

Rewriting the textbooks: evidence of co-limitation of arthropods by macro- and micronutrients

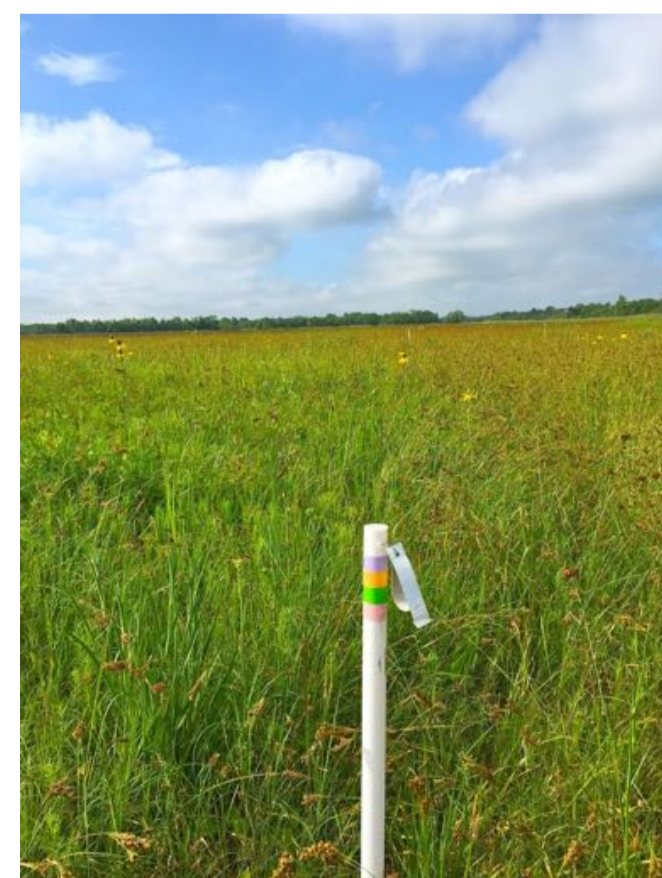
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Introduction

- Macronutrients, such as nitrogen and phosphorous, are important limiting factors in grassland ecosystems; however, little is known about micronutrients limiting effects to plants and animals.
- Previous studies have shown possible co-limitation of plants and arthropods by macronutrients.
- Major question: **Does the presence of micronutrients affect grassland arthropod communities? Does this effect change with macronutrient abundance?**
- We determined whether arthropods responded positively or negatively to the presence of macro- and micronutrients to determine if micronutrients are limiting to arthropods in these ecosystems.

