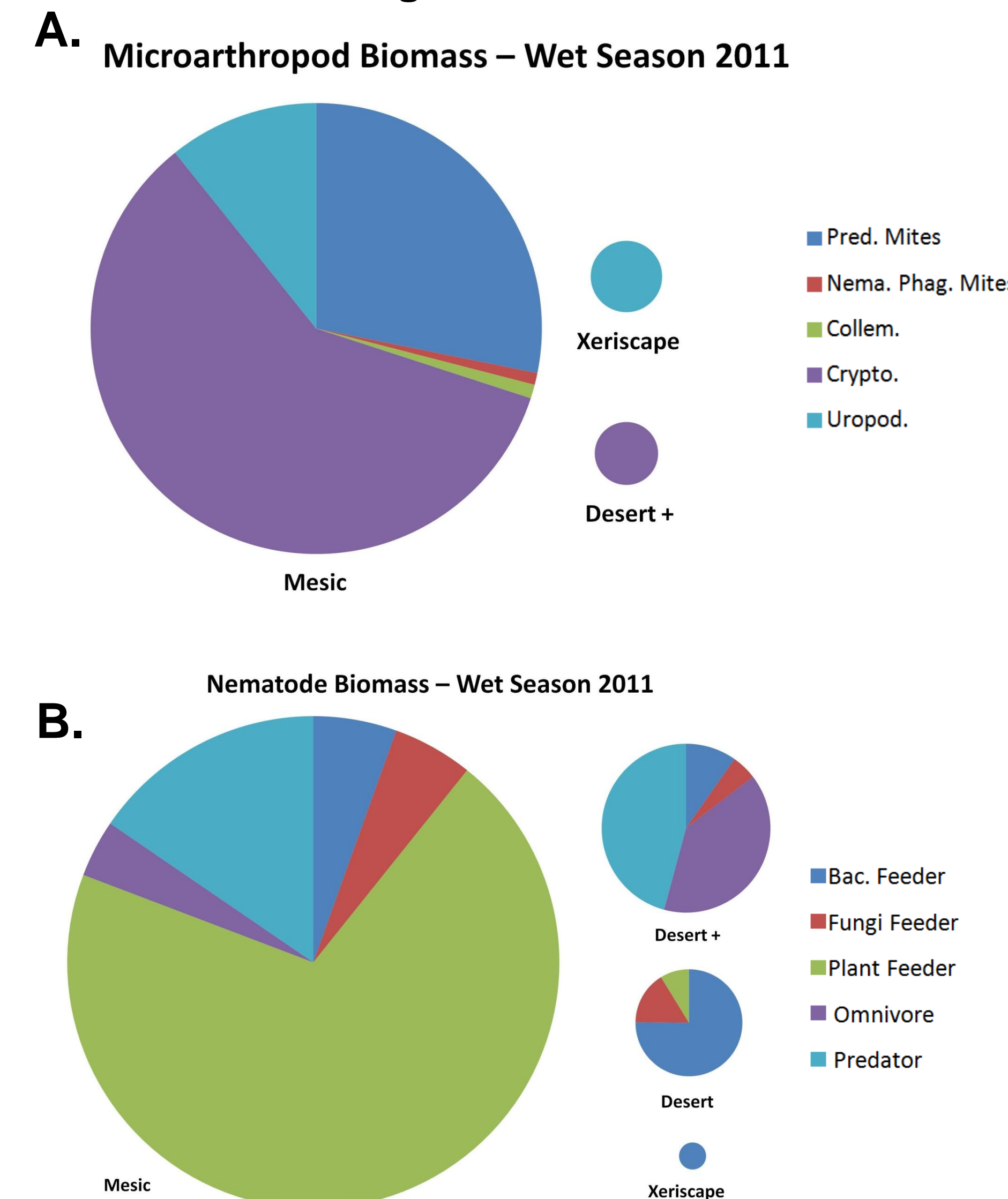
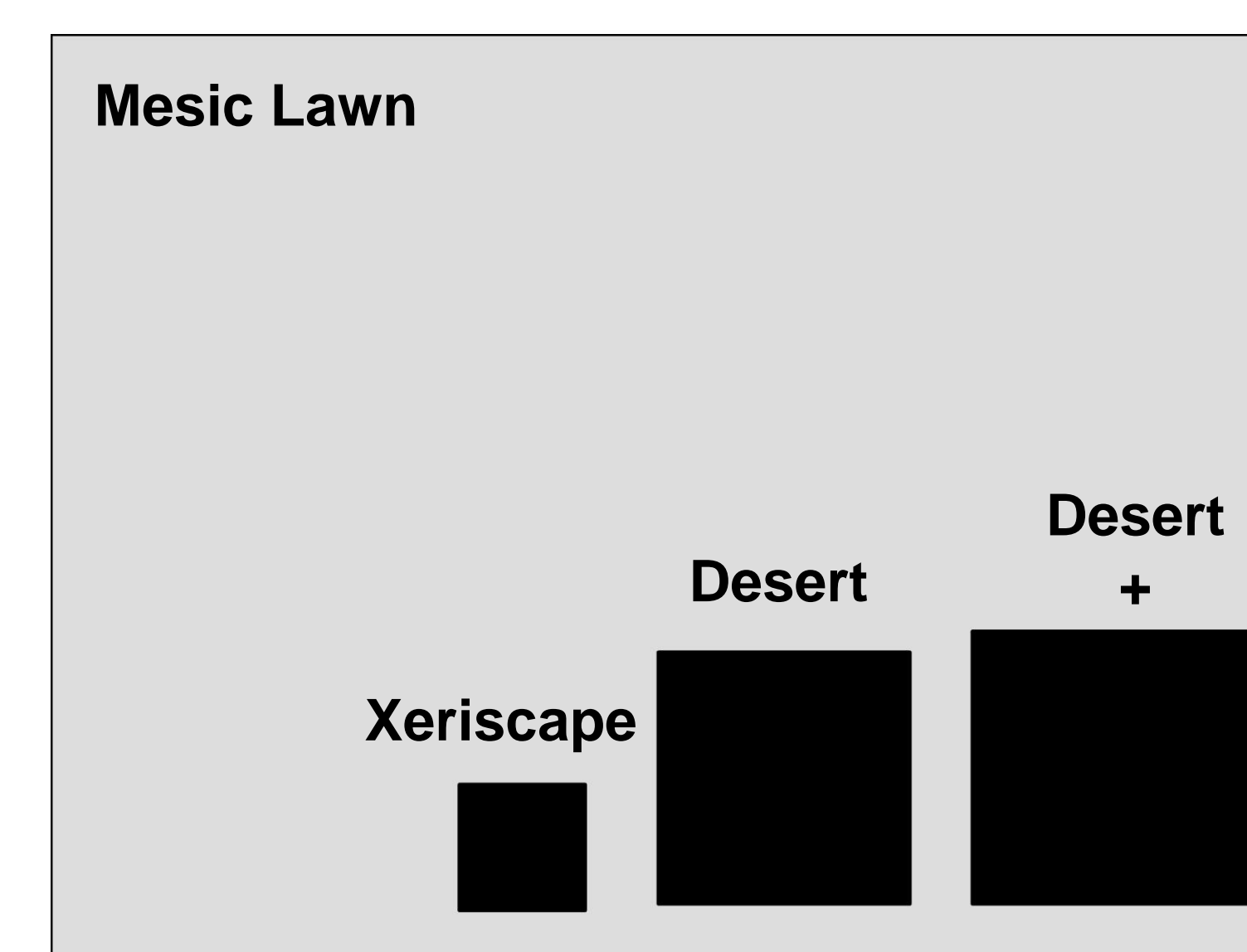


