The effects of successive large mixed-severity wildfires on vegetation and fuels in the Sierra Nevada, CA

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Outline

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- Working Model
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- Study Area
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- Future Directions
- Acknowledgements

http://www.soperwheeler.com/newsclips/managed-fire-worth-it/

Wildfire and Vegetation Change

- This is like someone from the west coast going to Florida to talk about hurricanes...
- You know the story…
  - 100+ years of fire suppression
  - Altered densities, composition, fuel loads
  - Climate change causing…
    - Increasing temperatures
      - Frequent fire weather
    - Reduced snowpack
    - Drier fuels
- The result…
  - Increased fire frequency
  - Larger fires
  - More and larger high-severity patches
  - Dramatic vegetation changes

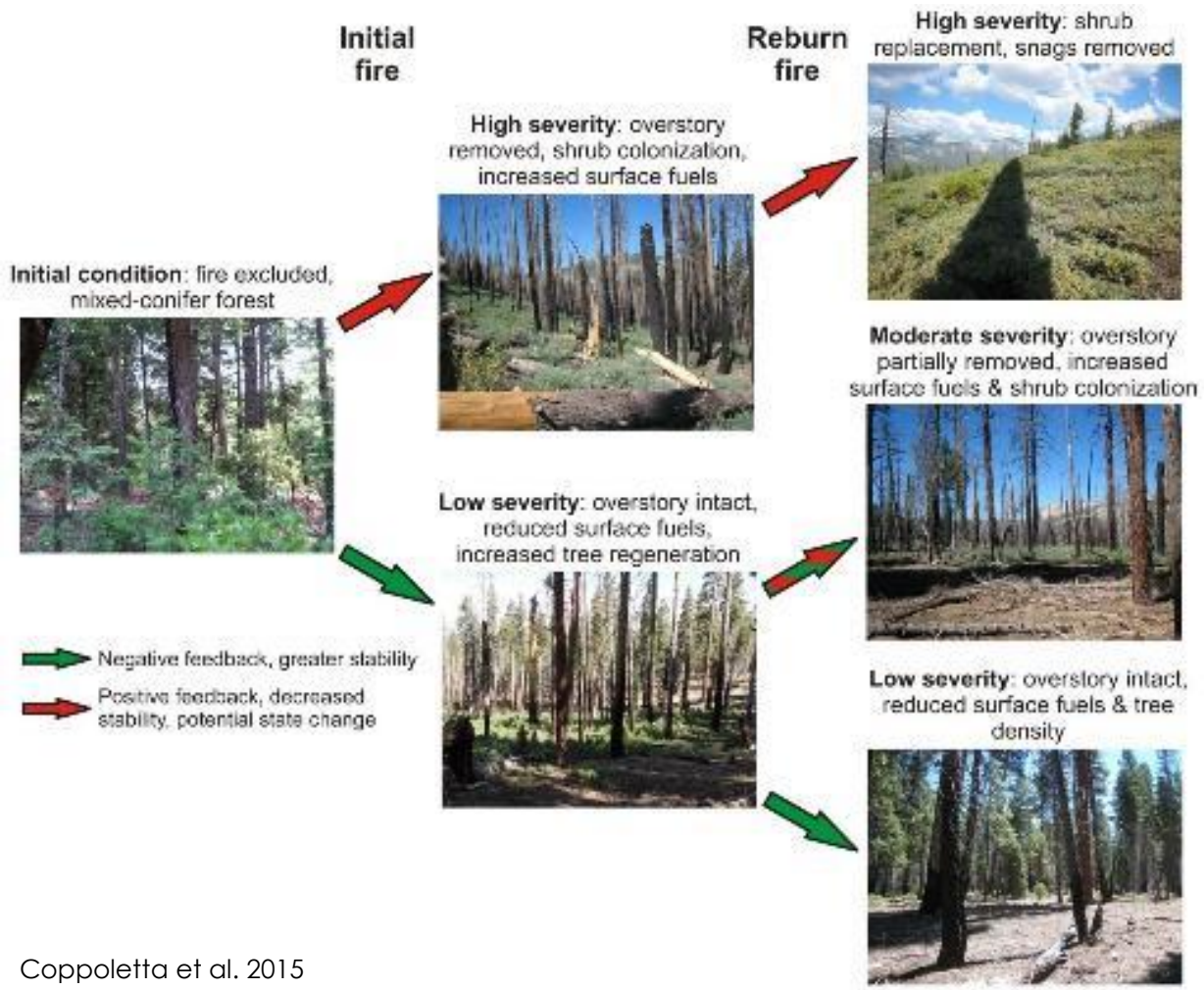
Fites et al. 2012

Wildfire and Vegetation Change

- What do we assume is different about rapid successions of fires, i.e. reburns?
