Effects of Soil Characteristics on Invasive Species Seed Bank Development after Wildfire

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Introduction

Wildfires have a large impact on many ecosystems in Alaska. The burns resulting from these fires can often open the door to invasion from nonnative species, which can spread further into other intact ecosystems (Spellman & Mulder, 2008; Spellman et al. 2014). The development of invasive species seedbanks may lead to increased vulnerability of burned areas to invasive species colonization, particularly with shortening fire return intervals (Seitz et al., 2024).

Some of the species that have been found colonizing burned areas in interior Alaska, such as *Melilotus albus* (white sweetclover), have seeds that can stay viable for up to 80 years. Soil factors can determine how long seeds are stored in the soil, and how successful germination will be in the event of a new disturbance (Fenner, 2012). Learning more about these variables can affect nonnative plant seed banks can help predict which burned ecosystems are most vulnerable to nonnative species invasions.

Figure 1. Invasive *Melilotus alba* emerging in an old burn site on the Elliott Higway.

Question

Does the soil sample location, color, texture, pH, water holding capacity, and bulk density influence the amount of invasive plant seeds stored in the soil seed bank?

Field Methodology

- Revisited 27 sites where invasives had been recorded spreading into burned land in 2007 along the Dalton, Elliott and Parks Highways.
- 15 Sites were able to be sampled, and we sampled the soils along 3 transects in each site.
- Sampled top (0-3 cm from surface) and bottom (3-6 cm subsurface) layers of soil in each location for a total of 18 soil samples per site.

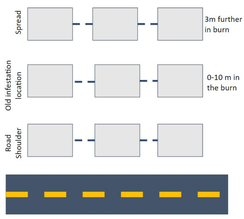


Figure 2. Sampling design at each field site.

Figure 3. Conducting field survey at a roadside burn site that had been colonized by *Melilotus alba* in 2007.

Soil and Seed Analysis

Figure 4. Soil sample being collected from previously invaded burn sites.

- After first testing for seedling emergence from the soils in the greenhouse, all soil samples were sifted to search for remaining non-native plant seeds.
- Seeds were tested for viability by germinating them in petri dishes.
- Soil samples were examined for soil pH, color, texture, water holding capacity and bulk density.

Learn more about this project:

Preliminary Results & Discussion

Species

For invasive plant seeds stored in the soil, we found primarily *Melilotus albus* (white sweetclover) and *Vicia cracca* (bird vetch). This makes sense given the hard seed coats and documented seed longevity for both species (Nawrocki et al. 2011).

Figure 5. *Vicia cracca* (left) and *Melilotus albus* (right) were the species of seeds that we found in the soil seedbank.

Figure 6. *Melilotus albus* seedlings emerging from top layer.

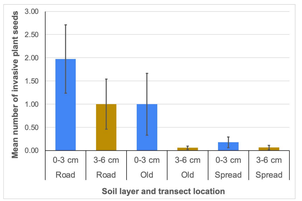


Figure 7. Mean number (± S.E.) of non-native plant seeds stored in the top 3 cm and the lower 3-6 cm of soil in roadside, old infestation site ("old") and 3 m further into the burn ("spread").

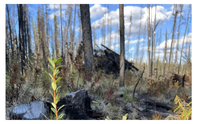
Soil Sample Location

Total amount of seeds stored in the soil was most prominent on the roadside and decreased further into the burn habitat. This matches the typical dispersal distances for both species, which have heavy seeds and typically don't spread more than 5 m without the aid of water, humans or other animals (Nawrocki et al. 2011).

Top 0-3 cm of soil had the most seeds across all the transects compared to 3-6 cm soil samples. This suggests that invasive plant seed dispersal is fairly recent.

Continuing work

We are currently completing an in-depth analysis of soil factors such as pH, color, texture, water holding capacity, and bulk density.



Acknowledgements

UAF Undergraduate Research & Scholarly Activity (URSA) Spring Research Award, US Forest Service Pacific NW Research Station Agreement 22-CR-11261944-079 (PI: Spellman,) Bonanza Creek LTER Program (NSF Award DEB1636476, USDA Forest Service RJVA-PNW-01-JV-11261952-23), UAF Climate Scholars Program, and and Travel Award. We thank Taylor Seitz and Dr. Christa Mulder for their major contributions to the larger project.

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