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

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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 soil food webs in arid, 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 SOM) 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 and 2012, we collected 96 soils at 10cm depth from 4 different land-use types **(Fig. 1)** within the Phoenix Metropolitan Area during dry and monsoon seasons.

• 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] and Excel for regression analysis.

•Food web visualizations and network information were derived using EcoNet 2.2 and FOODWEB in R.

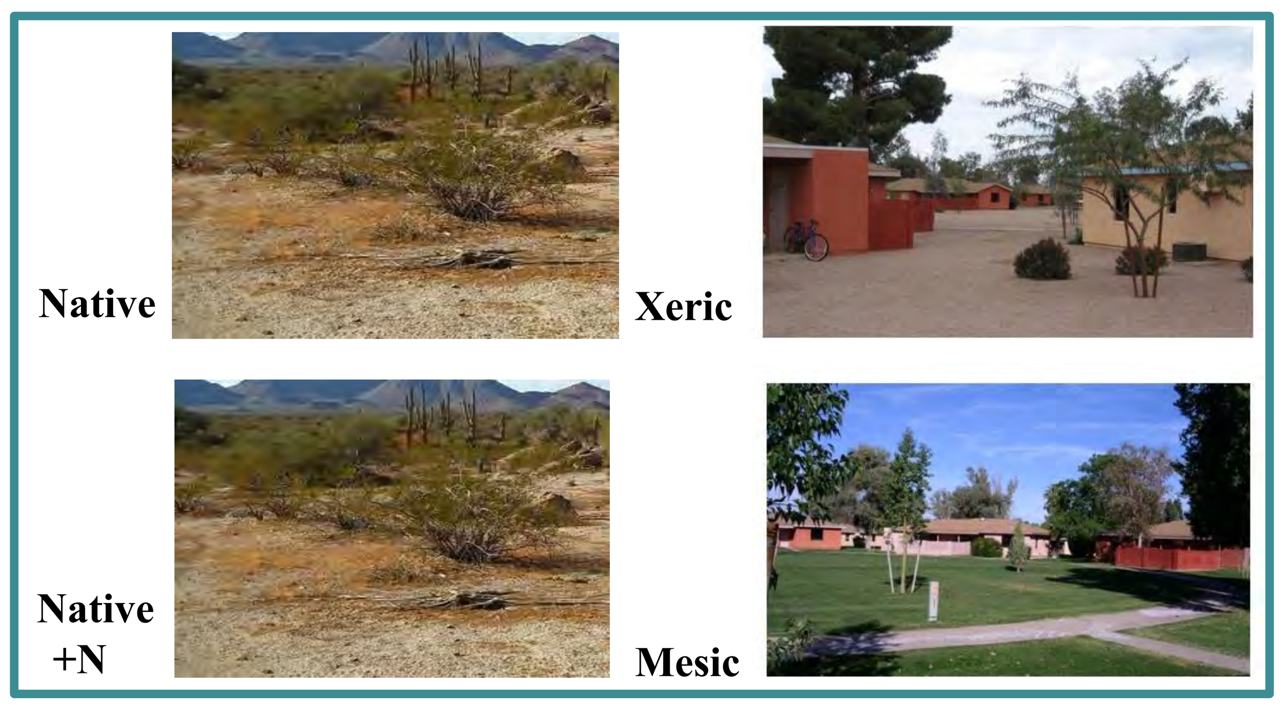

Fig. 1 – Central Arizona Project (CAP) LTER sites used in this study.