- We expect fire to reduce fuels, which results in…
  - Delay next fire for fuel buildup
  - Reduced severity in subsequent fires
  - Potentially stimulate regeneration
- Recent reburn patterns instead may…
  - Increase fuels after high-severity fire
  - Reduce high-severity return intervals
  - Increased probability of high-severity in reburns
  - Reduced regeneration potential

Fites et al. 2012

Working Model



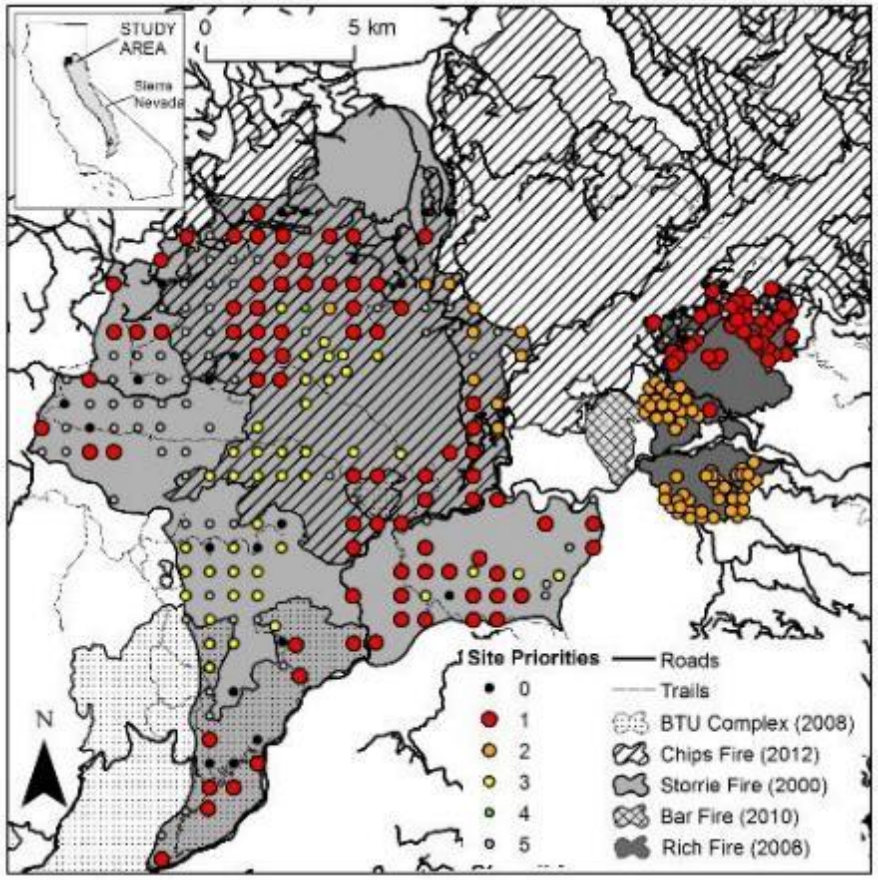
Coppoletta et al. 2015

Objective and Hypotheses

- **Objective:** Examine pre- and post-reburn vegetation and fuel loadings to test hypotheses about future successional trajectories under potential positive and negative feedback loops in montane mixed conifer forests.
  - **H1:** Positive feedback - high severity fires promote dominance by shrubs and homogenization of vegetation structure and more high severity fires.
  - **H2:** Negative feedback - low to moderate severity fires reduce surface fuels and small tree density, maintain overstory trees, and promote forest heterogeneity and structural diversity and more low to moderate severity.

