Do Aspen Stands Reduce Fire Severity and Stop Fire Spread?

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Background

- Forests are economically and ecologically important
- Fire is an important factor in maintaining forest health and function
- Fires have gotten larger and more severe in recent decades
- Due to climate change these trends are projected to worsen
- Safety, ecologic, and economic concerns

Mammoth Fire, Manti- La Sal National Forest. Elyse Doty, 2019

Background

- Increasing concern about fire has led to more active management
- Aspen as fire management
- Aspen are assumed to reduce fire severity and slow fire spread
  - This has not been studied or quantified (Fechner and Barrows 1976)

Mammoth Fire, Manti- La Sal National Forest. Elyse Doty, 2019

Objectives & Hypotheses

- Using satellite-derived remotely sensed data:
  - Determine whether aspen reduce fire severity
  - Determine whether aspen stop fire spread
- I Hypothesize that:
  - Aspen stands will have lower fire severity values than conifer stands
  - Fire perimeters will be disproportionately located in aspen stands, demonstrating that aspen reduce fire spread

A mosaic of burned and unburned aspen stands within the Brian Head fire. Mark Kreider, 2017

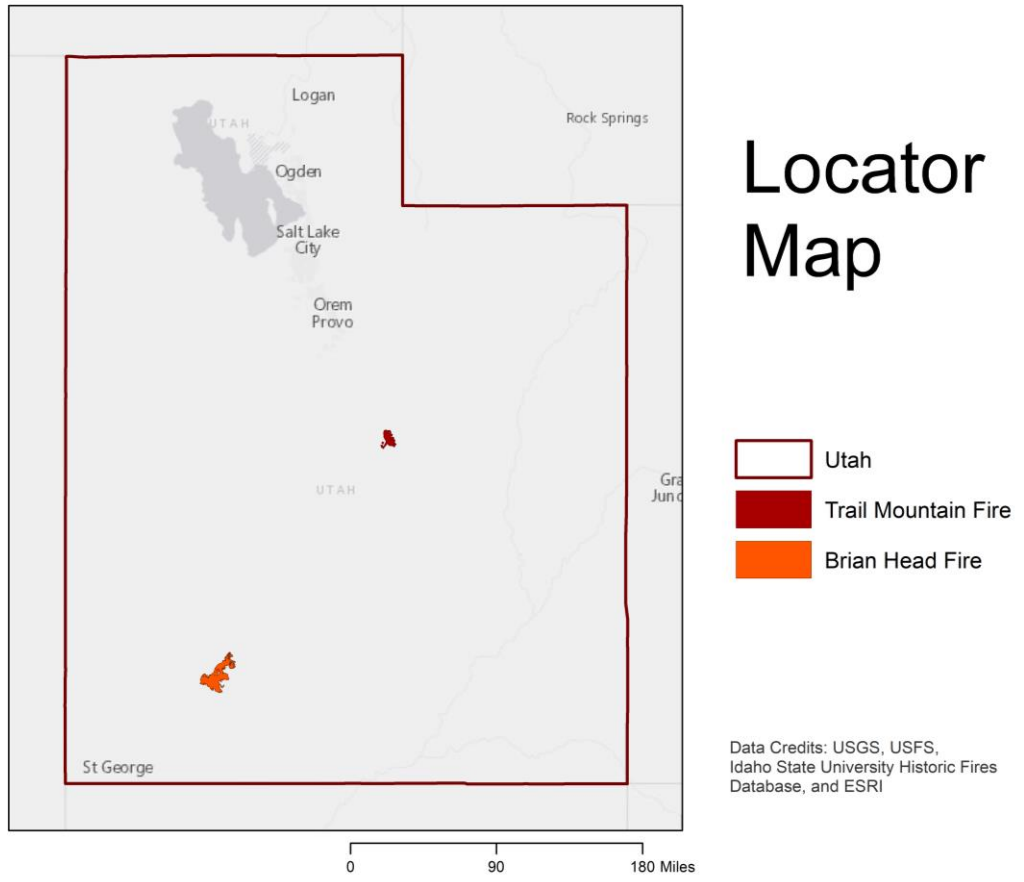
Methods: Site Selection

Brian Head Fire

- 2017
- Human caused Wildfire on the Dixie National Forest
- 71,673 acres
- Started June 17th