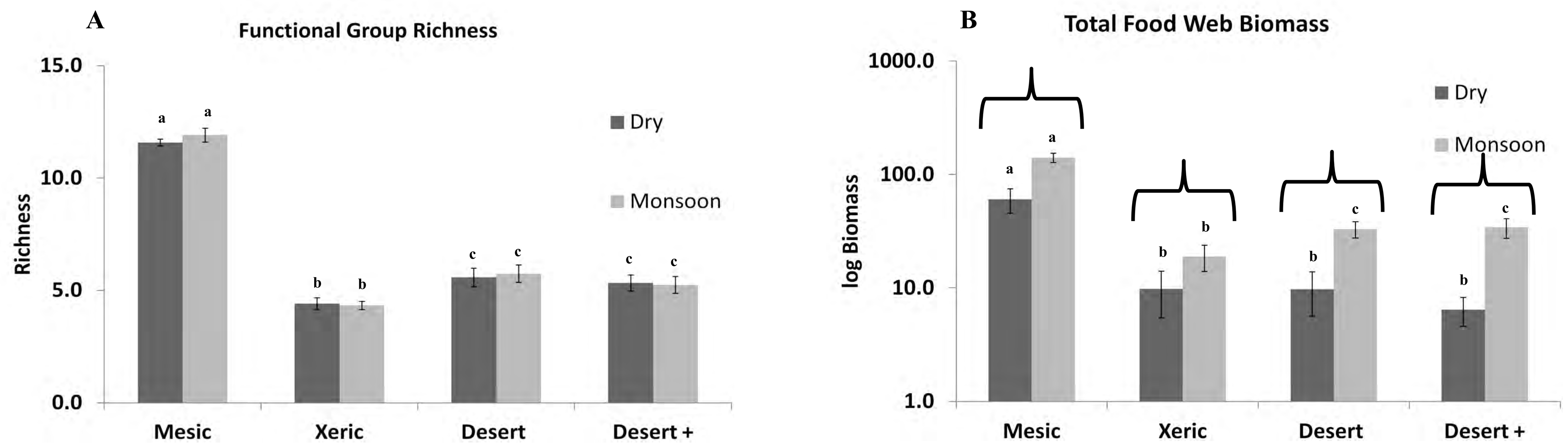

Fig 1a and Fig 1b - Brackets indicate significant seasonal difference within a site. Letters indicate a significant difference between sites for each season (p<0.05).