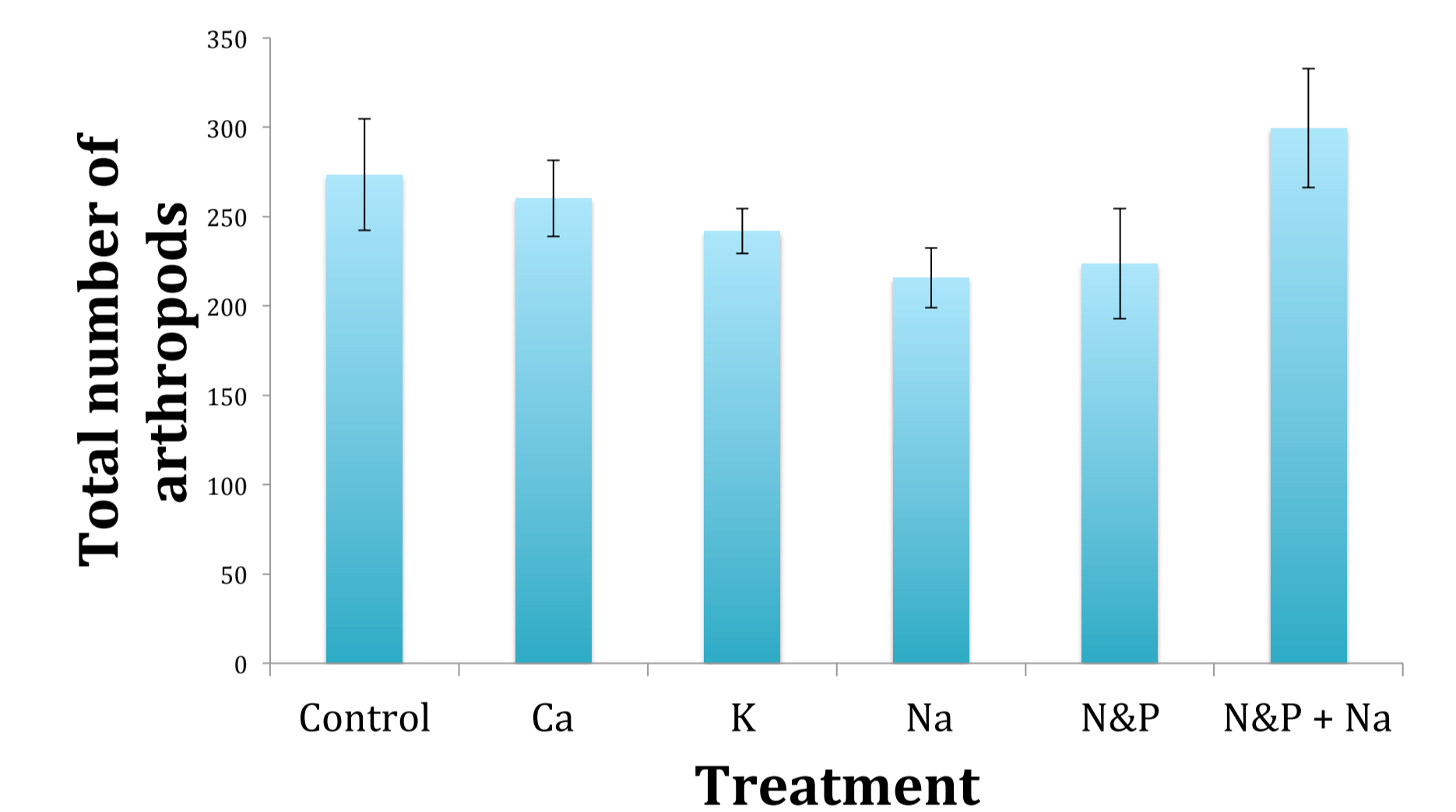
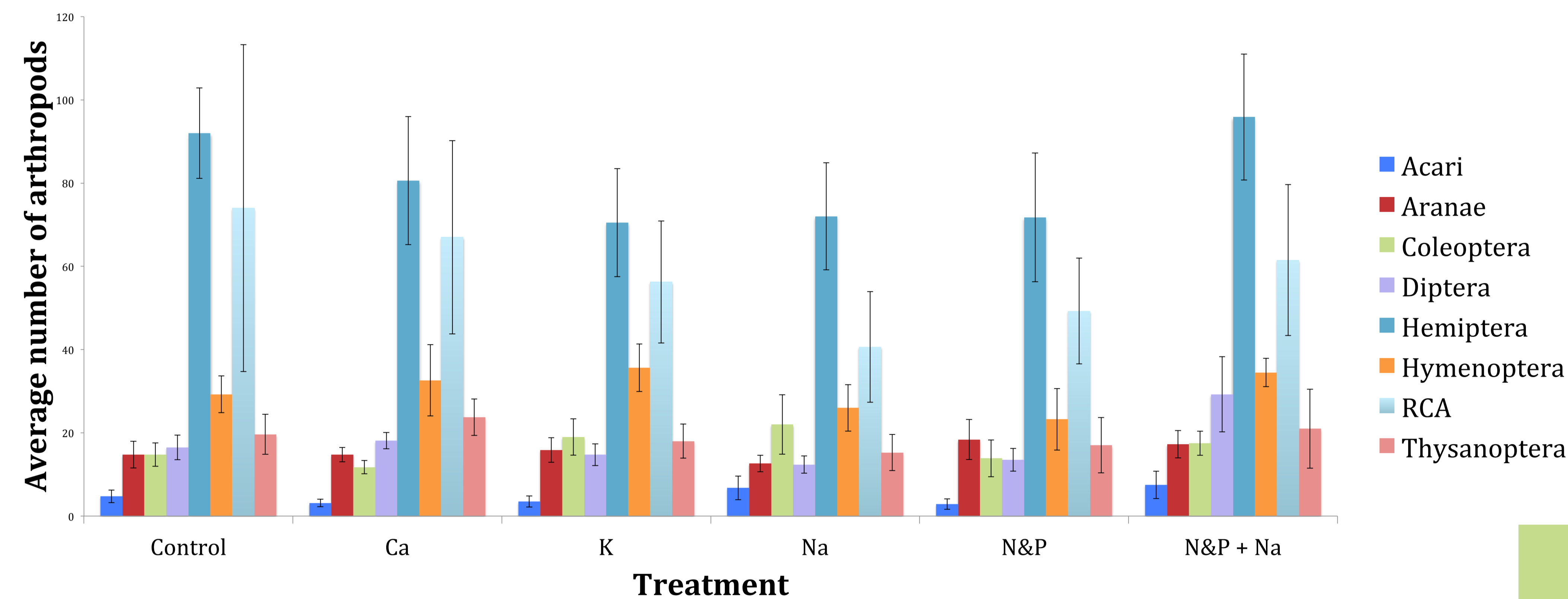
Materials and Methods

- We conducted a large fertilization experiment in a coastal tallgrass prairie in Texas.
- We manipulated nitrogen, phosphorous, calcium, potassium, and sodium in every possible combination (16 total treatments, each replicated 8 times for a total of 128 plots).
- Soil characteristics were measured (pH, conductivity, soil moisture, root moisture, and percent roots).
- Arthropods were collected by sweepnetting in experimental plots in June, 2016, and individuals were identified to order.



Results

Treatment	Order of Arthropods									
	Acari (mites)	Araneae (spiders)	Coleoptera (beetles)	Diptera (flies)	Hemiptera (true bugs)	Hymenoptera (bees, wasps)	Thysanoptera (thrips)	Total	Raspberry Crazy Ants	Total without ants
Ca	0	+	-	+	0	0	+	0	+	0
K	0	+	0	0	-	+	0	-	0	0
Na	+	0	0	0	-	0	0	-	0	-
N&P	0	+	0	0	0	0	0	0	0	0
N&P+Na	0	0	+	+	+	+	+	+	+	+



Most orders reacted positively in response to nitrogen and phosphorous with the addition of sodium.

- Only one order (spiders) responded to nitrogen and phosphorous on its own, which is what scientists have thought to be limiting for decades.
- No orders responded to any soil characteristics. There was no significant correlation between the insects and pH, conductivity, or soil moisture.
- Some orders responded to different plant characteristics.
 - Spiders responded well in areas with tall plants, especially with the presence of *Helianthus angustifolius*, a species of sunflower.

Conclusions

- There is evidence of co-limitation by macro- and micronutrients. There may be interactions between nutrients that are essential to these communities. Our results show that sodium, in addition to nitrogen and phosphorus, may be important co-limiting factors.
- More work needs to be done to determine how these nutrients interact, but these findings could completely change our views on how communities are driven by macro- and micronutrients. It may also change how we fertilize our land.

Acknowledgments



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