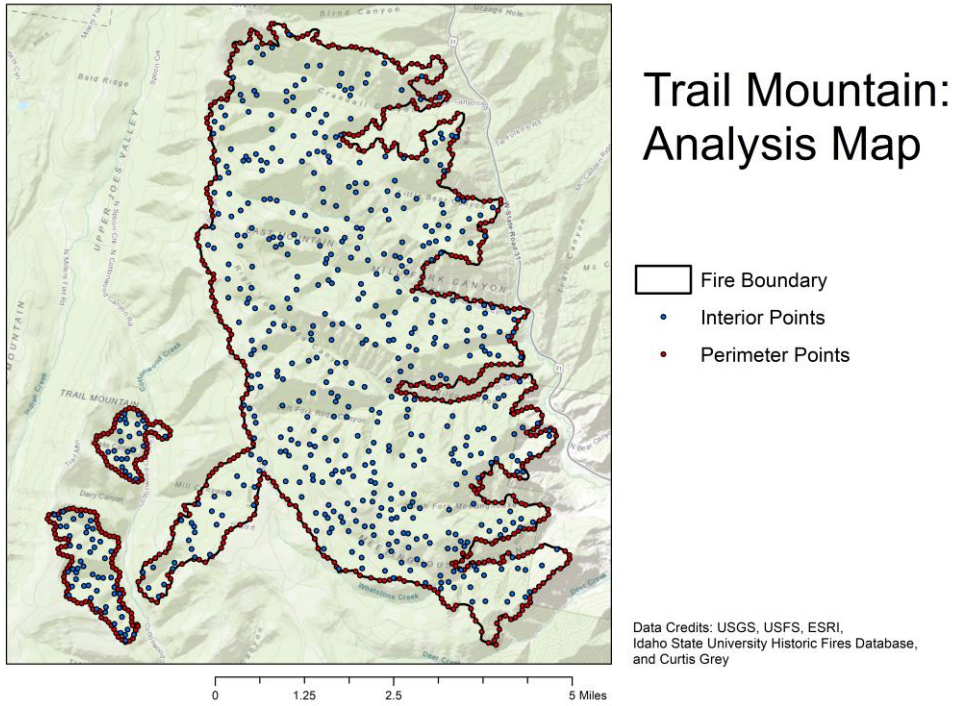
Trail Mountain fire

- 2018
- Rx burn - wildfire on the Manti- La Sal National Forest
- 18,011 acres
- Started June 8th
- Both burned in intense winds and extreme weather conditions.

