Functional trait variation among plant functional types in the Canadian Arctic tundra

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Introduction

- Shrubs are encroaching on Arctic tundra due to shifting climate and suppressed fire regimes
- Plant traits linked to drought can predict shrub plant functional type (PFT) presence [1].
- Varied surface water content of PFTs can be expressed through Normalized Difference in Water Indices (NDWI)

1. Do traits related to carbon gain differ across PFTs?
2. Is NDWI indicative of PFT presence?
3. Do competing tundra shrub PFT traits differ in response to spatial distribution?

Study area and methods

Figure 1. Location of TVC in upper North West Territories (NWT).

- Assigned 7 PFTs to polygons by dominant vegetation [2].
- Sampled traits for 3-5 individuals of 3-4 dominant species from polygons of each PFT.
- Estimated traits related to carbon capture such as leaf area (LA), leaf water content (LWC), leaf dry matter content (LDMC), and equivalent water thickness (EWT) following standard protocols [3].

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- Leaf scans corrected in GIMP, area calculations in Image J via *LeafArea* R package.
- Compared traits among PFTs using Kruskal- Wallis tests and post-hoc pairwise comparisons.

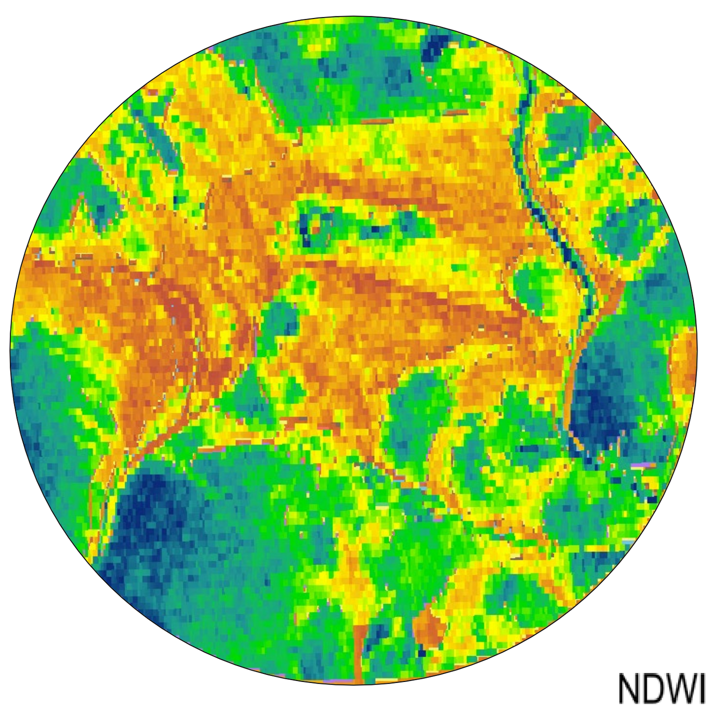

Figure 2. NDWI by PFT polygon across TVC footprint. Drought-stressed zones are <0.3 NDWI.

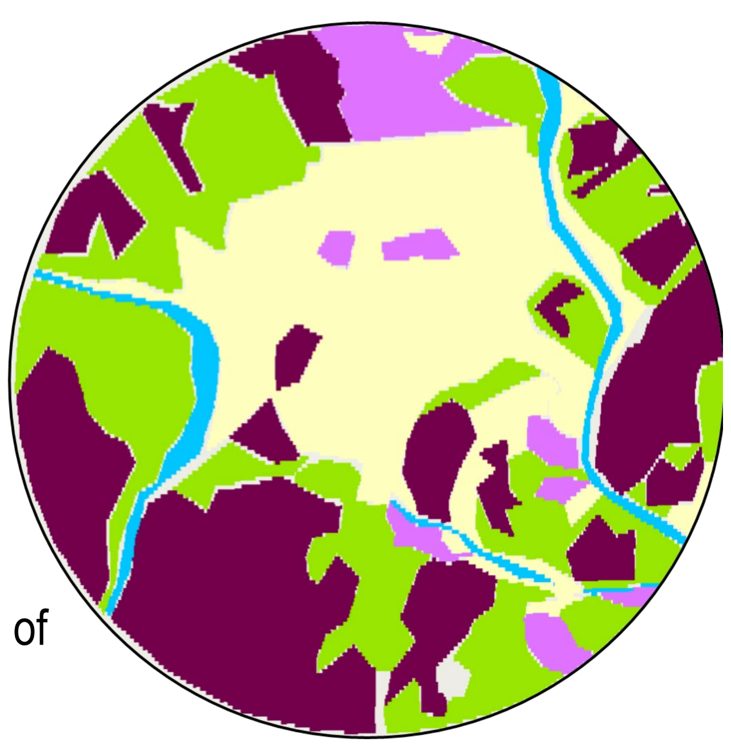

Figure 3. Spatial distribution of PFTs in the study area.

