

Simulating effects of forest management practices in a fire prone region of the Northwestern US

Evan Waldmann

University of Central Florida

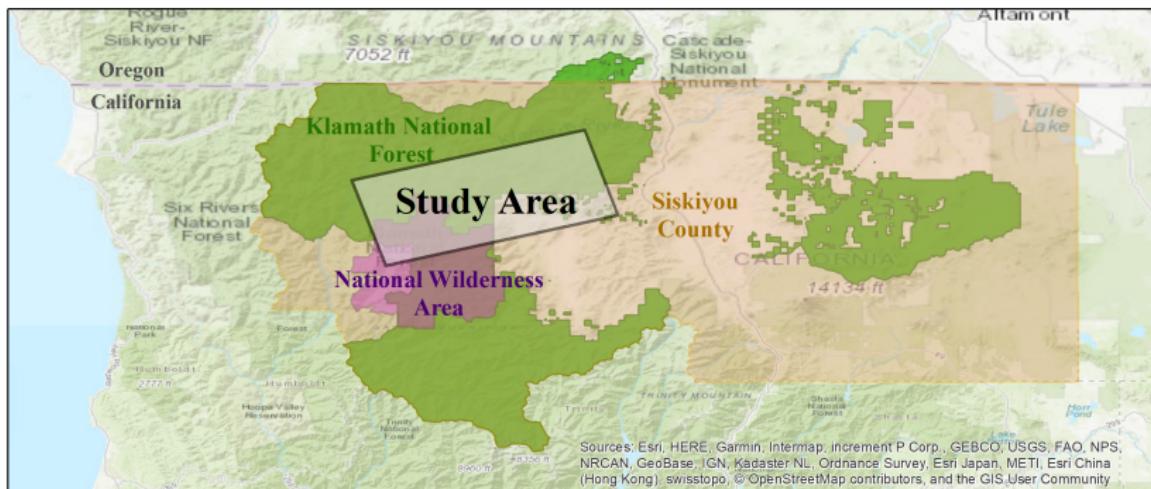
August 2nd, 2018



Objective of the Project

To model and simulate **dynamic** human response to forest disturbances
in order to see the impacts that humans have on the landscape

Study Area: Klamath National Forest



Dimensions: 101 rows X 205 columns

Cell resolution: 270m x 270m

Size: 20,705 cells (138,043ha or 1,380km²)

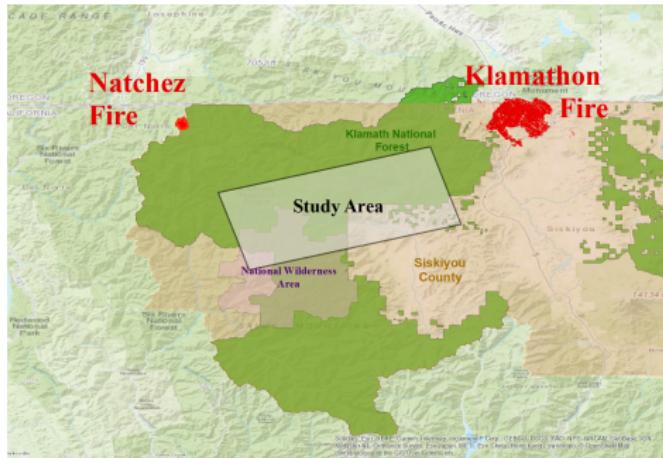
Timescale: 90 years (2010-2100) using 10 year time step

Recent Headlines about the Klamath Region

- **July 19, 2018** - Natchez Fire crosses into Klamath National Forest; burned an estimated **767** acres (NBC52)
- **July 9, 2018** - Klamathon Fire update; now at **35,250** acres, 30% contained, 81 structures lost (Harald and News)
- **June 28, 2018** - Cherry Fire: **100** acre fire burning through vegetation near Horse Creek (News10)



