Post-fire Plant Trajectory and Fire Line Restoration

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Fire Suppression
With the increase in number and areal extent of wildfires in the western United States, it is imperative to respond to and contain a fire immediately. Fire control techniques include constructing fire lines and applying fire retardants. Post-fire, there is also often collateral ecosystem disturbance from fire management equipment, such as bulldozers used to install fire lines. These exposed sites are prime sites for non-native species, which can heighten fire risk in the future.

Research Questions
1. How does disturbance (fire and fire line) affect the recovery and succession of native and non-native plants?
2. What fire line restoration treatment will be most successful in preventing non-native species invasion; Mulch replacement (cardboard), Seeding, Seeding bank or control?

Study Site
Vegetation: Site Hectares
Exposed sites are
Post equipment, such as bulldozers used to install fire lines. These western United States, it is imperative to respond to and contain fire lines. One of
Figure 1: 32-Fire Studied Plots
Location: SW Cascade foothills NE of Chico, CA
Hectares: 11.33 Date: Sept. 2017
Site Elev.: 463–548 m
Vegetation: chaparral, oak woodland & annual grasslands
Fire adapted plant species present such as Arctostaphylos spp. & Ceanothus cuneatus – all require fire for germination of seeds found in the seedbank
Temperature (avg): Minimum of 0°C in the beginning of January, and a high of 31.7°C in the middle of July
Precipitation (avg): Maximum of 16.3 cm of rain at the end of February, and a low of 0.25 cm of rain in the middle of July
Plot types:
1. Burn
2. Disturbed Fire Line
3. Unburned Reference
Fire Line: Installed on the north side of the fire site with a bulldozer to prevent fire from spreading and allow firefighter access
Width 6–12.2 m

Vegetation Sampling

<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>Burn</th>
<th>Fire Line (FL)</th>
<th>Unburned (Reference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Grassland</td>
<td>4</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td>CA Black Oak</td>
<td>5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Manzanita</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Wedgeleaf</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Spring 2018: 1st survey (6 months post-fire)
Spring 2019: 2nd survey (18 months post-fire)
- 39 plots (100 m² in diameter) were stratified randomly by burn treatment & veg. type
- % cover recorded in three 1m² subplots, presence/absence data collected for larger circle plot

Non-native Average % Cover by Treatments

Bray Curtis Index
Comparing similarities of species cover:
- CA Black Oak Fire Line
- Manzanita Fire Line
- Wedgeleaf Fire Line

Sorenson Index
Examining species presence/absence:
- CA Black Oak Fire Line
- Manzanita Fire Line
- Wedgeleaf Fire Line

Conclusions & Future Research
Due to high non-native cover in Wedgeleaf fire line and high similarity with annual grassland communities, as well as these areas not having primary species of vegetation type, could show this community may be on a trajectory away from original vegetation type
- Regeneration of Manzanita and Wedgeleaf species on site occurs post-fire from the seedbank, so future recruitment in fire line is less likely.

All fire line saw large amounts of non-native cover. Due to this and these areas possibly going away from original trajectory, highlights importance of looking into fire line restoration practices

Additional research will be necessary to better inform fire line restoration practices:
- Research assessing experimental plantings of fire-adapted shrubs for chaparral fire line areas or burning in fire lines would be beneficial, due to main species being unable to regenerate in areas that remain unburned.

Literature Cited

Acknowledgments
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Author’s Contact

Fig. 1: 32-Fire Studied Plots
Fig. 2: 32 Fire Survey Plots
Fig. 2: 2018 Non-native Plant Trajectory Averages
Fig. 3: 2018 Non-native Plant Trajectory Averages
Fig. 4: 2019 Non-native Plant Trajectory Averages
Fig. 5: Restoration Treatments – (A) Control, (B) Seedbank, (C) Seeding, (D) Cardboard

Purple needle grass (Nasella pulchra), a native perennial grass, were planted in treatments c-d.
- 60 seedlings planted – watered twice after planting
- Survey of seedling survival & % plant cover was conducted in May & Sept. (18), Jan & Mar (19)
- Seedling survival dropped to 50% survival after summer months
- Rest of seedlings were lost by the end of winter - January =11.7% survival, March = 0% survival