Fig. 5 – Relative sizes of each food web for the wet season.



4. Results

- Fig. 2A – There was a significant seasonal increase in food web biomass across all sites ($p < 0.05$).
- Fig. 2B – The number of trophic groups were higher in the mesic sites, across both seasons, relative to the arid sites ($p < 0.05$).
- Fig. 2C – Soil bacteria biomass decreased in mesic samples but increased in arid sites over the dry and wet seasons.
- Fig. 2D – Soil fungi biomass increased in all sites over the dry and wet seasons.
- Fig 3 – Visual depictions of soil food webs at each site show that mesic food webs are more complex than their arid counterparts.
- Fig 4A – Microarthropod biomass and feeding group richness was significantly greater in mesic samples than arid sites ($p < 0.05$). Graphs are scaled to represent total biomass.
- Fig 4B – Nematode biomass and feeding group richness was significantly greater in mesic samples than arid sites. Graphs are scaled to represent total biomass ($p < 0.05$).

5. Conclusions

- Mesic, turfgrass lawns are interesting ecosystems that have a food web similar to native grasslands^[3].
- ~ Double the number of trophic levels and ~4-8x more belowground biomass than arid systems (Fig. 5)
- NPP of Turfgrass Lawns – 1,020 g m⁻² yr⁻¹^[4]; NPP of Sonoran Desert – 150 g m⁻² yr⁻¹^[5]
- Lawns represent an ‘alien’ landscape that supports a unique soil food web compared to arid, urban soils.

6. Next steps

- Aggregate and model data collected in 2011 and 2012 to help complete our understanding of the interactions between soil properties, soil food webs, microorganisms, and N cycling.

References

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