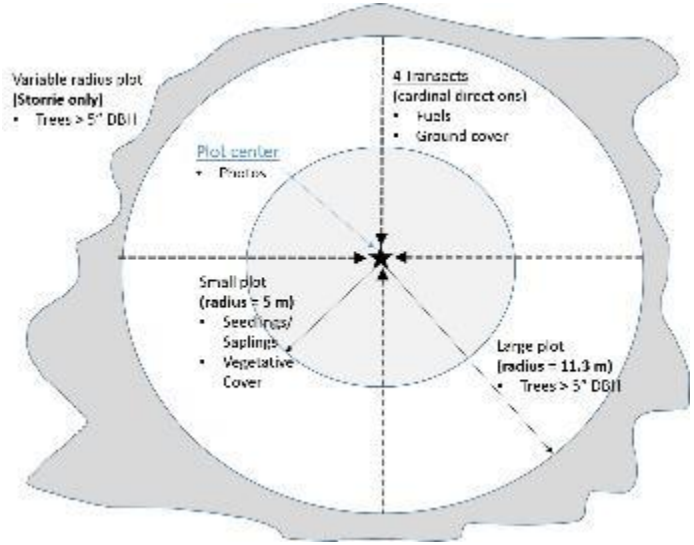
Study Area

- Boundary of Plumas and Lassen National Forests along Feather River Canyon and Route 70.
- Mixed-severity fires in mixed conifer forests:
  - Storrie Fire 2000
  - Rich Fire 2008
  - Both reburned, Chips Fire 2012
    - 1 = 39%, 2 = 30%, 3 = 20%
- Overstory mortality high and large shrub patches common in high-severity patches after fires.



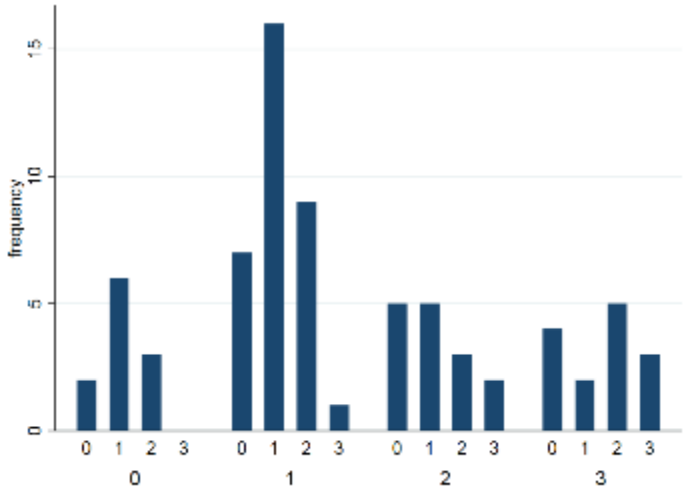
Field Methods

- Common Stand Exams.
- Minor variation among Storrie and Rich methods.
  - Variable radius in Storrie, fixed in Rich.
  - Seedlings >3 cm Storrie, all seedlings in Rich.