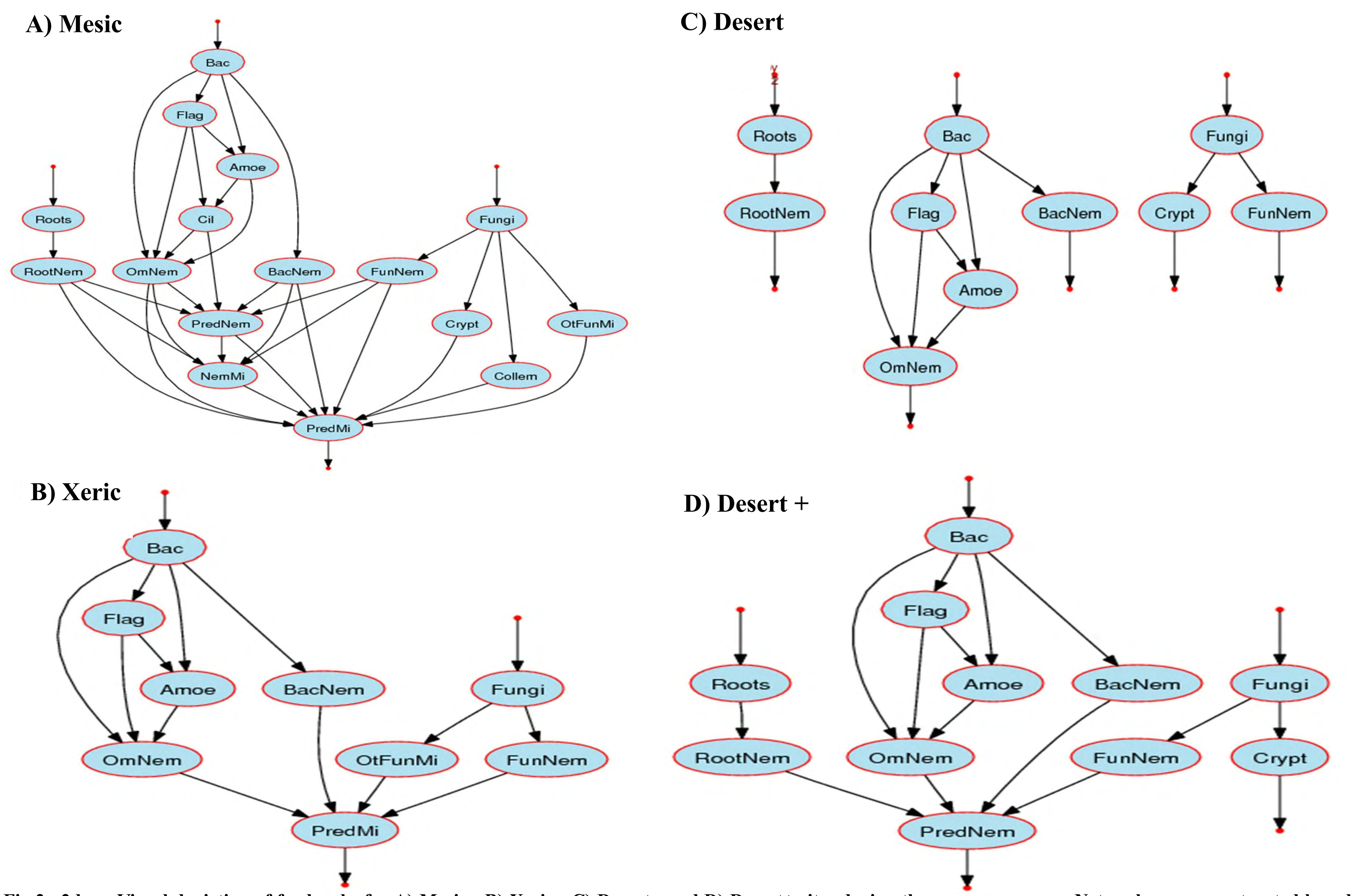

Fig 2a-2d – – Visual depiction of food webs for A) Mesic; B) Xeric; C) Desert; and D) Desert+ sites during the monsoon season. Networks were constructed based on maximum trophic richness counts made in each site. Nodes in the network represent the following groups: Bacteria (Bac); Fungi; Roots; Root Feeding Nematodes (RootNem); Flagellates (Flag); Amoeba (Amoe); Ciliates (Cil); Bacteria Feeding Nematodes (BacNem); Omnivorous Nematodes (OmNem); Fungi Feeding Nematodes (FunNem); Predatory Nematodes (PredNem); Cryptostigmatid Mites (Crypt); Other Fungal Feeding Mites (OtFunMi); Collembola (Collem); Nematode Feeding Mites (NemMi); and Predatory Mites (PredMi) Fluxes indicate energy flow via feeding interactions.

