Invasive Plant Seedbank Development After Wildfire In Alaska's Boreal Forest

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Questions

- Is a viable non-native seedbank developing in burned habitat?
- What is the proportion of non-native to native seeds in the seedbank?
- Does the presence and species composition of moss present influence the emergence of seedbank seedlings?

Introduction

Permafrost and cold winters have prevented invasive species spreading in Alaska in the past, but climate change and wildfires have increased vulnerability to bird vetch (*Vicia cracca*) and white sweetclover (*Melilotus albus*). White sweetclover and bird vetch compete with native vegetation for habitat and dramatically change soils as nitrogen fixers. Invasive seeds have the potential to build up in soils the same way native seeds do, forming a soil seedbank. Most non-native seeds decline in their viability within 25 years in soil (Conn and Werdin-Pfisterer, 2010). However, white sweetclover seeds can last for up to 80 years in the seed bank, and require scarification to germinate (Turkington et al. 1978). Non-native seedbanks can develop post-disturbance, such as after a wildfire, road development, or forest clearing, since seeds are more likely to arrive at the site and accumulate over time. Decreased burn intervals between wildfires and increased disturbance allows less time for ecosystem recovery, which creates opportunities for invasive plants to establish themselves. Research has shown a shift in seed banks from native species to more non-native over a 20 year period after forest clearing (Conn et al. 1984).

Field Methodology

1 Revisited 27 sites where invasives had been recorded spreading into burned land in 2007.

2 15 Sites were able to be sampled, and we sampled the soils along 3 transects in each site

3 Sampled top (0-3 cm from surface) and bottom (3-6 cm subsurface) layers of soil in each location

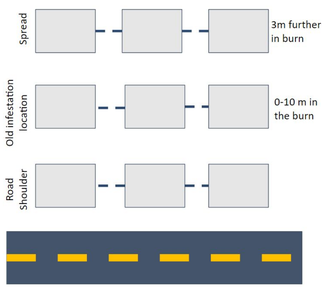


Figure 1. Sample site transects.