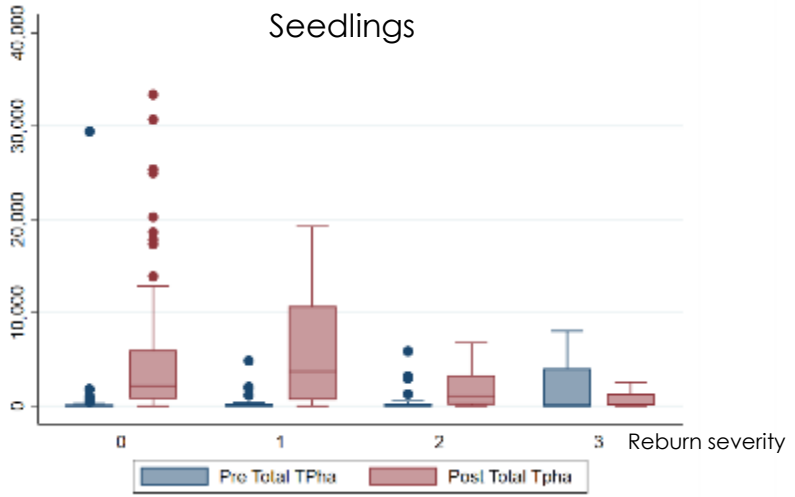


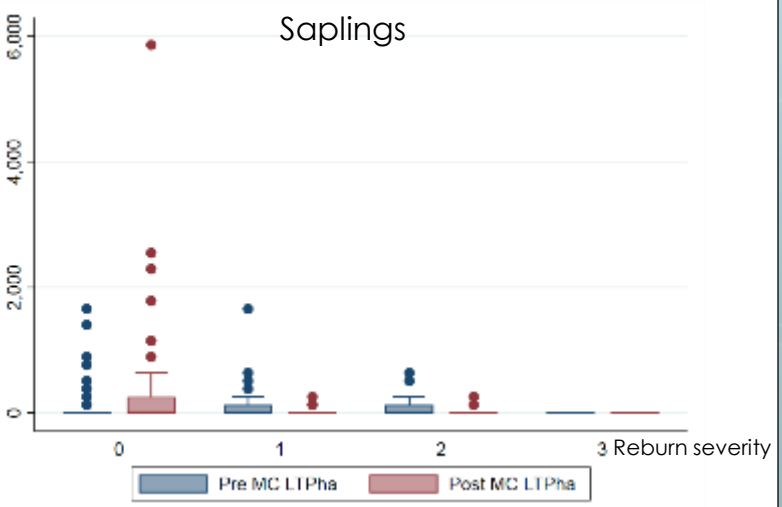
Field Methods

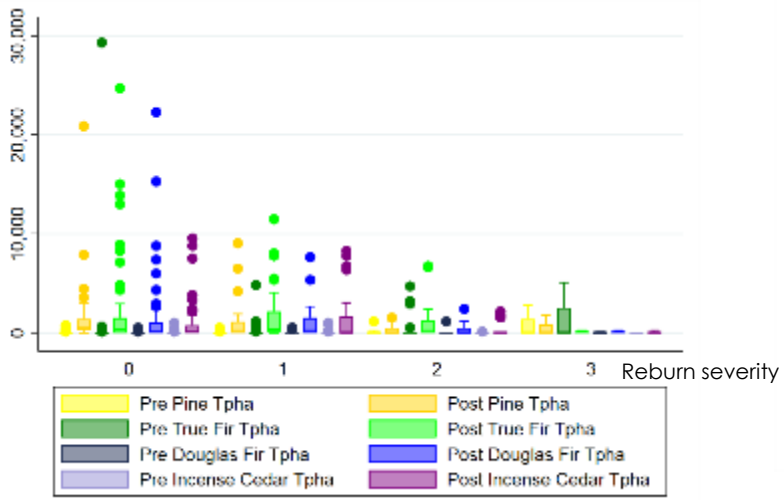
- Vegetation variables: shrub cover, seedlings, saplings (dbh), live and dead trees (dbh), fuels (all sizes).
- Physical variables: fire severity for each fire, slope, aspect, elevation, serpentine, groundcover (rock, soil, H_2O).

