Urbanization Affects Web Aggregation and Placement of a Funnel Weaver, *Agelenopsis pennsylvanica*

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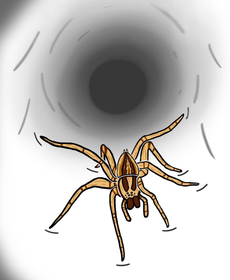


Spider Distributions in Diverse Habitats

- Animals distribute themselves based on **environmental factors** and **intra- and interspecific interactions** [1]
- **Aggregations** can form when resources are not evenly distributed, leading to higher-quality patches [2]
- **Diverse habitats** vary in access and distribution of resources, especially in and near areas of significant **human disturbance** [3]
- **Funnel weavers** (*Agelenopsis pennsylvanica*) are present across diverse habitats, including **an urban forest and a city center** in Lincoln, Nebraska

Goal: Quantify variation in aggregation, abundance, and position of funnel webs between an urban forest and a city center
Secondary goal: Explore potential predictors of such observed differences

Methods and Results

- We chose Wilderness Park (urban forest) and UNL City Campus (city center) due to their **distinctive environmental characteristics**, such as land cover (Fig. 1)
- We randomly selected start sites from path intersections and searched along a path until the first occupied (focal) web
- We measured the **distance between the retreats of the focal web and the two nearest neighbors** (Fig. 2)
- We counted the **number of spiders** (Fig. 3) and measured **web height** (Fig. 4) for each web in a 10-meter radius of the focal web
- We subset the data by habitat and ran AIC model selection on models with **environmental predictors** for each dependent variable (Fig. 5)

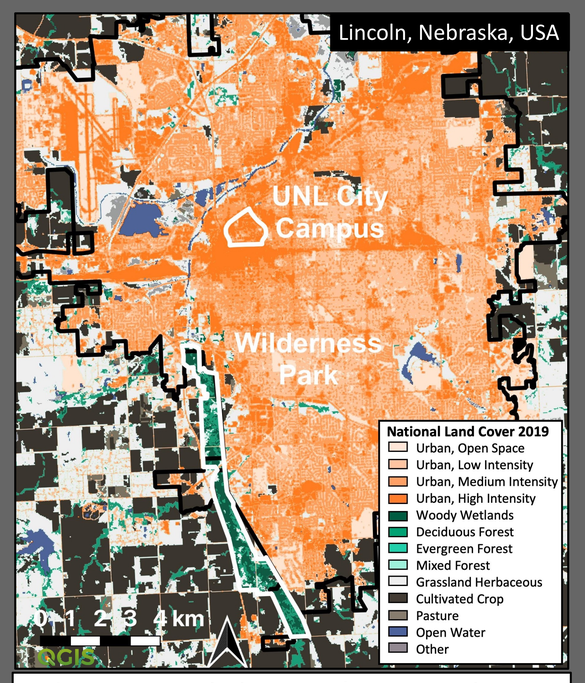


Fig. 1 Diverse habitats in/near Lincoln, NE
Wilderness Park = Forest
University of Nebraska-Lincoln (UNL) City Campus = City

Main Question: Do spiders vary in **aggregation**, **abundance**, and **web position** between an urban forest and a city center?
Follow-Up Question: What environmental factors may be correlated with such differences?

Main Question

Aggregation

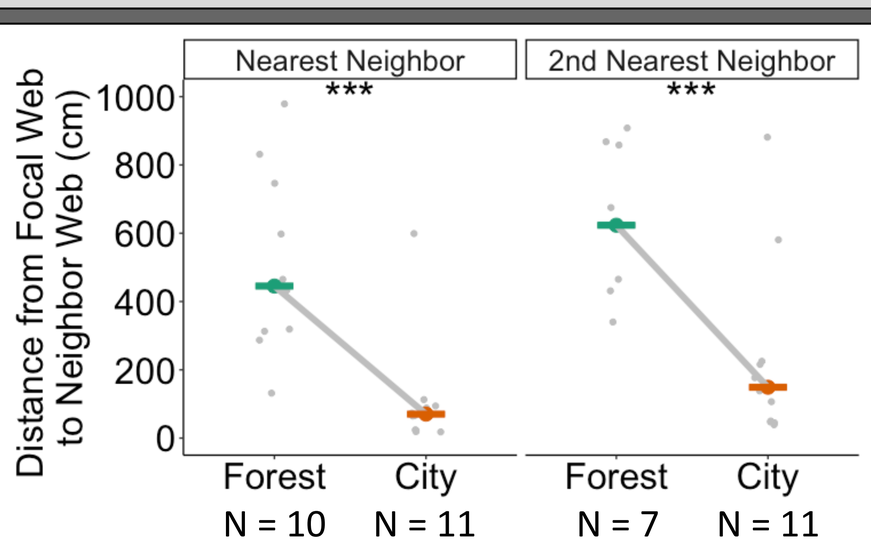


Fig. 2 Webs were **more aggregated** in the city
(Neighbor: P < 0.001, Habitat P < 0.001, Interaction: P < 0.001)