REFERENCES
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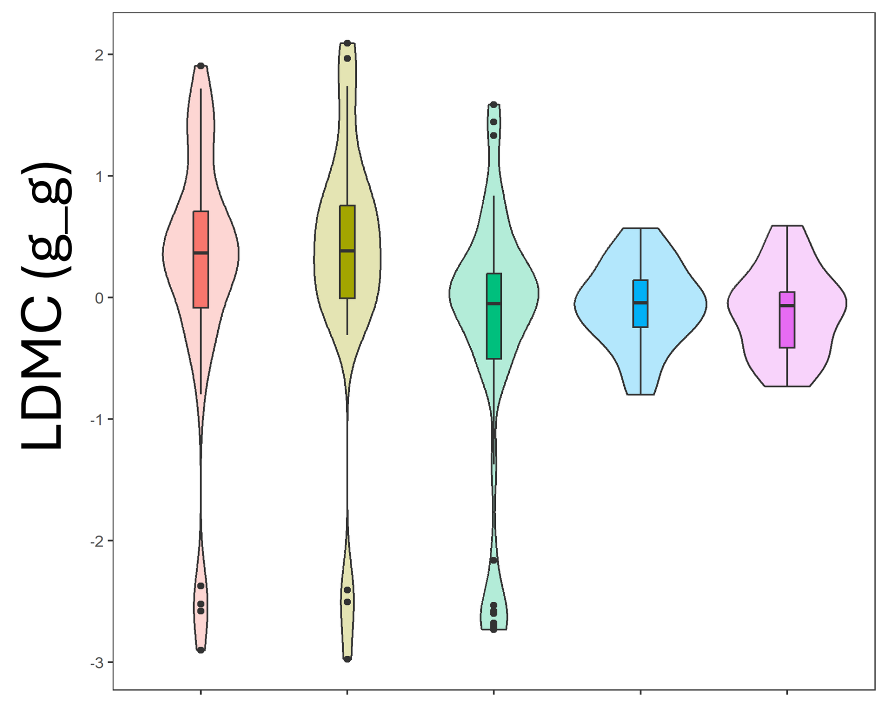
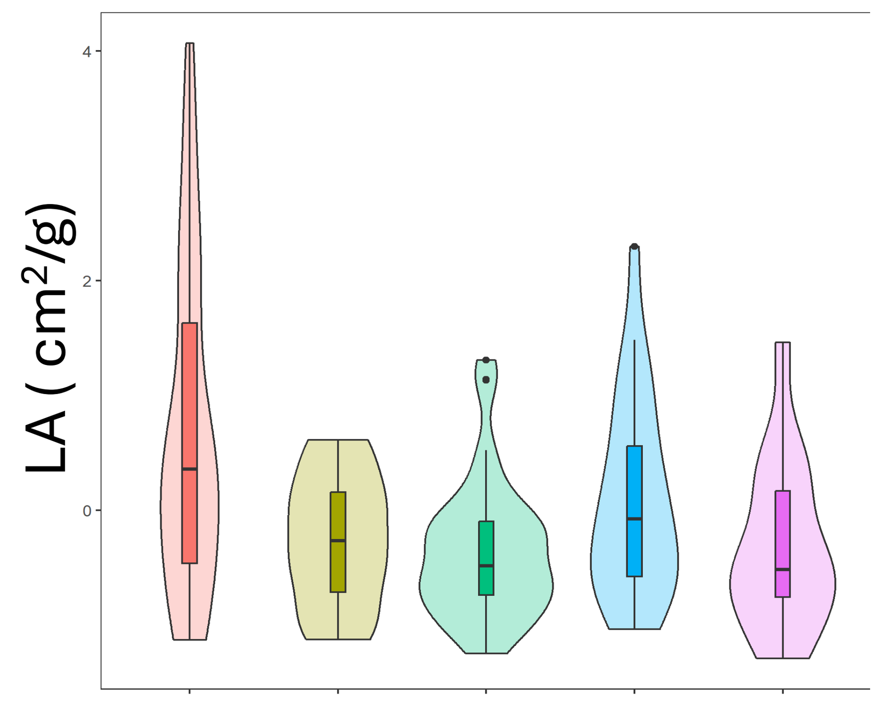
Results

Our results show differences in LA and LDMC across PFTs.

Alder | Birch | Lichen tundra | Riparian shrub | Sedge-moss tundra



	Alder	Birch	Lichen	Riparian shrub	Sedge-moss
Alder					
Birch	0.85				
Lichen	0.01	0.01			
Riparian shrub	0.01	0.01	0.95		
Sedge-moss	0.01	0.01	0.85	0.85	



	Alder	Birch	Lichen	Riparian shrub	Sedge-moss
Alder					
Birch	0.03				
Lichen	<0.01	0.35			
Riparian shrub	0.28	0.35	0.95		
Sedge-moss	0.05	0.55	0.85	0.85	

Figure 4. Violin plots of two morphological traits showing differences among PFTs. Post-hoc pairwise Wilcoxon tests are shown on the right side of each panel.

Future analyses

Figure 7. *Alnus alnobetula* in NWT, CA. Used with Permission from rkdanby under CC-BY-NC. 2016. https://www.inaturalist.org/observations/67222581

Figure 8. *Betula glandulosa* in NWT, CA. Used with Permission from andyfyonn under CC-BY-NC. 2019. https://www.inaturalist.org/observations/35256658

1. Compare traits of dominant shrubs (*Alnus alnobetula, Betula glandulosa*) within PFTs as part of TVC encroachment analysis.
2. Link vegetation indices to trait variation among measured PFTs and discover implications for remote sensing capacity.
3. Evaluate variability of lichen traits.

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