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Cline, Curtis, "A meta-analysis of the variables affecting tick abundance" (2024). *IdeaFest 2024*. 36.
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A meta-analysis of the variables affecting tick abundance

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Abstract

- I looked the current literature on ticks to determine the different variables that could impact the abundance of ticks
- There are a wide array of studies on ticks, though they primarily focus on disease rather than strictly density and abundance of the ticks themselves
- Many do report the abundance of ticks collected per unit of area, and I used this data along with other reported variables to determine patterns
- Results showed:
 - Similar levels of tick density in both urban and natural areas
 - Similar levels of tick density in Europe, Western North America, and Eastern North America
 - Significantly higher densities of the lone star tick (*A. americanum*) compared to the western black-legged tick (*I. pacificus*), the deer tick (*I. scapularis*) and the castor bean tick (*I. ricinus*)

Introduction

- Knowledge of parasite abundance is important for both those who participate in outdoor recreation as well as wildlife managers
- Ticks in particular present a concern due to the diseases they carry such as Lyme disease
- Few studies have directly compared urban to natural environments, but it has been found that tick abundance in these areas are similar (Ishak et al. 2018)
- Objective: Determine what variables affect the abundance of ticks in different regions and environments
- Hypothesis: The level of urbanization will not have an impact, while the location will have an impact on tick abundance

Methods

- Current literature on ticks were researched using Google Scholar using the following keywords: Tick abundance, tick density, *I. pacificus*, *I. pacificus* abundance, *I. pacificus* density, *I. scapularis*, *I. scapularis* abundance, *I. scapularis* density, ticks urban
- Only studies using the method of "flagging" for tick collection were considered (dragging and approximate 1 m² fabric sheet across vegetation)
- The following variables were collected or calculated from the available data: tick density (#/100 m²), urbanization, location, total number of ticks collected, total numbers of larvae, nymphs, and adults, species collected, season, year, and total area sampled
- When comparing two independent variable categories a t-test assuming equal variances was used
- When comparing multiple independent variable categories an ANOVA test was used followed by a Tukey test to determine the significant pairwise comparisons
- The primary species that were compared due to their importance to public and management concern were *I. pacificus* in Western NA, *I. scapularis* in Eastern NA, and *I. ricinus* in Europe

