# Resolving Permafrost, Vegetation, and Wildfire Interactions through Geospatial Space-Time Analysis

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### **Objective:**

- The purpose of this project is to better understand the spatiotemporal coupling between tundra wildfire, post-fire vegetation succession, and permafrost physical properties (e.g., active layer thickness, ground subsidence, and soil moisture content).
- We must better understand these couplings to characterize the impacts of Arctic amplification on the global climate system.

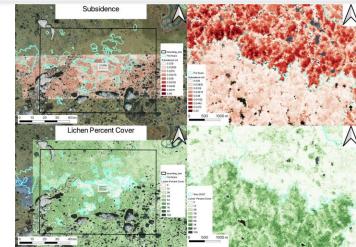
#### Approach:

- Joint analysis of airborne InSAR, PolSAR, and hyperspectral imagery and spaceborne InSAR imagery.
- Spectral diversity calculation from hyperspectral imagery, ground deformation rate and moisture content from InSAR data
- Integration with plant functional type community type maps.
- Statistically analyze the spatiotemporal correlation between vegetation and active layer properties as a function of time since wildfire burn.

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a Property of		A CALL ROOM
		Sentinel-1 N SAR
AVIRIS-NG Imagery	Mapped PFT Cover	Scenes
+		+
BRDF, Topographic Corrections, Mosaic	Source Year Mask (source > 2015)	Stanford Radar Processor
Flightlines	(300100 > 2013)	110003301
t l	Clip by Fire Boundaries	Interferogram
Mosaic Corrected		Formation, SNAPHU
Reflectance Scenes	Sampled, Kolmogorov-	Phase Unwrap
+	Smirnov Tested	+
Band Removal	+	Coherence Mask, LOS Conversion, Phase
ŧ	Clustered with Ward's	Deramp
Spectral Smoothing	Distance Method	+
avitsky-Golay Filter)	↓	Subtract soil Moisture
•	Classify PFT Map with Random Forest Trained	Phase Contribution,
NDWI Mask	from Clusters	Annual Rate and RMSE Estimation
+		Lacindución
Brightness		2015-2022
Normalization		Deformation Rates
	Plant Community Map	
1	AICC Fire Perimeters	Calculate
Spectral Diversity		Deformation, mean
Calculation	PDO ReSALT Soil	<ul> <li>ALT, moisture for</li> </ul>
	Moisture, ALT product	burn scars and communities
	-	
	Spectral Diversity and	
	Deformation Product by Fire	

## Results:

(Top) InSAR-derived surface subsidence with inset zoom at edge of 2016 fire scar; (Bottom) Multispectral-derived lichen percent cover with inset zoom at edge of 2016 fire scar. The spatial relationship between wildfire extent, surface subsidence, and lichen percent cover is clearly observed.



#### Key Milestones:

•	Process hyperspectral imagery	06/23
•	Process InSAR data	06/23
•	Generate subsidence rates	06/23
•	Present preliminary results at EUCOP	06/23
•	Generate plant functional type maps	08/23
•	Submitted grant to NASA ECIP-ES	08/23
•	Present continued results at 2024 AGU (student)	12/23
•	Finalize paper #1	Ongoing
•	Finalize grant to NSF ARCSS	Ongoing



Collaborators / Co-l's/Partners: Mark Lara (UIUC)