Wildfire Working Group

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Legacies

Thermal: Permafrost Information: Life History Traits Material: Soil Organic Layer, Seeds, Propagules



How are intensifying fire regimes, pushed by warming climate, reshaping the structure and function of Alaskan boreal forests?

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Increased fire severity and frequency

Legacies & post-fire climate

New stable states

Vulnerability and resilience of new ecosystems and landscapes

Human impacts on fire

H1: Climate warming and drying is causing shortened FRI and increased fire severity, resulting in the loss of black spruce ecosystem legacies that have historically promoted ecological resilience to fire

Legacies lost include:

- SOL C and N
- Semi-serotinous seed bank
- Understory seeds, spores and vegetative propagules
- Microbial communities
- Permafrost soils

Approach:

• Add reburned sites to the RSN



H2: Legacies interact with post-fire climate to drive the emergence of new stable states: from black spruce to alternative mixed, deciduous or non-forested successional trajectories

Approach:

- Add new mature burned sites every year to the RSN - follow over time so that we can separate fire and climate effects
- Examine differences in productivity of newly established seedlings versus mature stands at time of establishment (JFSP and RSN sites)



H3: Shifts from black spruce to deciduous, mixed and non-forested stands alter structural, functional, and temporal dynamics

Differences:

- Primary Productivity, Phenology, C-G responses
- Stocks and fluxes of C and N
- Soil thermal regime , permafrost
- Plant and microbial diversity and function
- Landscape configuration and connectivity
- Net feedbacks to climate
- Ecosystem services
- Human response

Approach:

 Add in old mixed and deciduous stands to RSN so that study design contains full alternative successional trajectories





H4: Shifts from black spruce to deciduous, mixed and non-forested stands alter vulnerabilities and resilience to climate disturbance interactions and to interacting disturbance agents

Wildfire:

- Fire self-limitation
- Resprouting

Consumers, Pests, Pathogens:

- Impacts future growth and mortality
- Reduces fire self-limitation?
- Reduces post-fire resprouting?

Permafrost:

- Total loss with next fire or canopy loss Approach:
 - Add newly burned deciduous and mixed stands to RSN



H5: Human modifications to the fire regime alter fire frequency and severity, which can impact the strength of legacies both spatially and temporally

a) Indigenous people promoted high frequency, low severity fire: maintained deciduous dominance, reduced black spruce dominance, stimulate understory productivity, thawed permafrost, create high graminoid productivity wetlands

b) Contemporary fire suppression has promoted low fire frequency and increased the risk of high severity fires around rural and urban communities: retained historic black spruce dominance

c) Built fuel breaks can reduce these risks but need design elements to be ecologically, socially, and economically sustainable

Approach:

a) Fire TEK

b) Remote sensing of stand age and composition surrounding communities compared to region

c) Knowledge co-production with Alaska Natives, TCC, fire managers, economists, social scientists. Remeasure experimental manipulations of legacies in fuel breaks and their effects on successional trajectories.



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