Ecosystem engineering of red foxes increases white spruce tree (*Picea glauca*) reproduction

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Background

- Red foxes (*Vulpes vulpes*) increase soil nutrient levels at their den sites through urination, defecation, and concentrating prey remains.[1]
- Denning activities change plant community.[1]
- White spruce trees are a dominant species in the boreal forest and at the treeline.
- Spruce are anemophilous and reproductive success may be density dependant.
- Fox dens have greater spruce tree growth and greater cone production.[1,2]
- Measuring spruce seed production and viability will provide insight on how red foxes indirectly affect plant growth.

Methods

- **Study site:** Boreal woodlands and tundra near Churchill, Manitoba.
- **Protocols and experimental design:**

1. Tree height measurements and tree density estimates at den sites and controls.
2. Estimate yearly cone production with photographs.
3. Cone collection from trees.
4. Measure seed production and viability with Tetrazolium analyses.

- **Statistical analyses:** t-tests and GLM.



Objective

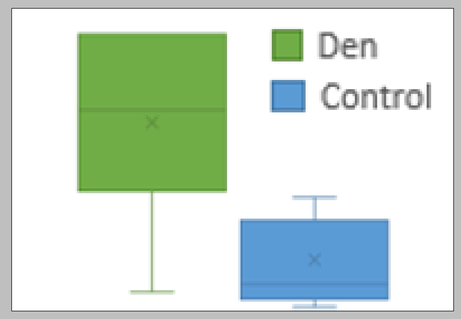
- Do red foxes increase the seed production and viability of white spruce trees at their den sites?

Hypothesis

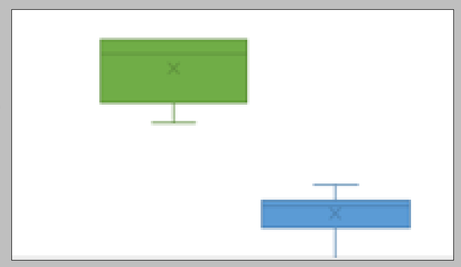
- **Hypothesis:** White spruce tree reproduction is nutrient and density limited at the treeline.
- **Predictions:** Trees on fox dens have greater cone and seed production, greater tree density, and more viable seeds than controls.

Expected results

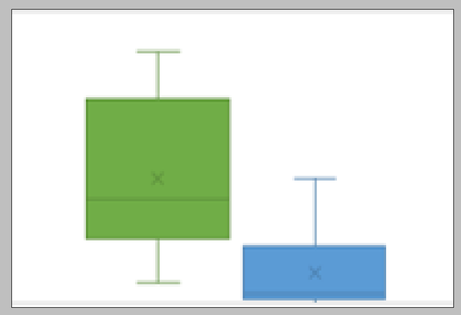
1. More cones/tree at dens than controls



2. Greater tree density at dens than controls



3. More viable seeds at dens than controls



Discussion

- More cones on the trees at the den sites along with a greater tree density provides better opportunities for successful wind pollination.
- The greater number of viable seeds/tree at the den sites may lead to a greater number of seedlings and greater foraging opportunities for other animals.
- As the climate warms in the subarctic, red foxes are advancing their range northward and could significantly alter the position of the northern treeline.
- **Future directions:** We would like to explore how the greater cone and seed production at den sites affects foraging activities of animals such as American red squirrels (*Tamiasciurus hudsonicus*).


Acknowledgements and references

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- 1. Lang, J. A., Roth, J. D., & Markham, J. H. (2021). *Scientific Reports*, *11*(1), 1–8.
- 2. Kucheravy, C. E., Roth, J. D., & Markham, J. H. (2021). *Basic and Applied Ecology*, *51*, 11–19.

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