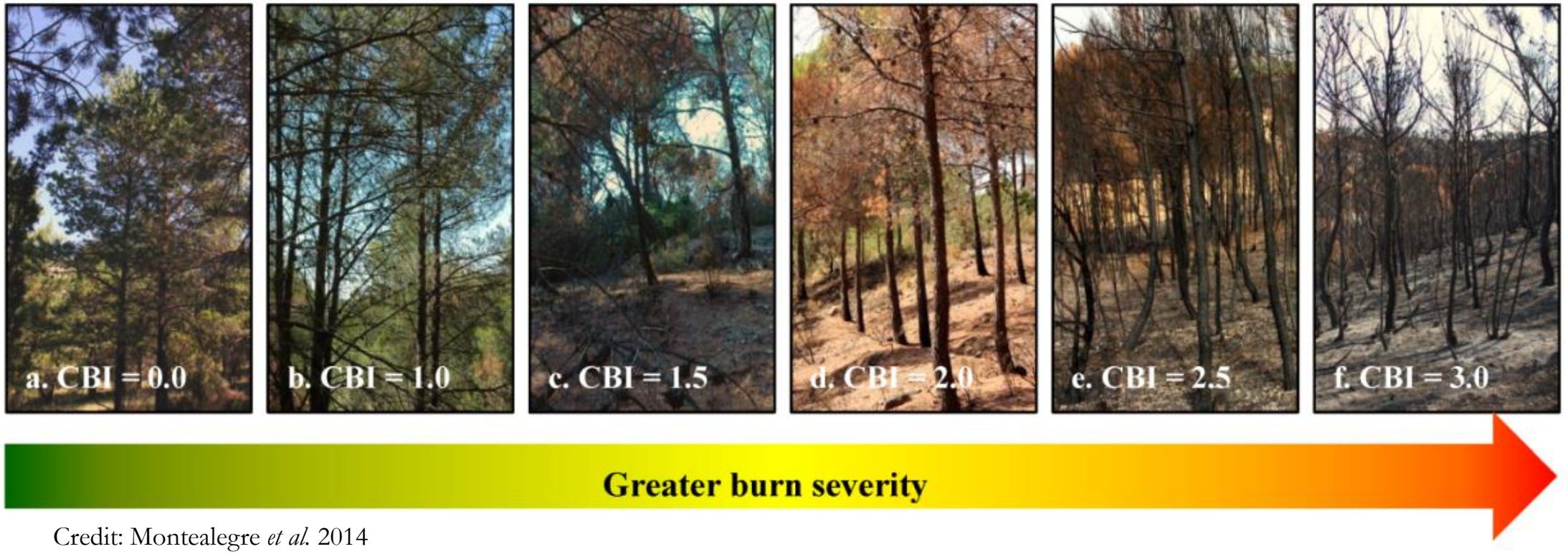


Methods: Analysis

- Fire severity analysis
  - 500 points within the burn area managing for spatial auto-correlation.
  - Aspen cover and burn severity were extracted at each point.
  - Linear regression analysis
- Fire spread/perimeter analysis
  - 500 random points on the fire perimeter compared against a expected cover of 500 random points within the fire.
  - Aspen cover was extracted at each point
  - distributions were compared with a K-S test