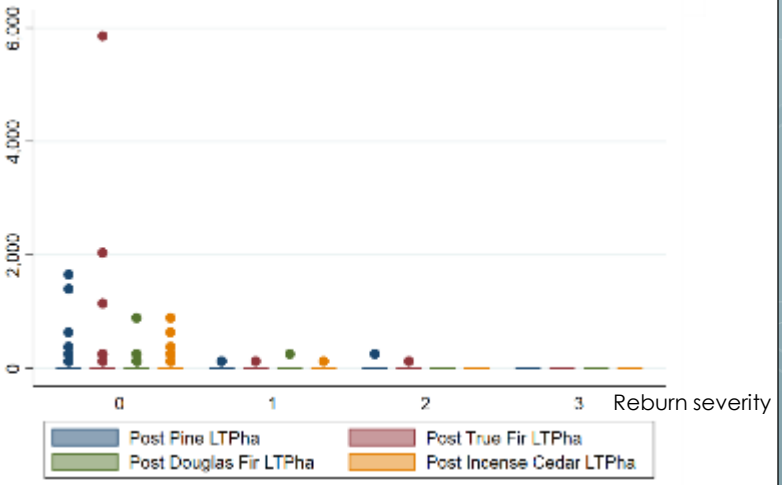


Preliminary Analysis: Seedlings/Saplings

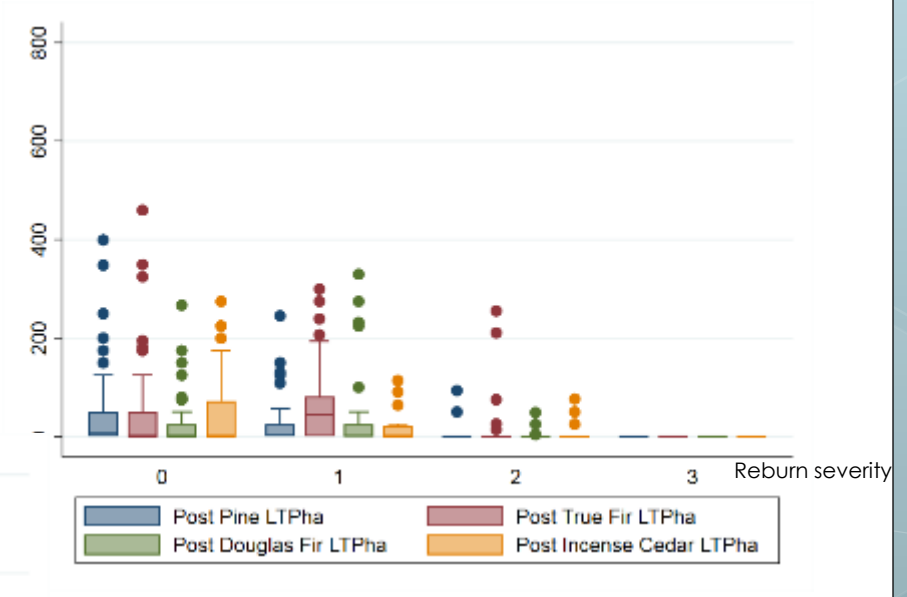


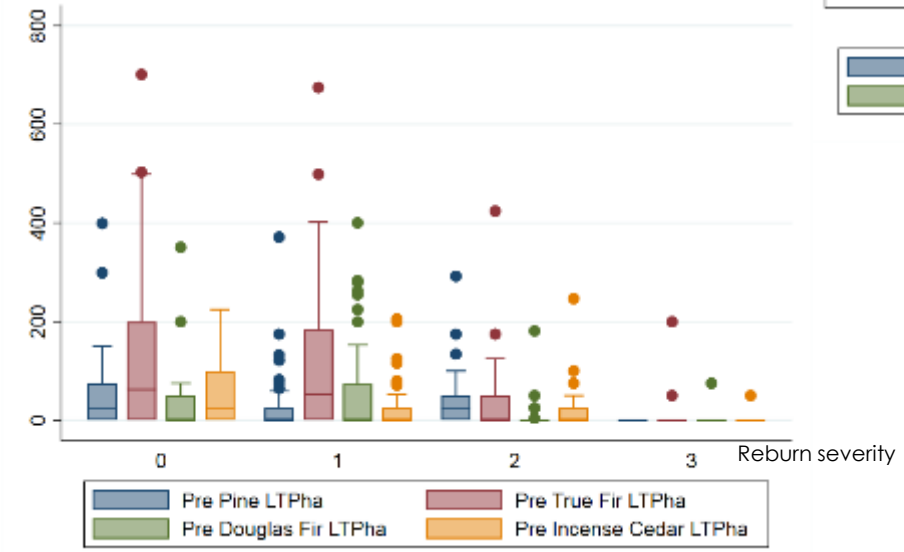




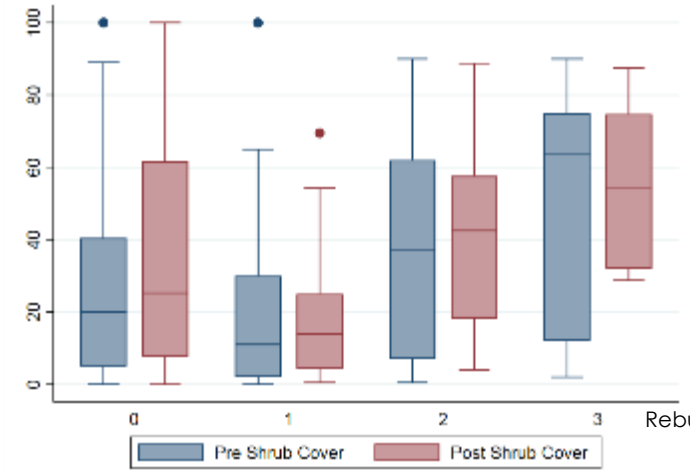


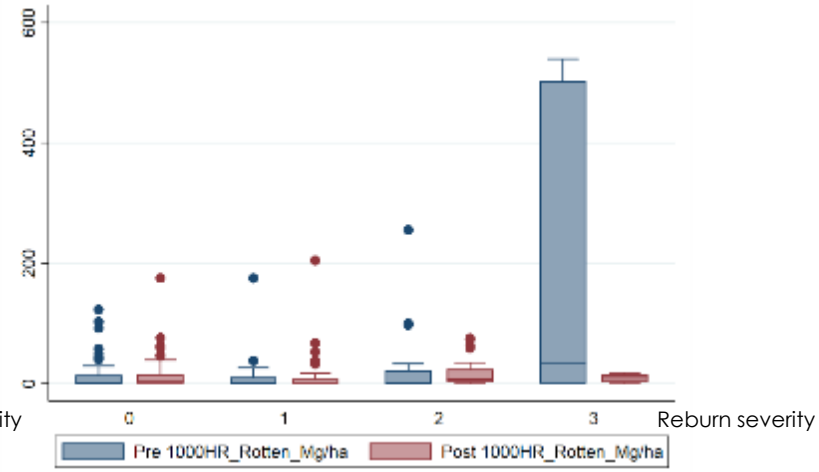
Preliminary Analysis: Trees

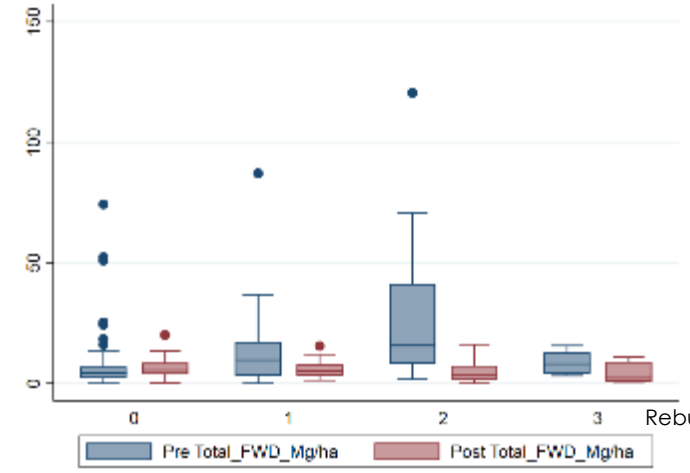


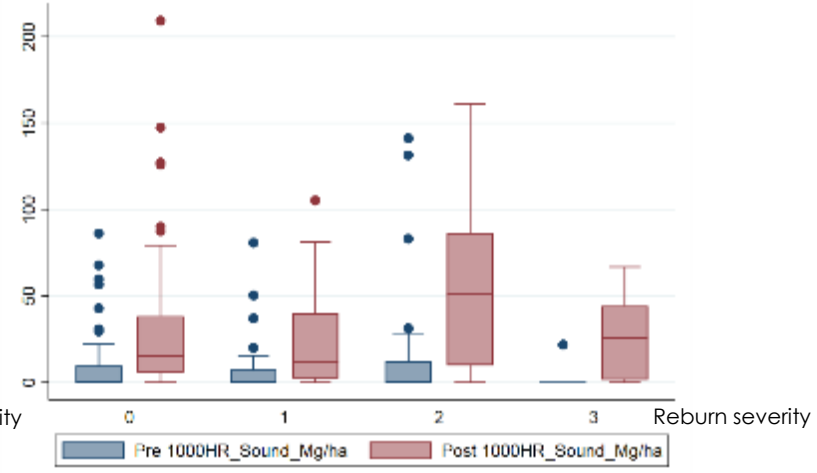


Preliminary Analysis: Shrubs/Fuels









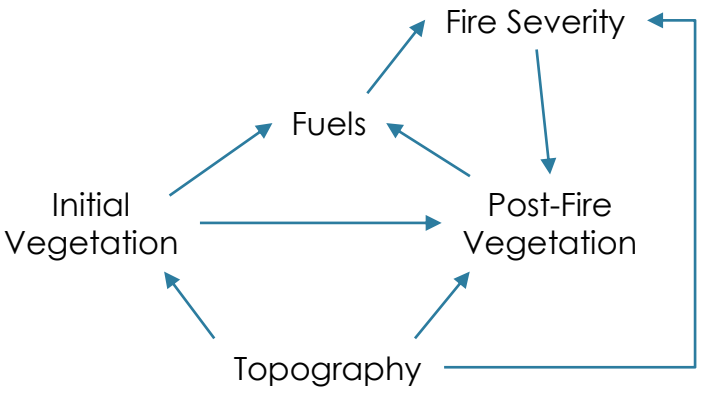
Discussion

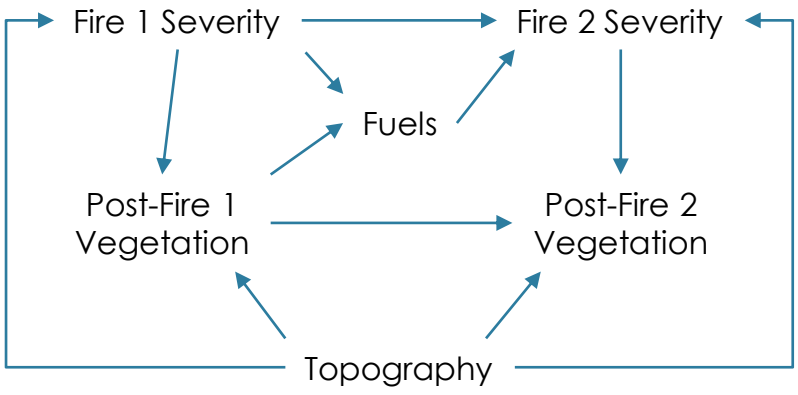
- H1 (+ feedback).
  - Evidence of homogenization:
    - MC overstory gone
    - Shrub cover high
    - No saplings
    - Some seedlings present, low dens/divs
  - More future high-severity fire?
    - Probability not greater than initial fire?
    - Rotten fuels replaced by sound fuels. What effect on near-term reburns?

- H2 (- feedback).
  - Evidence of heterogeneity maintenance:
    - MC overstory persists after low-severity, but substantial loss after mod-severity.
    - Lots of seedlings and some saplings of all species.
    - Low shrub cover in low-severity, but quite high in mod-severity.
  - More low- to mod-severity fire?
    - FWD consumed in mod-severity reburn, but a lot of sound CWD created.
    - With elevated shrub cover, are mod-severity primed for future high-severity?

Future Directions

- Pre/Post-test ANCOVAs or Negative Binomial GLMs.
  - Dependent vars: species composition; tree, sapling and seedling density; tree basal area, shrub cover; and fine fuel loading and coarse woody debris.
  - Main effects: severity of the initial fire, the severity of the reburn, and the time interval between fires.
  - Continuous covariates: physical and vegetation variables (pre-reburn).
- Path Analysis/Structural Equation Model – allows us to handle direct and indirect effects and feedback effects.





Acknowledgements. Questions?

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  - We would like to thank the following people for assistance with field sampling:
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