Abundance

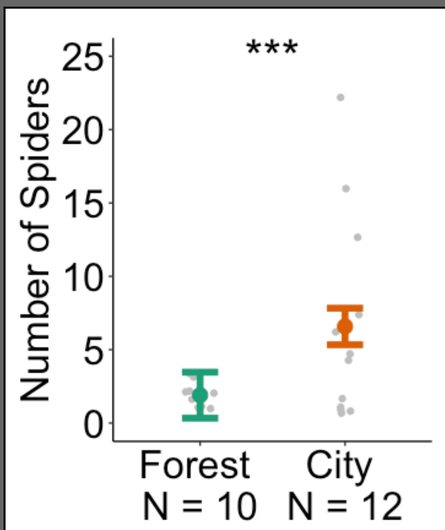


Fig. 3 Spiders were **more abundant** in the city
(P < 0.001)

Position

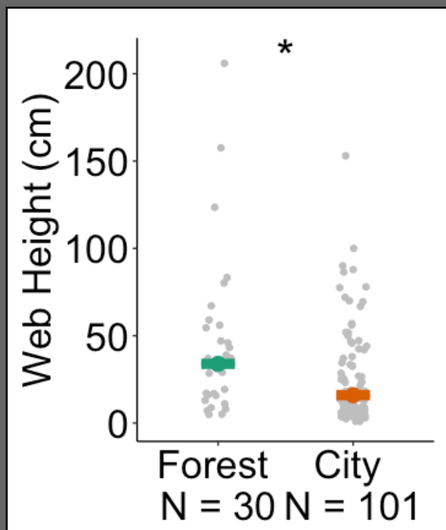
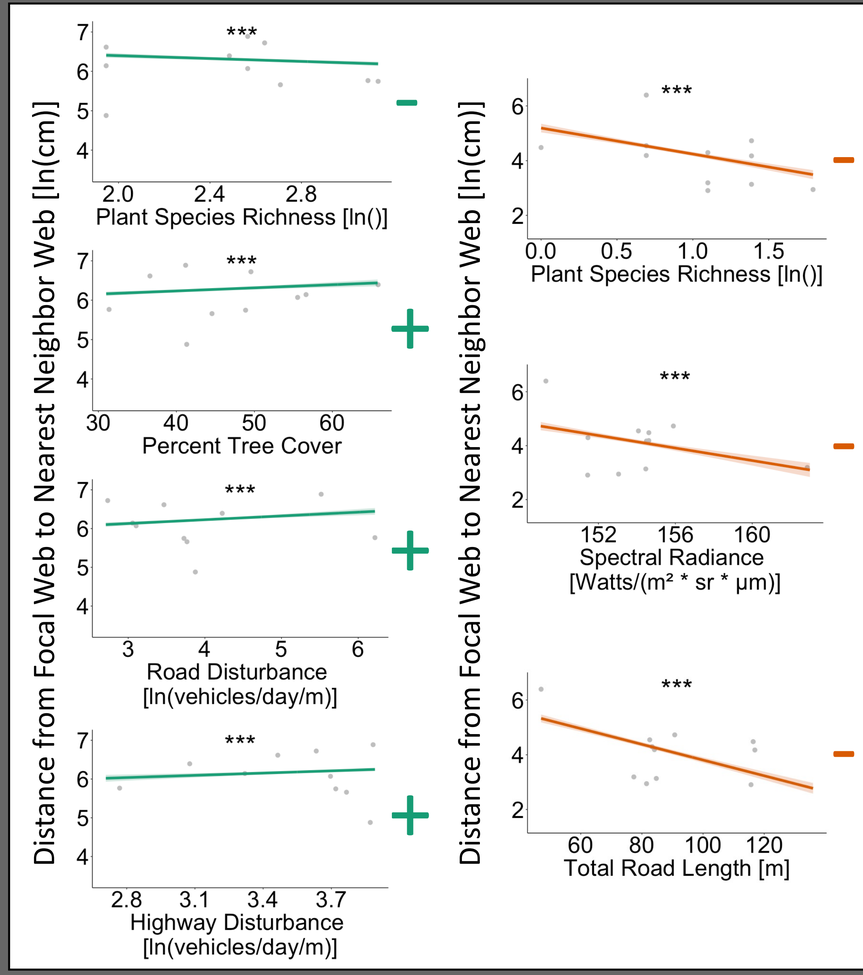
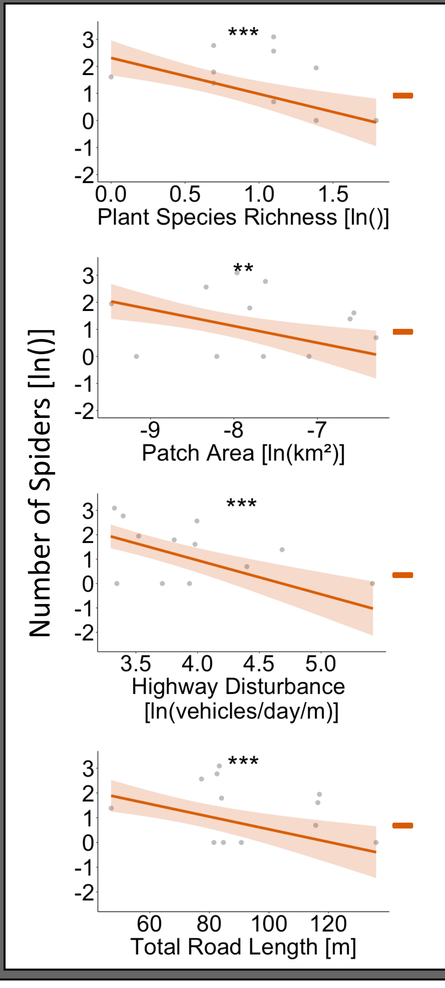


