The Potential Role of Grasslands in the Future Vegetation of Interior Alaska

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Presented by Karen Murphy

Fire Effects Task Group Meeting

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Goal

- Estimate the disturbance regime and environmental conditions that would result in dominance of grassland at roughly 1 km^2 spatial resolution.

Methods

- Characterize the climatic characteristics of similar ecosystems where *Calamagrostis Canadensis* is a dominant vegetation type
- Examine the paleorecord for times when grasslands were more prevalent in interior Alaska
- Estimate probabilities for transitions among states within the ALFRESCO modeling framework

Example: *Calamagrostis canadensis*

- “Up to 1m tall, culms from creeping rhizomes forming tussocks...”

- “Meadows, wet places. Common in interior”

- Hulten 2000

Ecology of CC

- Common colonizer after disturbance
- Colonization from seed if disturbance is near moist areas
- Can gain dominance from vegetative growth (rhizomatous) if fire is low or moderate severity where existing rhizomes survive

Literature Review

- A fair bit of research on CC is focused on impacts on forest regeneration after logging
- Significant impact on aspen regeneration and spruce seeding survival have been shown

Literature Review

- Prolific flowering is typically only observed in marshy areas and recently disturbed sites
- Strength of CC population in non-marshy areas is a function of time since disturbance (e.g. flowering linked to post-fire moisture)

Paleorecord: Initial Observations (Interior Alaska)

- Grasses last played a significant role 10K ybp
- This was the end of the last glacial maximum
- Vegetation changes were driven by changes in both temperature and precipitation

Paleorecord: Initial Observations

- Some evidence that the interior was warmer than present around 7,500 years ago
- This corresponded with a retreat of Picea from West to East
- Cooler and wetter conditions around 5,000 years ago resulted in Picea expansion from East to West

Paleorecord: Preliminary Summary

- Past warming was driven by differing climatic mechanisms than current warming

- Responses of forest tree species provide information about likely scenarios in response to future warming (i.e. Picea will likely not respond favorably to warmer and drier temperatures)

Future Climate and Disturbance

- IPCC future climate scenarios indicate warmer and drier future
- ALFRESCO modeling suggests increased disturbance from fire

Future Climate and Disturbance

- Precipitation is highly uncertain, yet critically important

- Even if there are no “trends” in precipitation that occur in the future, changes in the interannual variability of precipitation may significantly impact post-fire succession

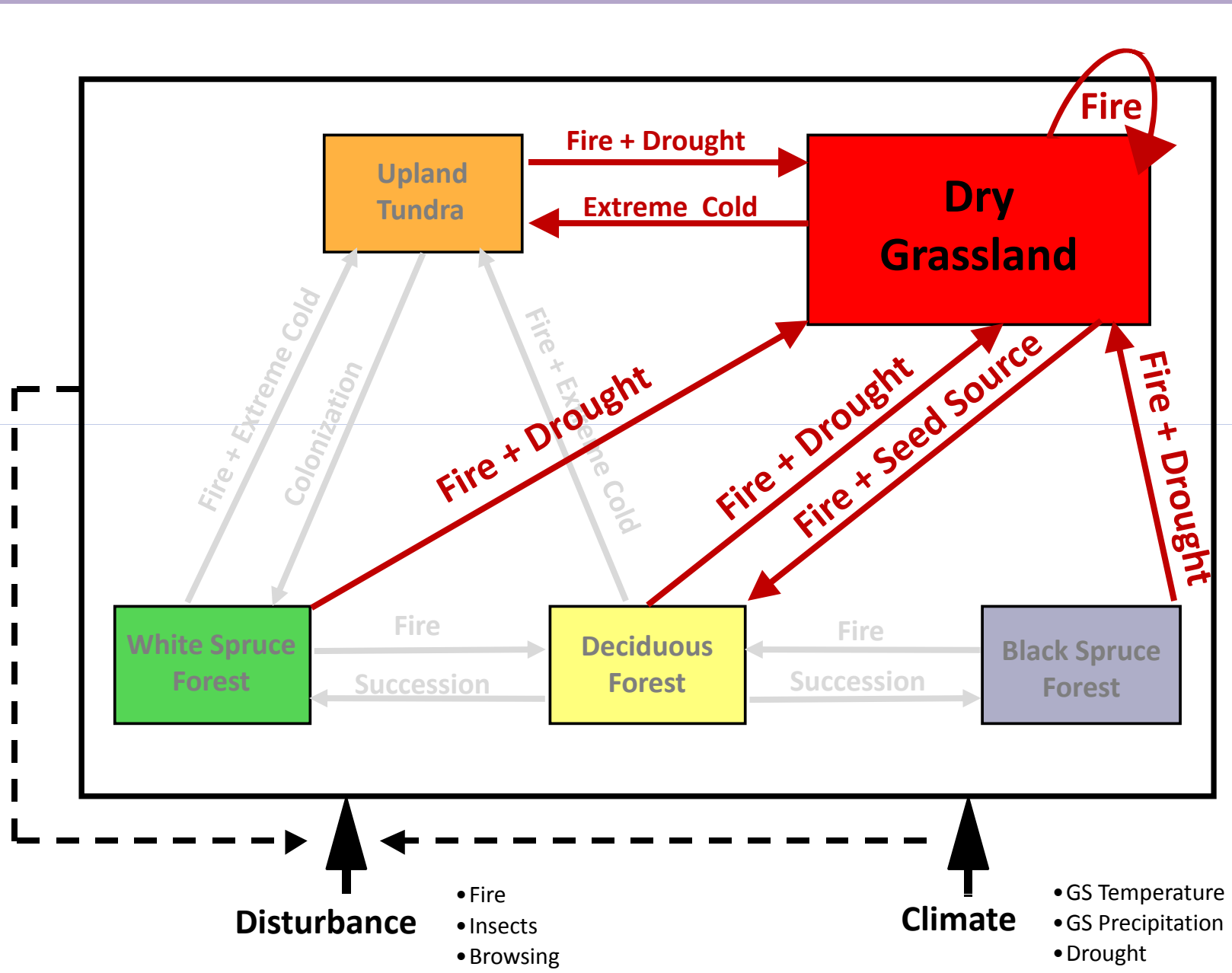
Conceptual Model

- Several years of “drought” (i.e. not enough moisture to support tree seedlings) will be a necessary condition for grassland dominance after fire

- Severity of the fire plays a strong role in the successional trajectory

Conceptual Model

- In low severity burns where grass is already present, grass will be a strong competitor
- In high severity burns, availability of seed source and weather in following years will play a strong role


Fire
Fire + Drought
Upland Tundra
Extreme Cold
Dry Grassland
Fire + Extreme Cold
Colonization
Fire + Extreme Cold
Fire + Drought
Fire + Drought
Fire + Seed Source
Fire + Drought
White Spruce Forest
Fire
Succession
Deciduous Forest
Fire
Succession
Black Spruce Forest
Disturbance
• Fire
• Insects
• Browsing
Climate
• GS Temperature
• GS Precipitation
• Drought

Next steps

- Assign probabilities to transitions from different states in the model
  - Data solicitation
- Characterize likely dominance as a function of burn severity
- Run scenarios into the future and see if grass takes over (*not yet funded)

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