- CBI plots were conducted to ground truth the remotely sensed data we used for analysis.



Methods: CBI

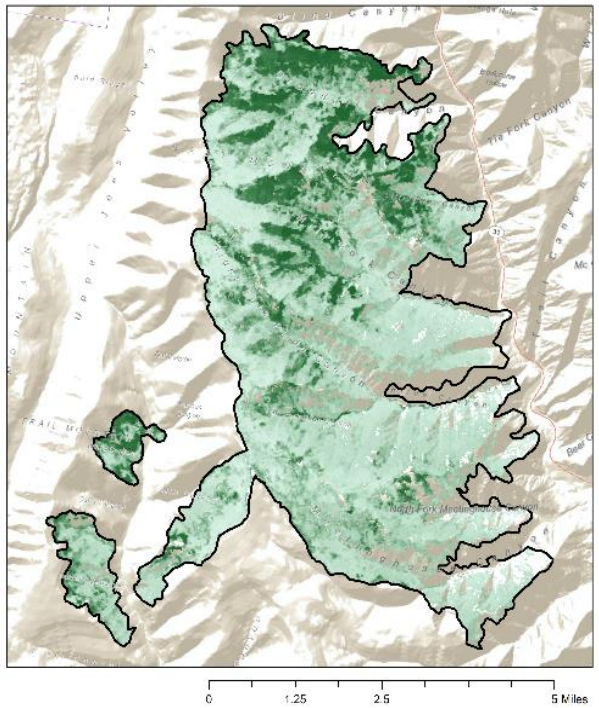


Credit: Montealegre *et al.* 2014

Results

Trail Mountain fire, Manti- La Sal National Forest. Elyse Doty, 2020

Trail Mountain Fire



Trail Mountain: Percent Aspen Cover

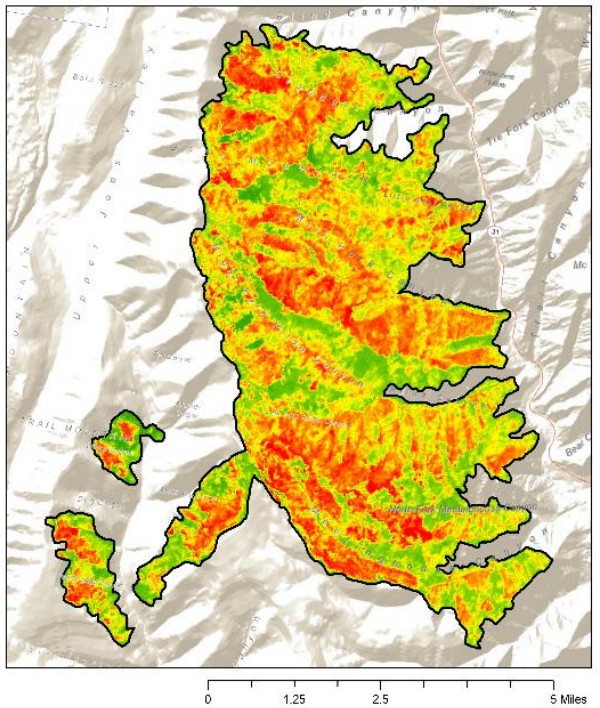
Fire Boundary

Aspen

High : 63%

Low : 1%

Data Credits: USGS, USFS, ESRI, Idaho State University Historic Fires Database, and Curtis Grey