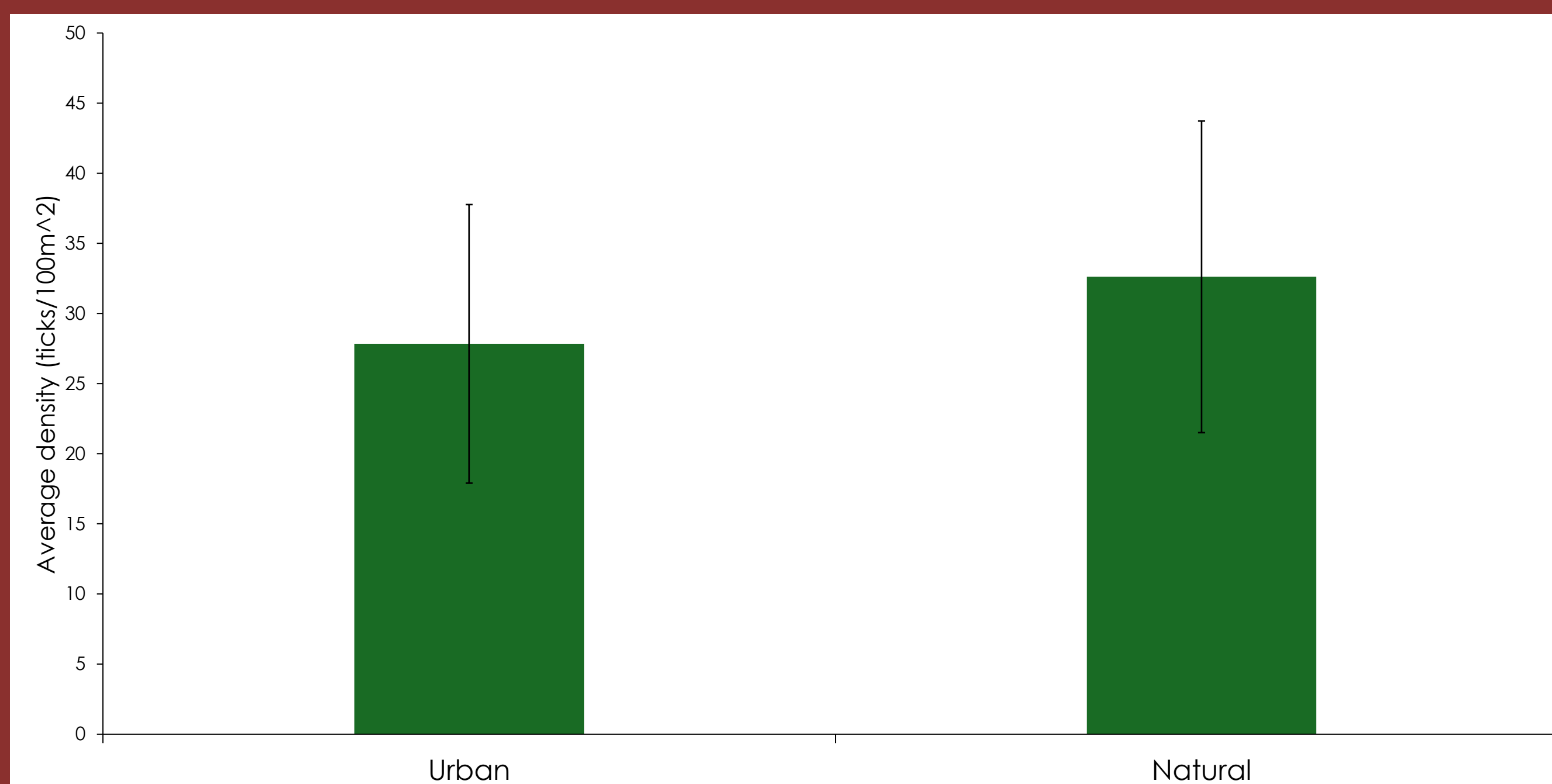


Figure 1. A comparison of average tick densities (#/100m²) in urban and natural environments in the available literature on ticks, collected and calculated in Spring 2024

