The Influence of Short-Interval Reburn Disturbances on Biophysical Properties

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Background

- Boreal systems are crucial carbon sinks that are experiencing amplified warming and wildfire activity.
- Changes in wildfire dynamics may alter fire effects, ecological response, and biophysical properties.
- Wildfires alter biophysical properties, including albedo and land surface temperature.
- Changes in biophysical properties can impact regional climate and ecosystem dynamics.
- Short-interval reburn events, where forests do not fully recover between two sequential fire events, alter fire effects and ecological response.

Research Question

How do short-interval reburns influence biophysical properties?

Hypothesis

Figure 1: ***Hypothesis.*** During winter months snow cover increase the surface albedo. While conifers and deciduous canopy structure shade and obscure surface snow cover resulting forested areas have higher albedo compared to summer months (left panel), but albedo is lower then non-forested areas with snow cover. While single burns retain more canopy branch structure they simultaneously expose more snow cover producing higher albedo (middle panel) than patches of short-interval reburn where more structural biomass is consumed reducing the legacy structure exposing the ground surface and reflective properties of snow resulting in higher albedo (right panel). *Art Credit J. Dean.*

Methods

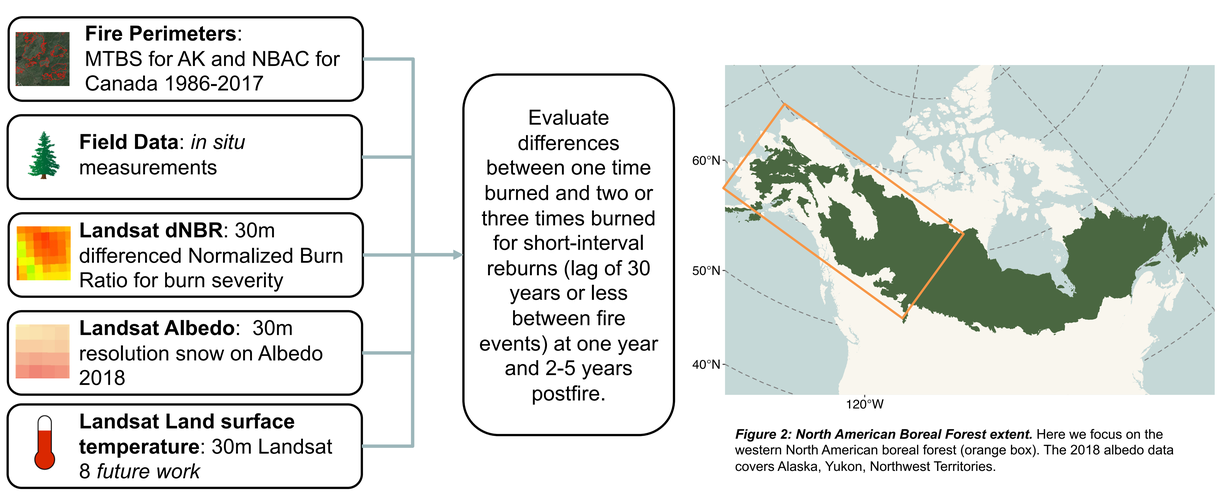

Figure 2: North American Boreal Forest extent. Here we focus on the western North American boreal forest (orange box). The 2018 albedo data covers Alaska, Yukon, Northwest Territories.

Preliminary Results

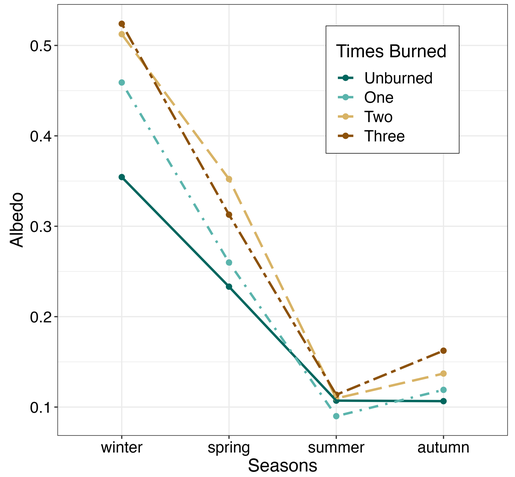

Figure 3: ***Season Albedo.*** The seasonal albedo trends following unburned, one, two, and three times burned. Points at each season are means, with lines indicating the seasonal trend. Snow-on albedo in winter increases with number of times burned and that pattern holds through the spring.

- The difference mean snow-on albedo across unburned, one, two, and three times burned including time since fire (Figure 4).
- Differences in snow-on albedo across NW Canada show higher values in for reburn sites (two and three times burned) than single fire events (one time burned).
- Unburned sites have the lowest snow-on albedo.
- Seasonal changes in albedo (Figure 3) .
- Seasonal trajectories show higher snow-on albedo for two and three times burned compared to one time burned and unburned.

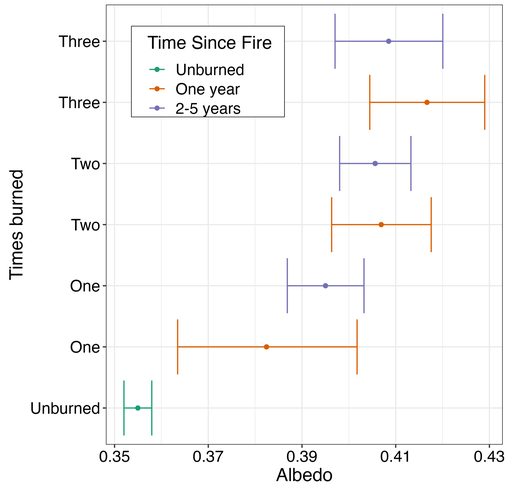

Figure 4: ***Snow on Albedo.*** Differences in snow-on albedo across the western North American boreal. The y-axis shows the number of times burned and x-axis shows albedo. Points are means with upper and lower 95% confidence intervals as error bars. Colors represent time since fire groups. Two times burned was statistically difference than one time burned one year postfire *(p=0.03)*. Three times burned was statistically different than one time burned one year postfire *(p=0.003)*. For 2-5 years following fire, the difference between one and two times burned as well as one and three times burned is distinct but with more variability around the mean *(one-two p=0.06; one-three p=0.06)*.

Figure 5: ***Examples of short-interval reburn landscapes.*** Eleven (left), fifteen (middle), and 23 (right) years following short-interval reburn fire event in interior Alaska. *Photo credit: X. Walker*

Ongoing and Future Work

- While this work is on going, we find that preliminary results indicate differences in snow-on albedo following reburn events.
- These findings support our hypothesis and *in situ* field observations where there is an observed reduction in standing snags and coarse woody debris.
- We are refining the selection of reburn pixels using dNBR and *in situ* measurements from the field.
- We plan to expand the temporal coverage of Landsat 8 albedo to improve time since fire variable.
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- Next steps include integrating Landsat 8 land surface temperature to evaluate the difference between one, two, and three times burned.

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