Trail Mountain: Burn Severity (dNBR)

Fire Boundary

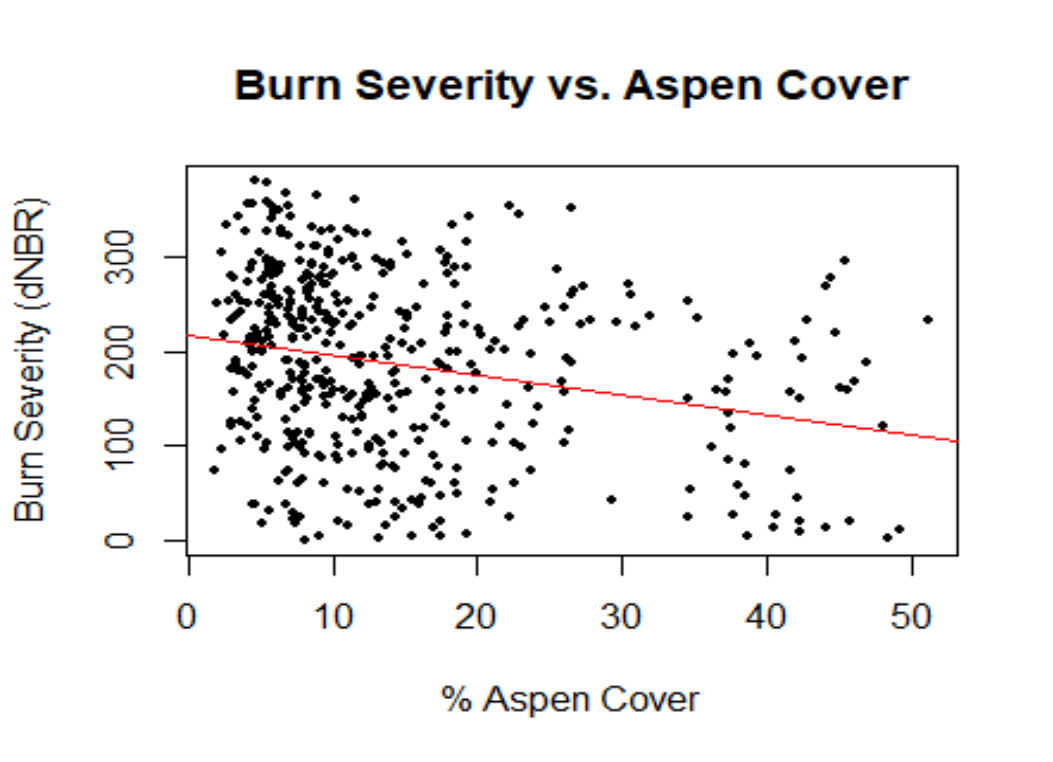
Burn severity: dNBR

High

Low

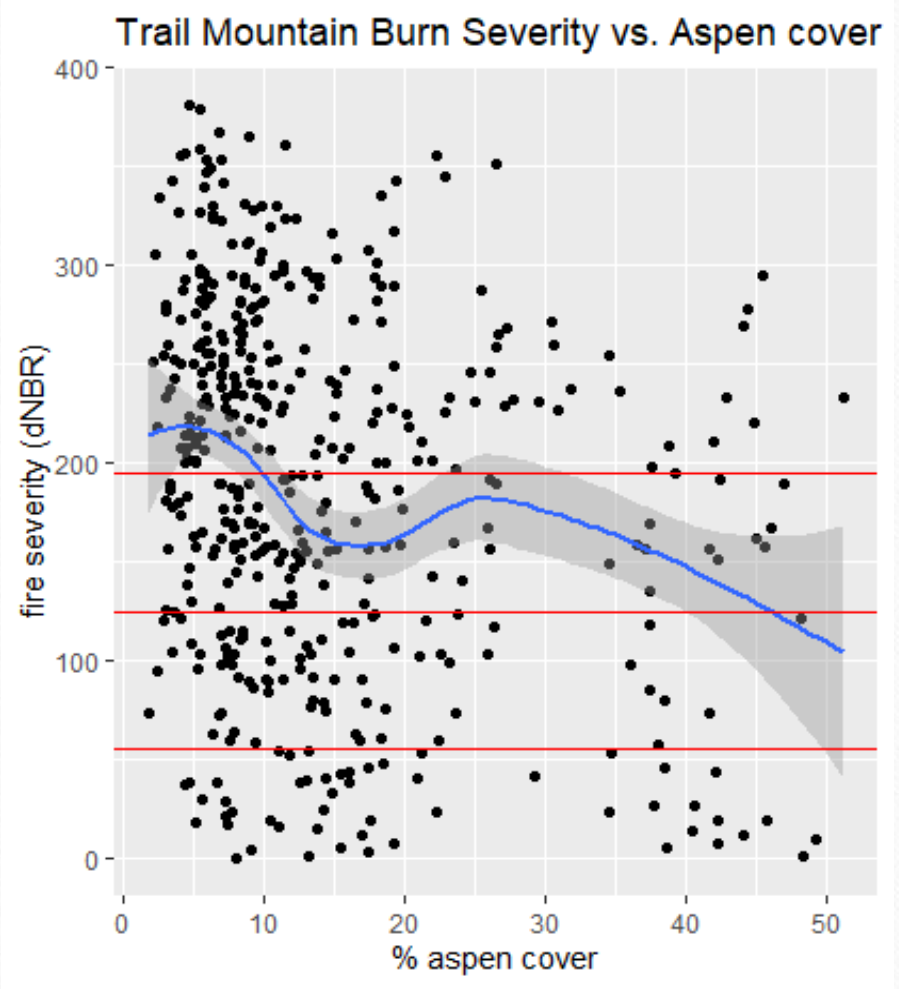
Data Credits: USGS, USFS, ESRI, Idaho State University Historic Fires Database, and Curtis Grey

Trail Mountain Fire



R-squared 0.060 P-value < 0.01

Statistically significant relationship between aspen density and burn severity in the Trail Mountain burn area

