Investigating Drivers of Plant Abundance and Community Structure on Fuelbreaks

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Fuelbreaks are used to:

- Decrease fire intensity
- Increase surface area of fire retardant
- Allow firefighter access
- Light backburns
Fuelbreaks and Invasive Plants

Plus frequent wildfire... threatens shrubland ecosystem stability
Fuelbreak Ecology?

Balance fuel management and shrubland ecosystem stability
Project Questions:

1. What structures plant community composition?
   - Disturbance History
   - Invasive Plants

2. How does disturb./abiotic variables alter non-native plant abundance/diversity?

3. Gain insights for reducing impacts, managing non-native spp, and future rehabilitation or recovery?
Survey Method

Intact chaparral

Fuelbreak

Intact chaparral
Survey Method

Point A - 0m
Point B - 50m
Point - 5m
Point - 10m
Methods:

Quantifying Disturbance
• USFS records
• Aerial imagery (UCSB Framefinder, USGS, and Google Earth)

Abiotic Variables
• Downloaded climate data PRISM
• ArcGIS - average transect elevation, slope, aspect.
Invasive Plants Structure the Community

Limits light and soil moisture...

Altered the structure of the habitat
Invasive Plants Structure the Community

Which Traits May Change?

Plant Height
Flowering Duration
Seed Mass
Invasive Plants Structure the Community

Gathered trait data on native species
  • Jepson Manual, Kew Gardens Seed Database
TRANSECTS

1. What structures plant community composition?
   • Disturbance History

   Dozed during 2017 Thomas Fire
   - OLD
     • consistently disturbed
   - NEW
     • 1st Time Disturbed

   Not Dozed during Thomas Fire
   - ABANDONED
     • Disturbed in past
   - FIRE
     • Burned over in Thomas Fire

Do these different regimes result in different plant communities?
PERMANOVA

P > 0.001

Stress = 0.183

Native Species + Non-native Species

- treatment:
  - FIRE
  - NEW
  - ABANDONED
  - OLD

PERMANOVA
P > 0.001
1. What structures plant community composition?

- Invasive Plants

P < 0.0001, $R^2 = 0.39$

Native Community

P < 0.005, $R^2 = 0.27$

Native Community
2. How does disturb./abiotic variables alter non-native plant abundance/diversity?
2. How does disturb./abiotic variables alter non-native plant abundance?

<table>
<thead>
<tr>
<th>Abundance of non-native plants</th>
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<tr>
<th>Disturbance: Frequency</th>
<th>Average return interval</th>
<th>Minimum return interval</th>
<th>Maximum return interval</th>
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<tr>
<th>Abiotic Variables: Total precipitation</th>
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<tbody>
<tr>
<td>Minimum temperature</td>
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<tr>
<td>Maximum Temperature</td>
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<tr>
<td>Maximum VPD</td>
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<td>Slope</td>
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<td>Aspect</td>
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<td>Elevation</td>
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*Climate was subdivided into seasons*
Long Time between disturbances And Fewer total disturbances

Shorter Time between disturbances And Many total disturbances

Less total annual rainfall And Less winter/spring rainfall

More total annual rainfall And More winter/spring rainfall
1. What structures plant community composition?

*Disturbance regimes create distinct plant communities*

*Limit native plants to “weedy”, persist in grass dominated*
2. How does disturb./abiotic variables alter non-native plant abundance/diversity?

Frequently disturbed and short returns = increases abund.

Rainfall, most important climate variable
3. Implications for Management?

1. Restoration or weed control (1-2 year window)
2. Invasive species persist w/o disturbance, limit native recovery
3. Distinct community- **one size does not fit all**
4. High rainfall- increased grass abundance
Community weighted mean (CWM)

\[ \sum_{\text{plot}} \text{trait value}_i \times \text{relative abundance}_i \]

\( n = i \)

(e.g. Plant Height of native species,)

Averaged across each transect