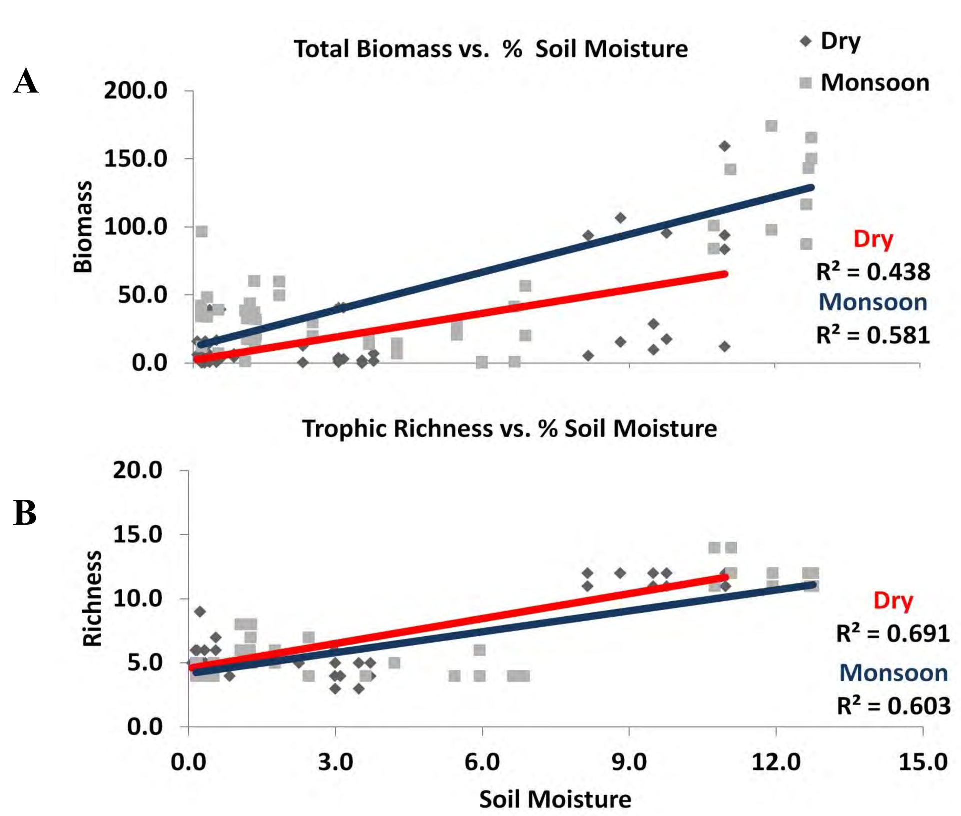

Fig 3a-3b - Correlation between total biomass (3a) and trophic richness (3b) and SM content for samples taken in the dry and monsoon season.