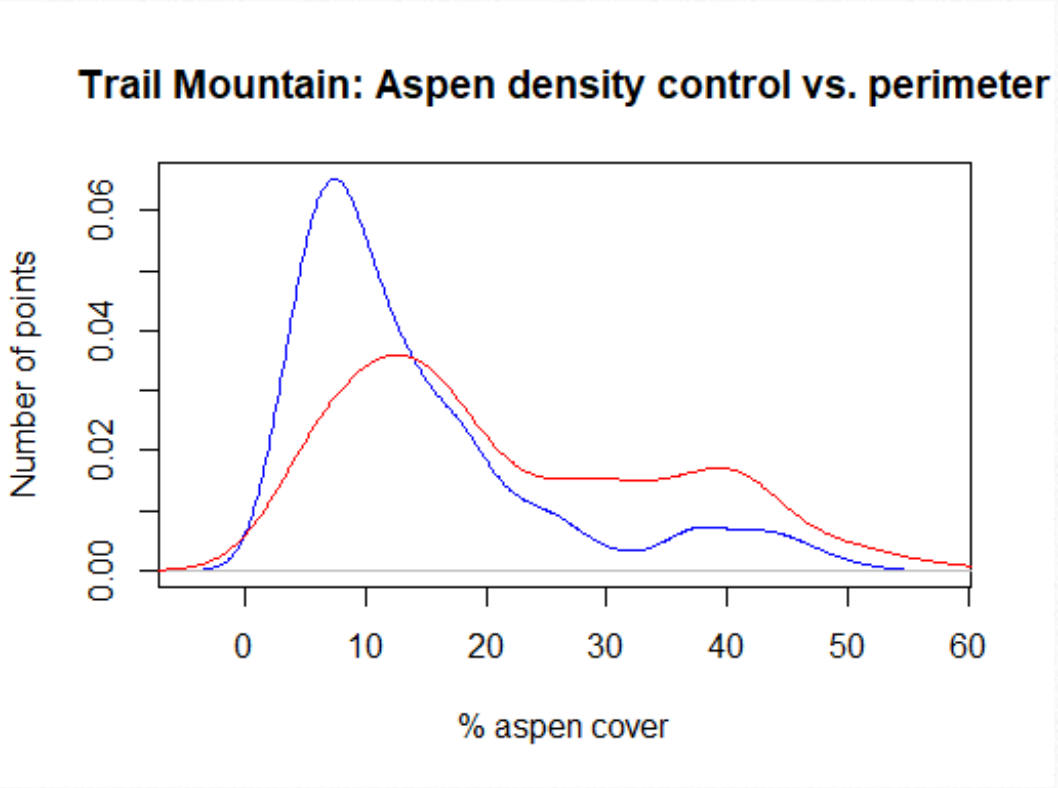


Ggplot smoothed line

Red lines – severity distinctions from CBI data

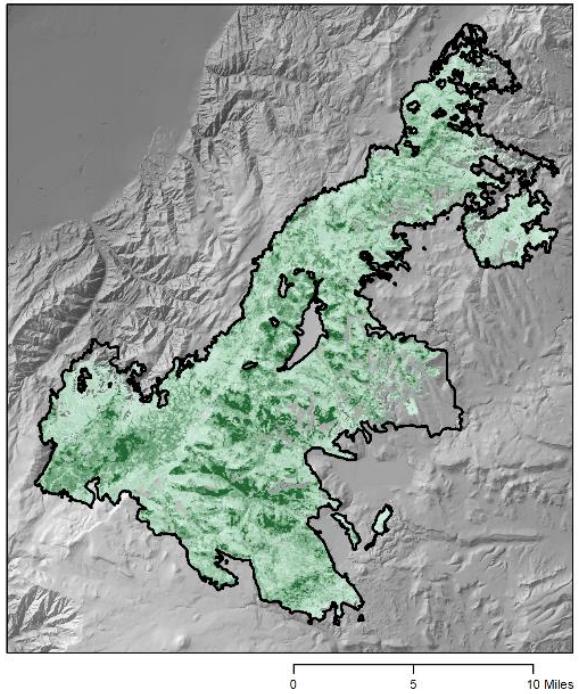
Trail Mountain Fire

Perimeter analysis to determine whether aspen have an impact on fire spread.



Red line – perimeter aspen cover distribution
Blue line – interior (control) aspen cover distribution
According to a K-S test of discrete distributions the difference is statistically significant.

Brian Head Fire



Percent Aspen Cover

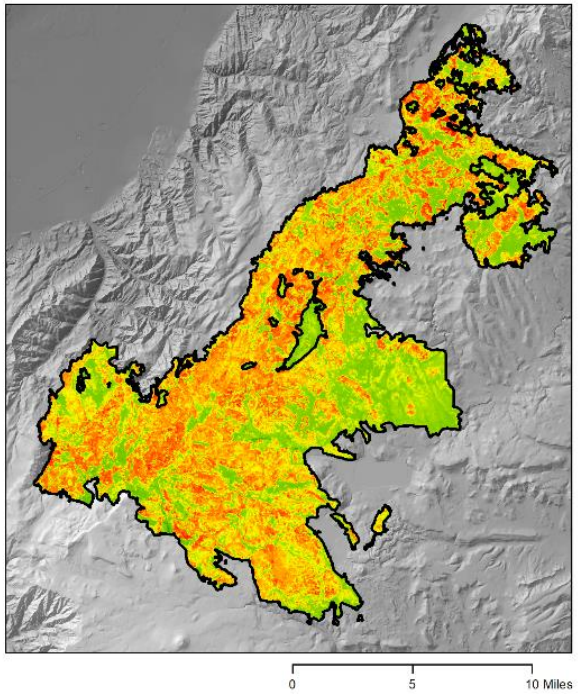
Fire Boundary

Aspen

62%

1%

Data Credits: USGS, USFS, Idaho State University Historic Fires Database, and ESRI