Klamathon Fire
Photo from Harald and News

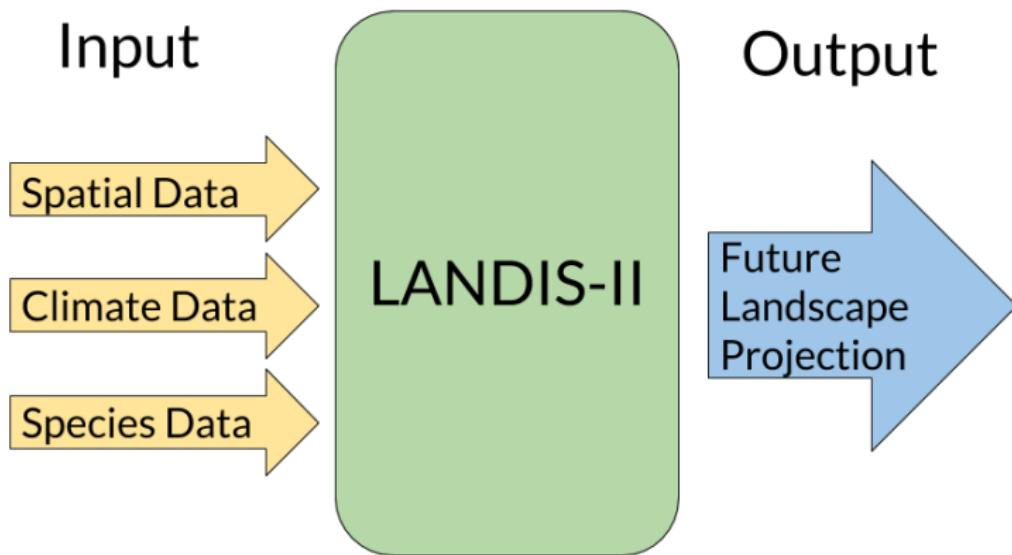


Experimental Design

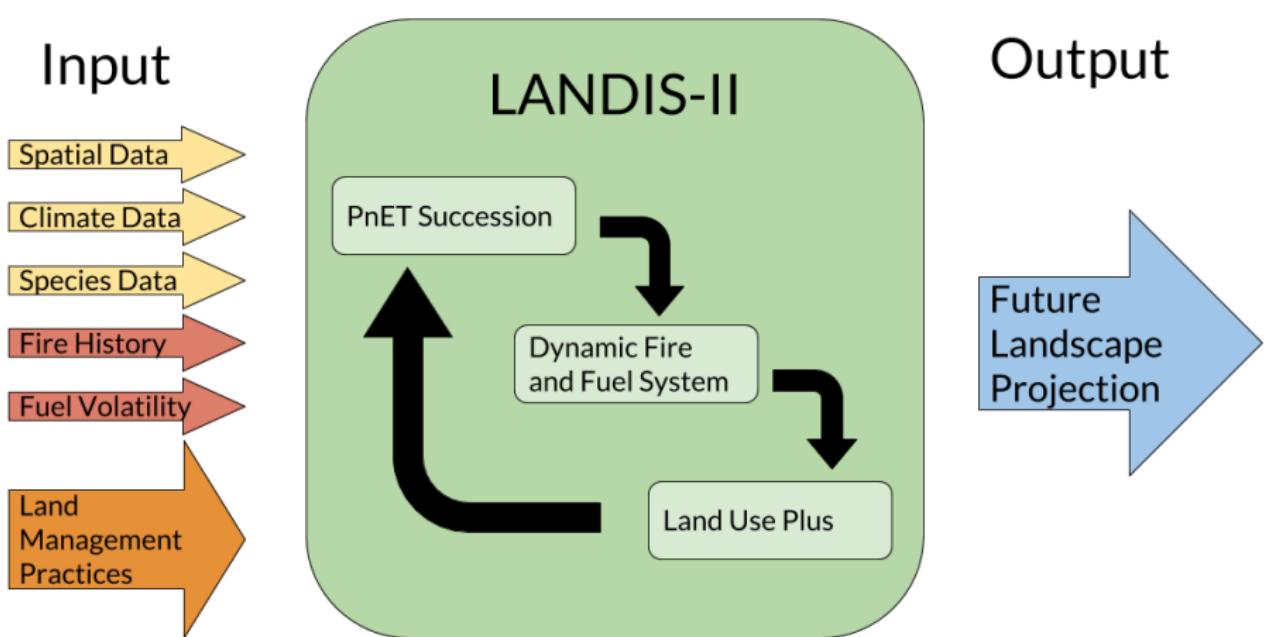
Scenarios	Climate	Fire	Human Response
Historic Climate	Historic Climate	Inactive	Inactive
Historic Climate & Fire	Historic Climate	Active	Inactive
Historic Climate & LU	Historic Climate	Active	Active
Climate Change	Climate Change	Inactive	Inactive
Climate Change & Fire	Climate Change	Active	Inactive
Climate Change & LU	Climate Change	Active	Active