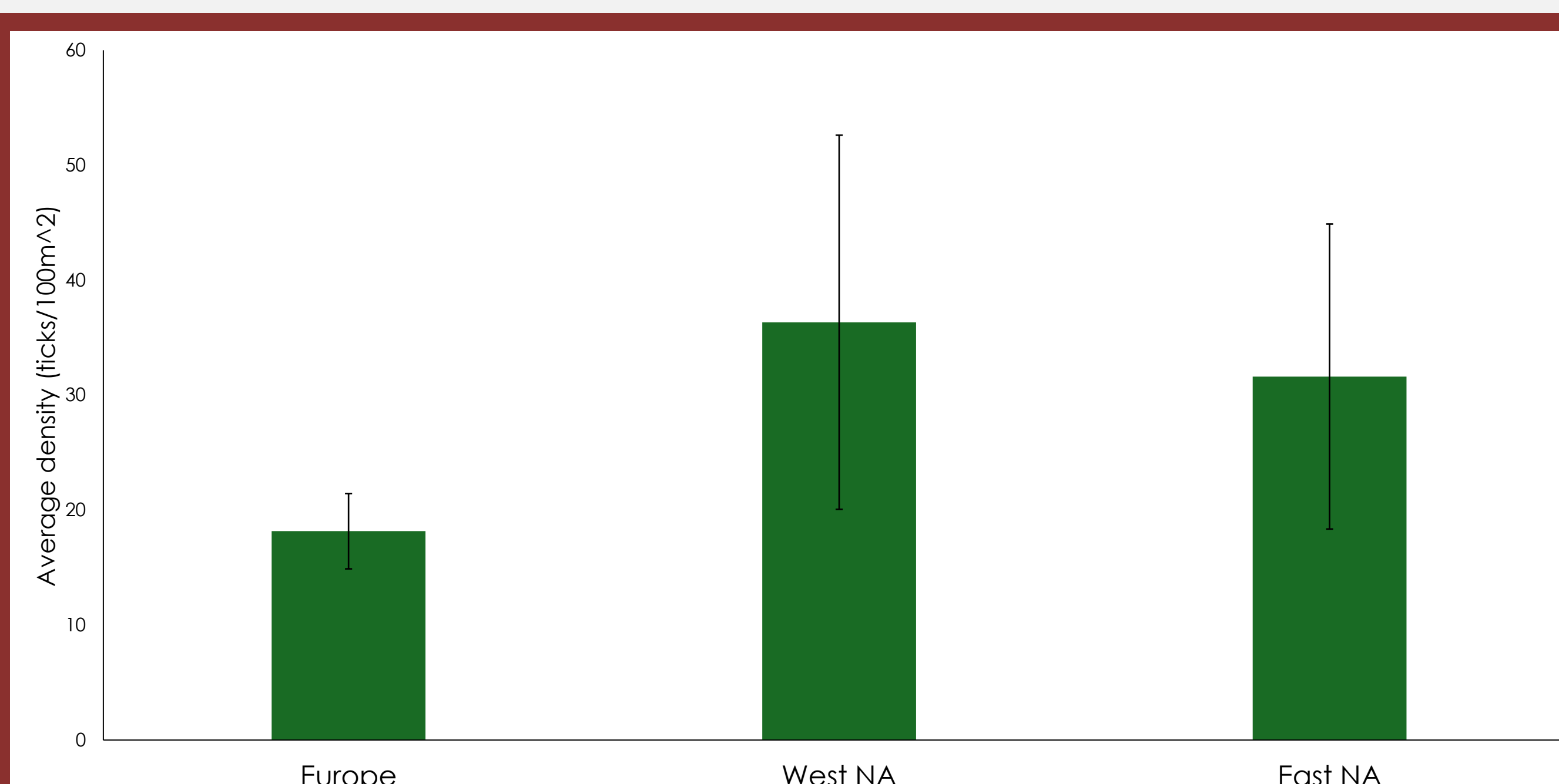


Figure 2. A comparison of average tick densities (#/100m²) in Europe, Western NA, and Eastern NA in the available literature on ticks, collected and calculated in Spring 2024