Burn Severity dNBR

Fire Boundary

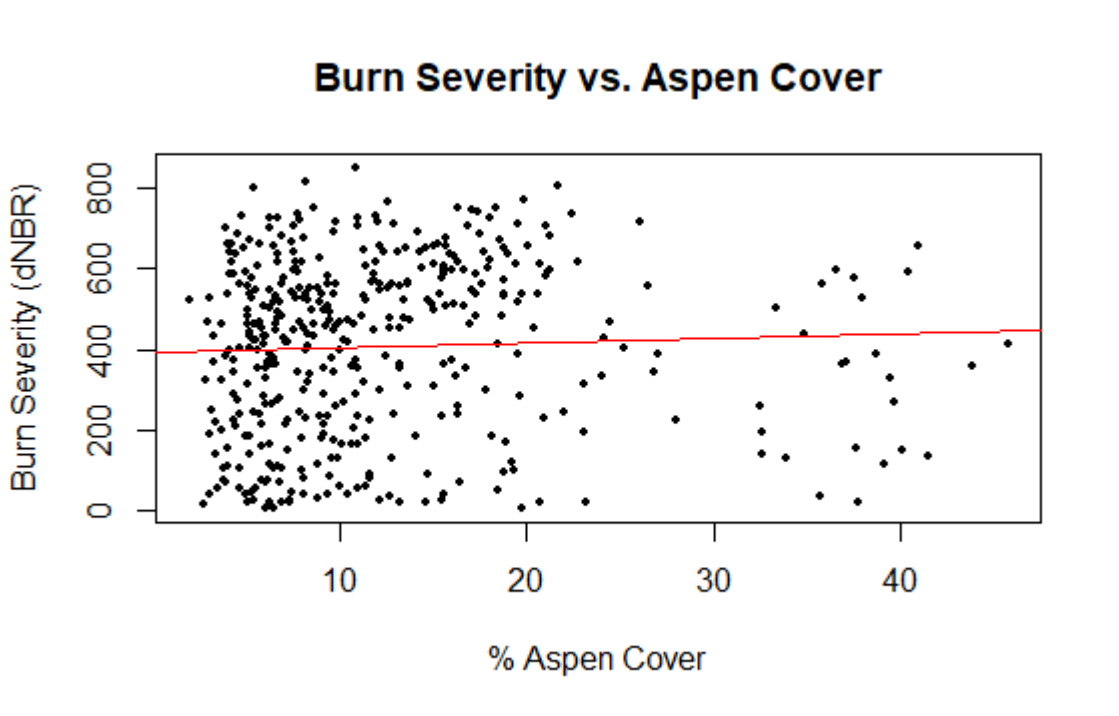
Burn Severity (dNBR)

High

Low

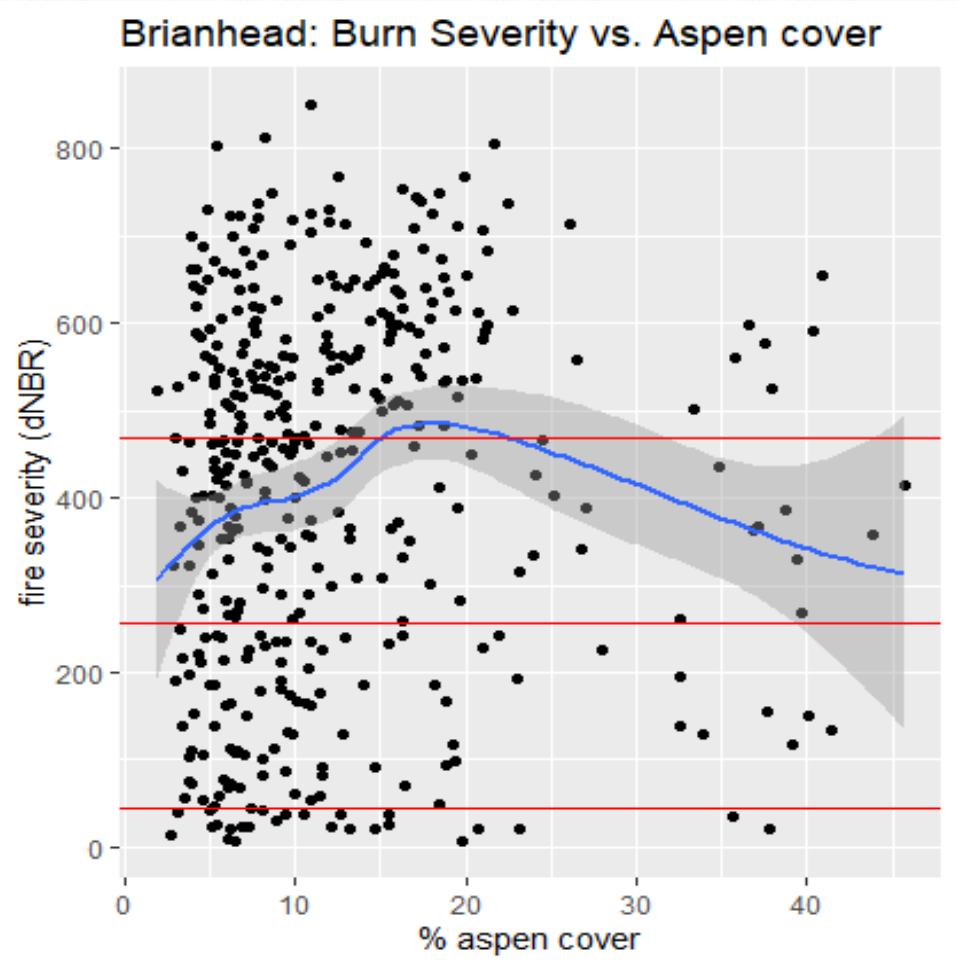
Data Credits: USGS, USFS, Idaho State University Historic Fires Database, and ESRI