Fig. 4 Spiders **built lower webs** in the city
(P = 0.017)

Follow-Up Question





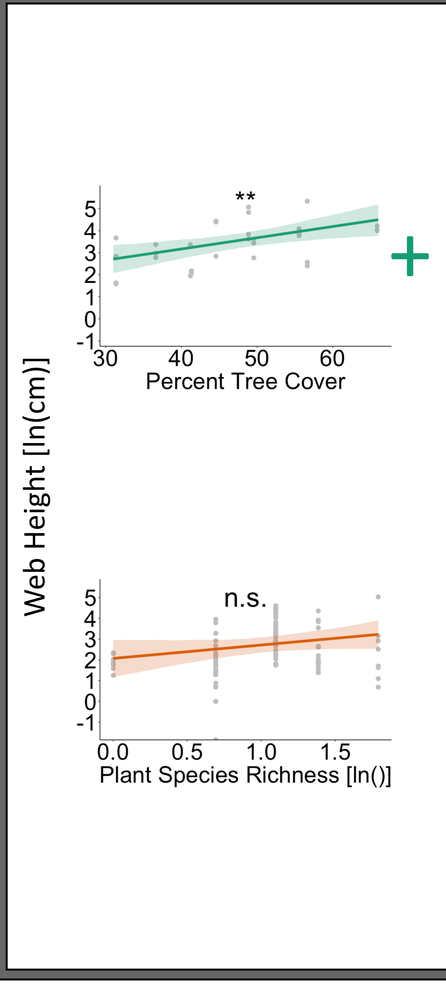


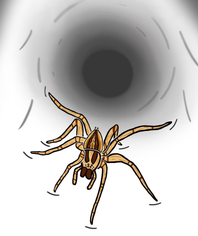
Fig. 5 Web aggregation and city abundance, but not forest abundance nor position, were correlated with the selected environmental predictors
(*** P < 0.001, ** P < 0.01, * P < 0.05)

- **Webs were more aggregated in the city**
  - Spider aggregations may form when **abundant or clumped prey** allow for higher tolerance of neighbors [4], but this should be tested directly
  - Webs were more aggregated with **greater plant diversity**
  - Plants were less diverse and clumped in the city, so perhaps aggregation is related to **suitable web substrate** [5]
  - Forest spiders aggregated more under **lower traffic disturbance**, but city spiders aggregated more with **greater road length**

In a test of spacing that accounts for density (nearest neighbor calculations [6]), we find that webs were **clumped in the urban center** (0.47) and **uniform in the urban forest** (1.24)

- **Spiders were more abundant in the city**
  - Forest spider abundance was **unaffected** by the selected environmental predictors
  - City spiders were more abundant in **small patches with less diverse plants and lower traffic disturbance**
  - Variation in spider abundance may relate to **prey abundance** [7]

- **Webs were lower in the city**
  - Lower webs in the city could be the result of **prey type** [8] or **frequent lawn maintenance**
  - Forest webs were built higher at sites with **more tree cover**
  - Perhaps higher webs in the forest, especially under more tree cover, **avoid destruction** by small animal movement [9]



Significance: Many factors influence the prevalence and distribution of animals through space. Human-caused environmental alterations in cities can have profound effects on animal distributions with consequences for ecosystem interactions. Spiders are essential pest control agents [10] and play important ecosystem functions. Understanding how humans impact spider distributions has important implications for pest control and ecosystem health, among others.

Moving forward, we conducted a playback study to understand the spiders' behavioral responses to vibratory noise – like traffic noise

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