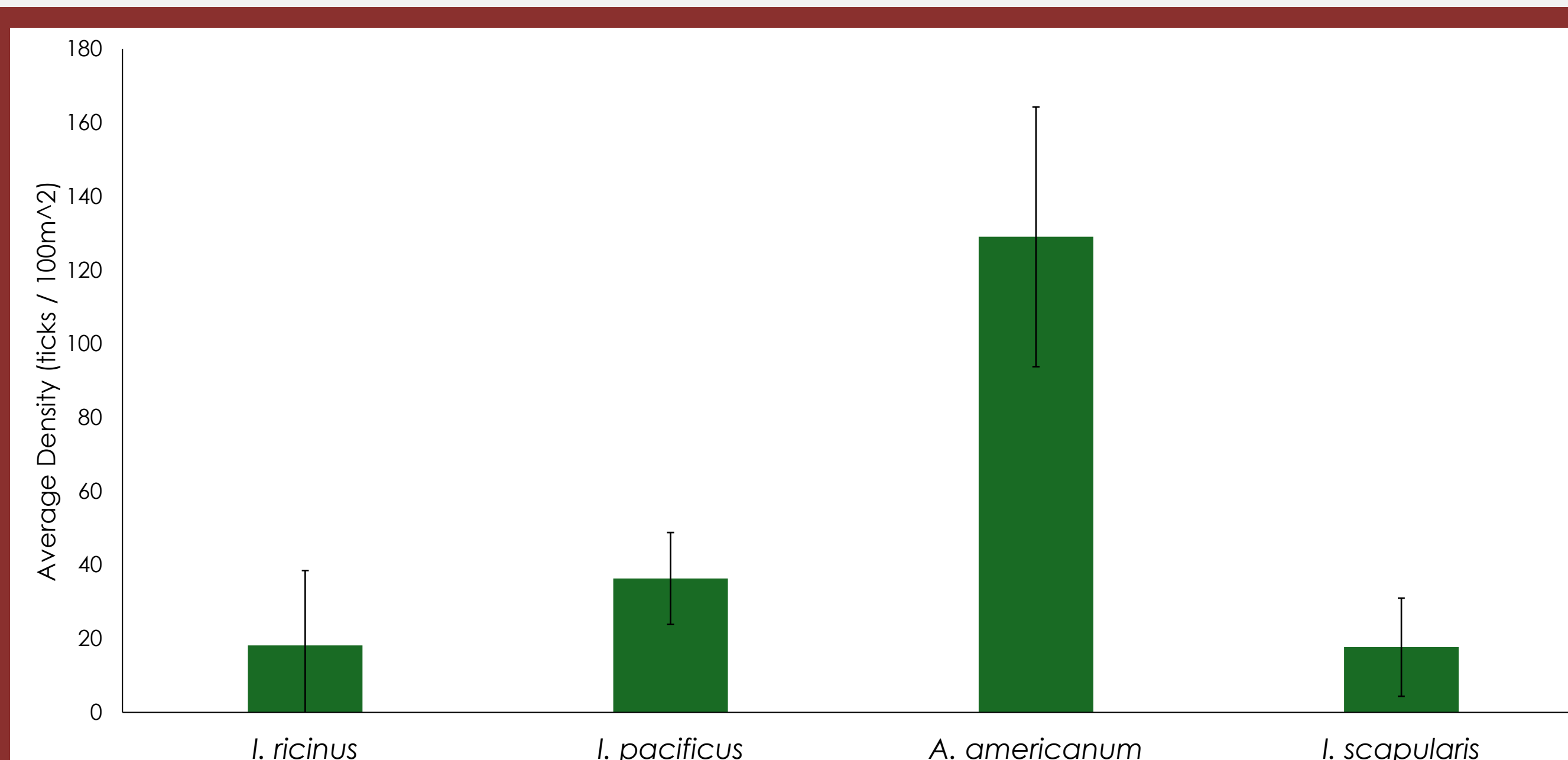


Figure 3. A comparison of average tick densities (#/100m²) of four different species in the available literature on ticks, collected and calculated in Spring 2024

Results

Table 1. Statistical results of the analysis on multiple variables and their effect on the density of ticks, calculated on the data of available research in Spring of 2024

Ind. Variable	df	test stat	P value
Habitat Type	14	0.753	0.464
Region	37	0.238	0.790
Season	35	-0.543	0.591
Species	37	3.106	0.039
Year	37	-0.176	0.861

Discussion and Management Implications

- The most important result is that ticks are abundant at similar densities in both urban and natural environments. This means that the public should be just as cautious in the areas around their home as they are in the areas they explore for recreation
- Another important result to consider is the similar densities among the different major regions that literature has been developed for. Europe and North America were shown to have similar levels of abundance despite the different species present, meaning those looking to travel should continue to be cautious as they were on their own continent. This also means that similar management strategies can be used by managers on these two continents, encouraging cooperation between researchers across the globe.
- One last thing to consider is the relatively high density of *A. americanum*, a major concern for managers to consider when looking to protect the public and the wildlife in the area.

Acknowledgements

Thank you to Ange Baker for the advising on the project, to Jon Montgomery for the education on statistical analysis software, to Nick Kerhoulas for the help in brainstorming research ideas, and to all my friends and family for the encouragement throughout the semester

Literature Cited

Ishak, S. N., M. A. Yusof, S. M. Nor, S. A. M. Sah, F. S. Lim, J. J. Khoo, and F. S. Mohd-Taib. 2018. Prevalence of on-host ticks (Acari: Ixodidae) in small mammals collected from forest near to human vicinity in Selangor, Malaysia. *Systematic & Applied Acarology* 23:1531–1544.

To view a list of the literature used in this meta-analysis, please reach out to Curtis Cline at cc561@humboldt.edu



Western black-legged tick
Photo Credit: iNaturalist user Zygy



Deer Tick
Photo Credit: Scott Bauer



Lone star tick
Photo Credit: NEVBD



Castor bean tick
Photo Credit: Robert Rozwałka