Brian Head Fire



Linear regression with an R-squared of 0.002

No significant correlation between aspen and burn severity

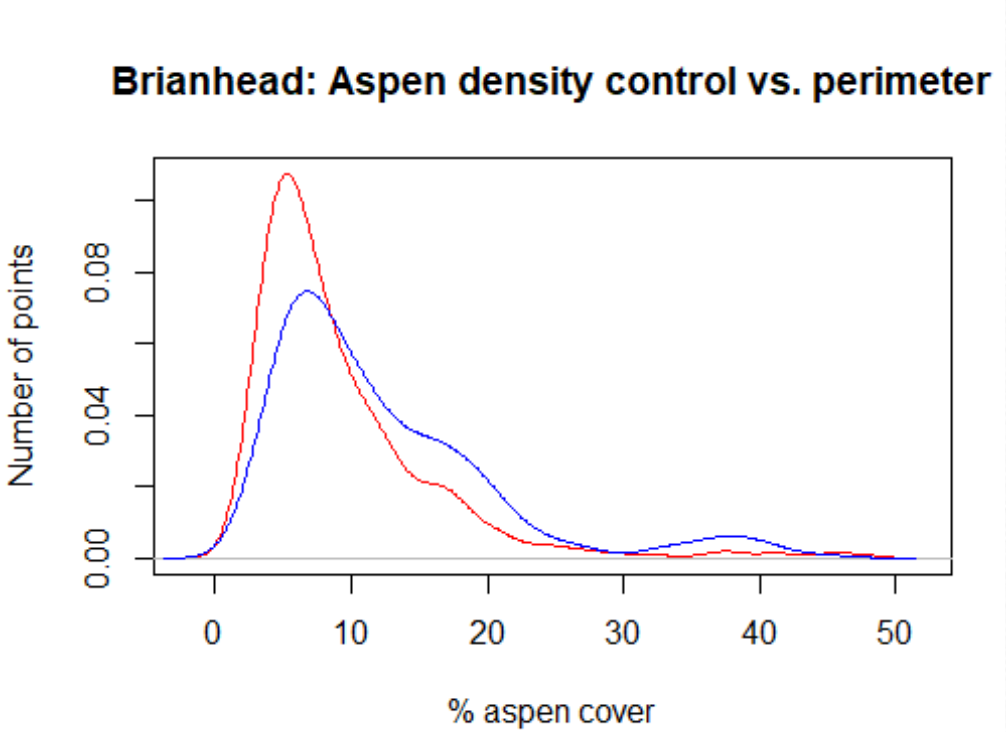


Ggplot smoothed line

Red lines – fire severity cutoffs from CBI data

Brian Head Fire

Perimeter analysis to determine whether aspen have an impact on fire spread.



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Discussion


Mammoth Fire, Manti- La Sal National Forest. Elyse Doty, 2019

- Brian Head fire analyses show no correlation between aspen stands and fire spread or severity
- The Trail Mountain fire analyses statistically significant correlation between aspen stand density and fire spread and severity
- Both fires burned under severe weather conditions and high winds. The Brian Head fire burned into unforested areas where suppression efforts were more effective
- Trail mountain unburned aspen could be terrain related.

Future Research Direction

- Pilot study of just 2 fires
- hypotheses only supported in one of the two fires studied meaning more research to better understand this phenomenon.
- More fires
- Progression maps & weather data
- Fires that burned under a range of conditions

Mammoth Fire, Manti- La Sal National Forest. Elyse Doty, 2019

Questions?

Trail Mountain burn area, Manti- La Sal National Forest. Elyse Doty, 2019