Greenhouse Methodology

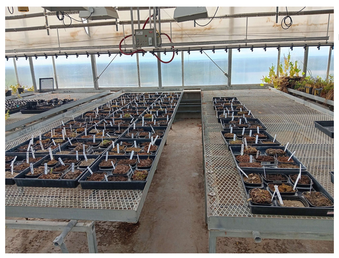


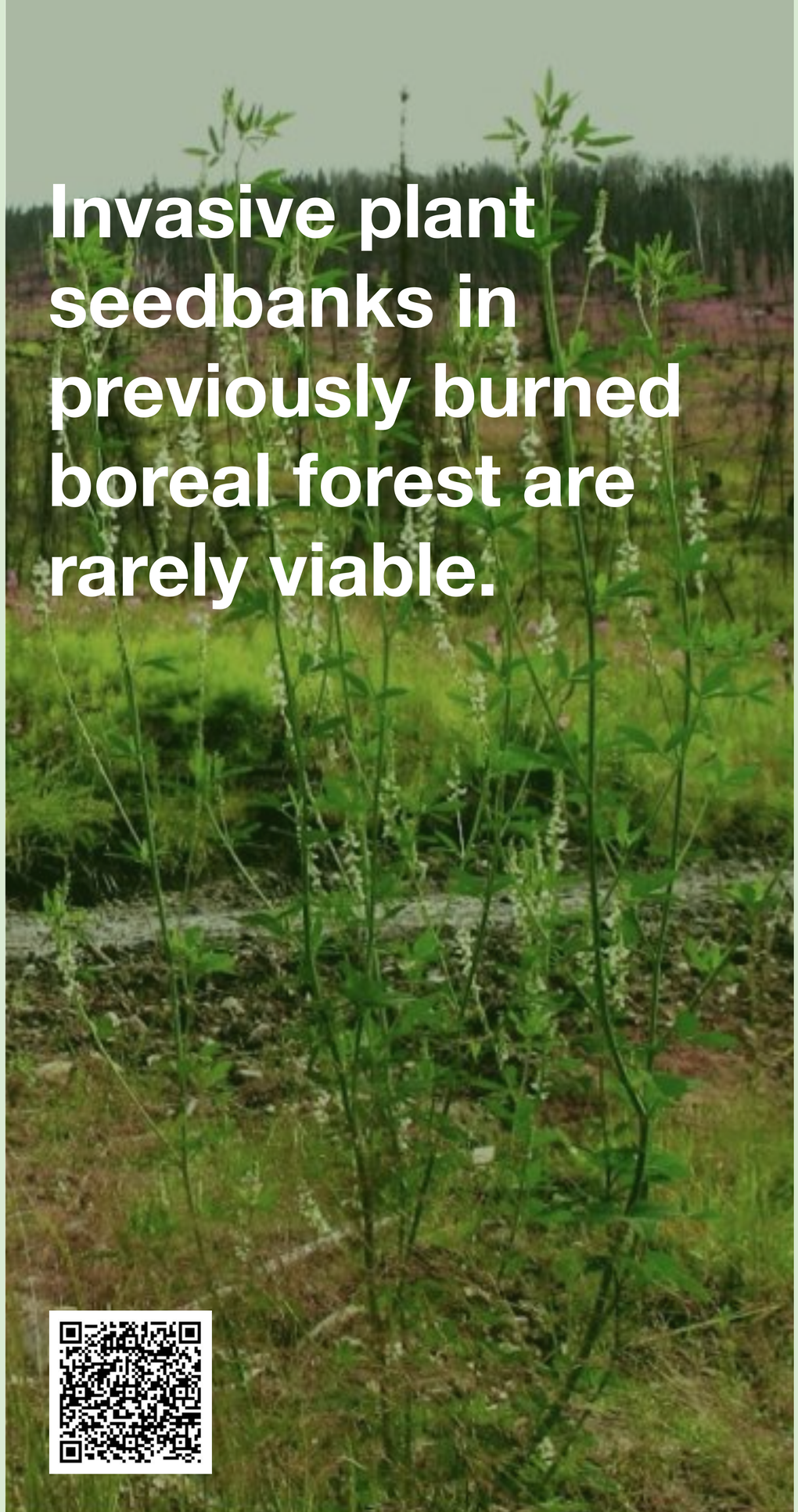
Figure 2. Samples in UAF IAB Greenhouse.

4 To allow new seedlings to emerge, the vascular cover was removed.

5 Estimated non-vascular plant cover by species in top layers

6 Placed in the greenhouse for potential seeds to germinate (average of 70.85°F and daily watering)

7 Identified, counted, and plucked seedlings that emerged over 8 week period



Results

What the greenhouse data can tell us: Surface and subsurface germination

- Top Layer: seedlings that would have emerged if conditions were good and there was no vascular competition
- Lower Layer: Seedlings emerging from bottom layer suggests populations are persistent, not dependent on reintroduction

Figure 3. Seedlings emerging from **top** layer

What the greenhouse data can tell us: Germination in the three different transects

- Road - Seeds are present and persistent populations are there if germinating from the lower soil section
- Old infestation site in the burn - seeds are being reintroduced if on top layer, and persistent if in bottom layer.
- "Spread" transect in the burn - seeds are dispersing or have in the past.

Figure 4. Seedlings emerging from **Lower** layer

We found:

- Native seedling emergence was high, especially fireweed, bluebells, birch, and bluejoint grass
- Only a few non-native species emerged: sweetclover, Norwegian cinquefoil, bird vetch, quackgrass, lambsquarter

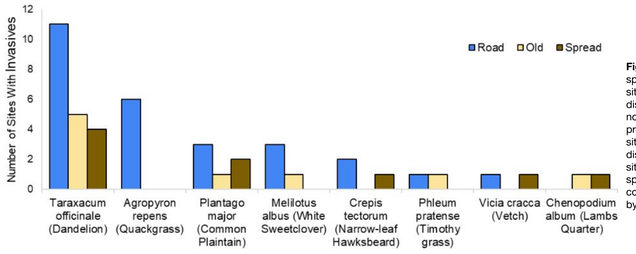


Figure 5. Non-native species present at sites. Horizontal axis displays the variety of non-native species present at sample sites. Vertical axis displays the number of sites with each species. The colored columns are separated by transect.

Discussion

What these early results suggest:

- Very small amount of persistent viable seed banks of invasives in the burns
- Native species are better represented (likely due to better dispersal mechanisms)

Future Directions:

- Remove moss and see what comes up
- Sieve soil and check for remaining seed viability
- Potential scarification of any remaining white sweetclover seeds to gauge further invasive seed bank resilience

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