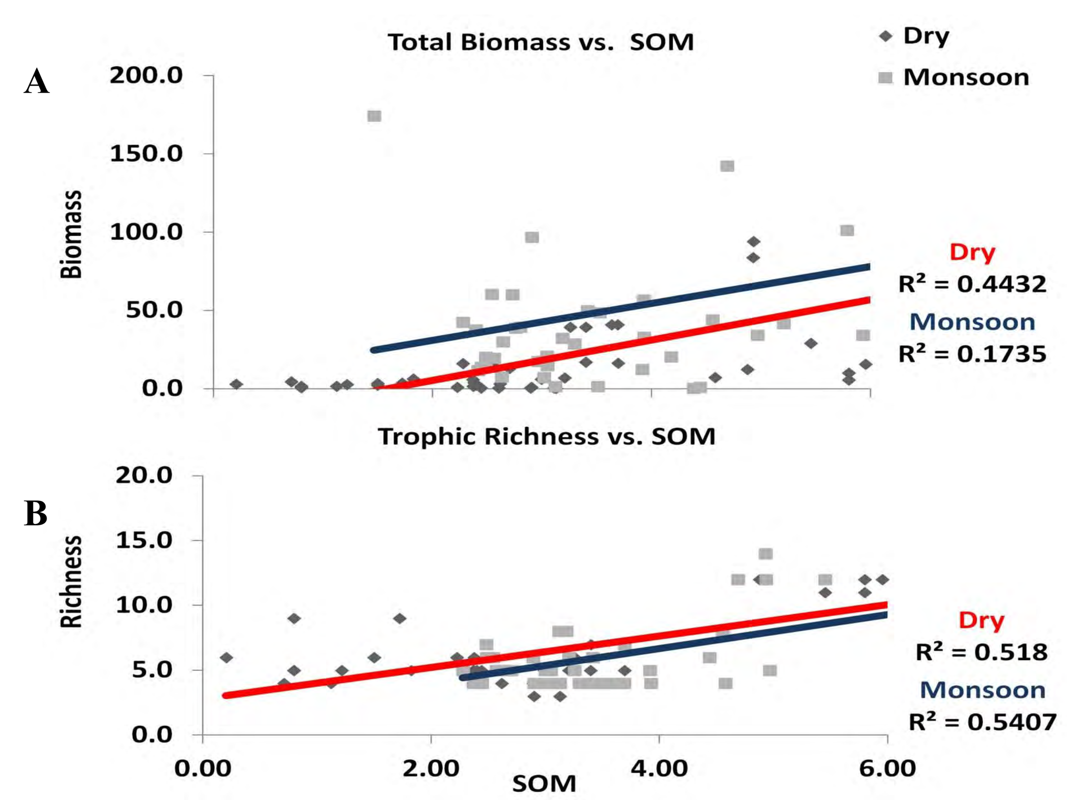

Fig 4a-4b - Correlation between total biomass (4a) and trophic richness (4b) and SOM content for samples taken in the dry and monsoon season.

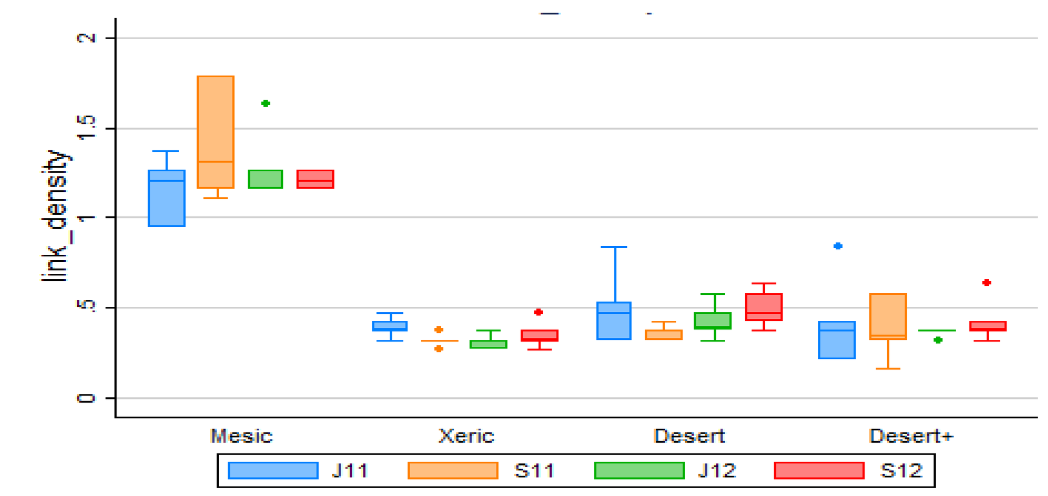

Figure 4 – Link density for food webs by site and season.

4. Results

• **Fig. 1A - 1B -** The number of trophic groups and biomass were highest in the mesic sites, across both seasons, relative to the arid sites (**p<0.05**).

•**Fig. 1B -** There was a significant seasonal increase in food web biomass across all sites (**p<0.05**).

•**Figs 2A - 2D -** Visual depictions of soil food webs at each site show that mesic food webs are more complex than their arid counterparts.

•**Figs 3A&3B - 4A&4B –** Food web biomass and trophic richness are significantly correlated with SM & SOM for both seasons **(p <0.05).**

•**Figure 4–** Link density is highest in the mesic plots during the dry and monsoons. Furthermore, maximum connectance increases only in the xeric plots during the monsoon season (not shown).

5. Conclusions

• ~ Double the number of trophic levels and ~4-8x more belowground biomass than arid systems

• NPP of Turfgrass Lawns – 1,020 g m^{-2} yr^{-1}[4]; NPP of Sonoran Desert – 150 g m^{-2} yr^{-1}[5]

• Unclear whether urban soil food webs are structured primarily by SM or SOM

6. Next steps

• Use FOODWEB[3] model to measure N and C flux between trophic groups. This will help complete our understanding of the interactions between soil properties, urban soil food webs, and N cycling.

References

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