LANDIS-II

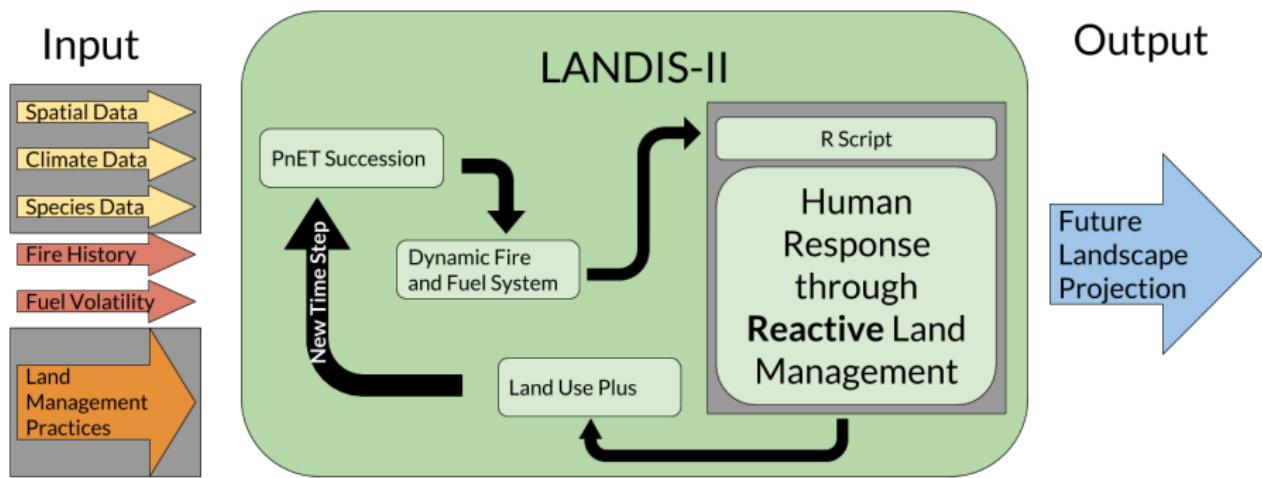
LANDIS-II is a spatially explicit model that simulates forest growth and disturbances across landscapes.



LANDIS-II Diagram



What Existed and What I added



Climate Scenarios

Climate Change

- describes a future with high populations, slow demographic transition, and substantial emissions due to delayed technological development
- CO₂ concentration is 390 parts per million in 2010 and **grows to 856 parts per million** in 2100

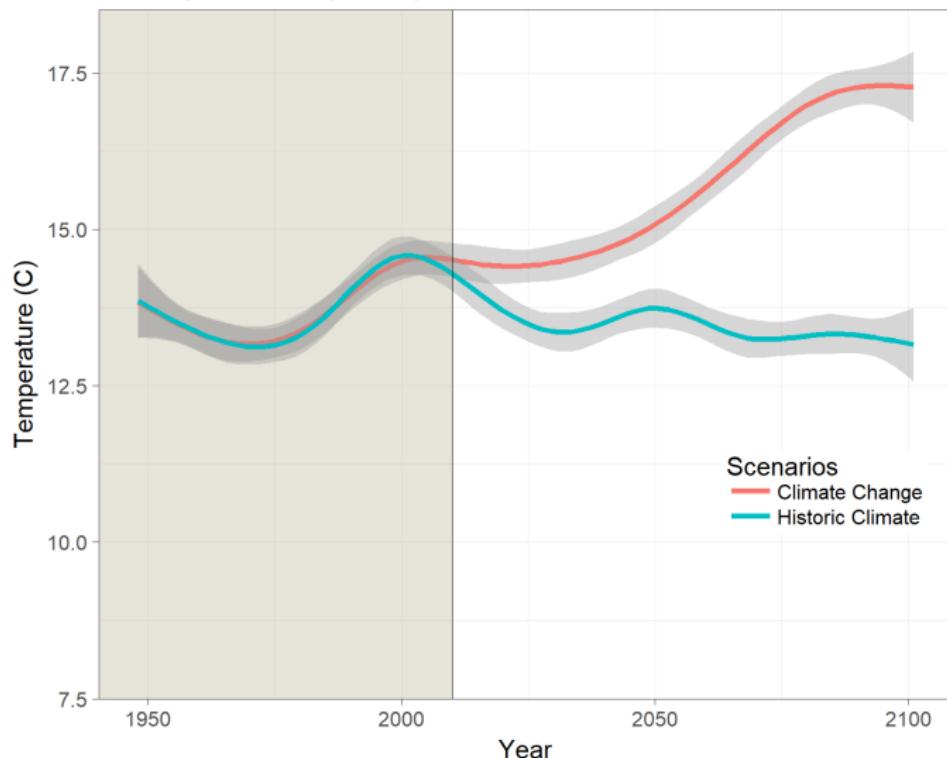
Historic Climate

- samples historic trends yearly to produce the climate beyond 2010
- CO₂ concentration set to a **constant 390 parts per million** beyond 2010

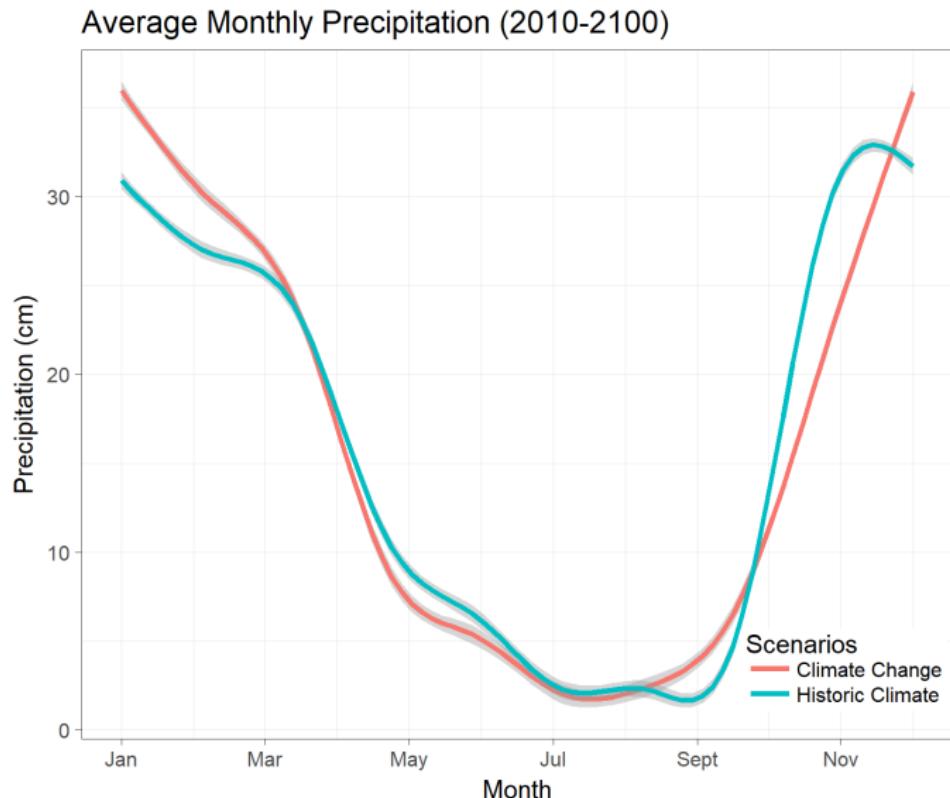
Data from Hostetler, S.W., J. R. Alder, & A. M. Allan. 2011. Dynamically downscaled climate simulations over North America: Methods, evaluation, and supporting documentation for users: U.S. Geological Survey Open-File Report 2011-1238, 64 p
A2 Scenario from IPCC. 2010. Emission Scenarios. Cambridge University Press.

Temperature

Average of Yearly Temperature Extremes

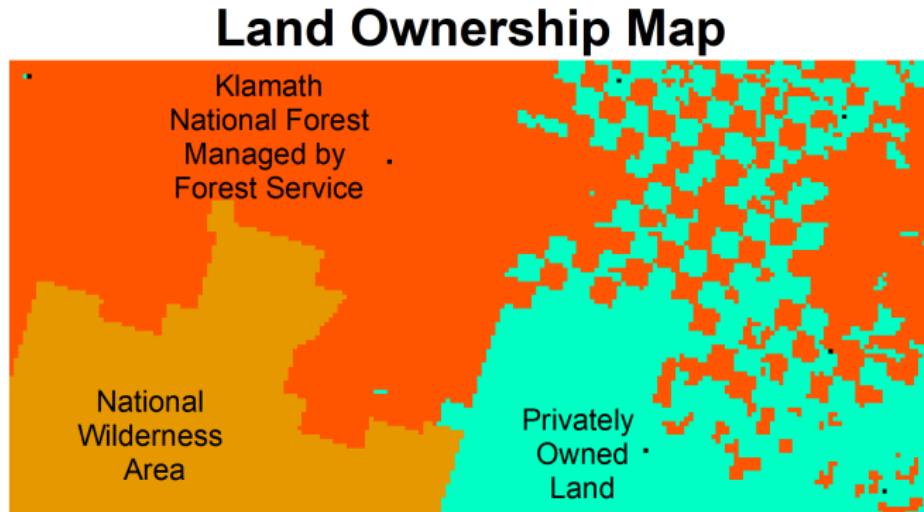


Precipitation



Simulating Human Response: General Rules

- Cuts are effective for 15 years
- Land owned by the Forest Service maintains planned fuel breaks that follow low elevation areas
- National Wilderness Areas are never cut



Simulating Human Response: Basic Idea

Proactive Response

- Fuel breaks implemented to divide large groups of connected fuel types

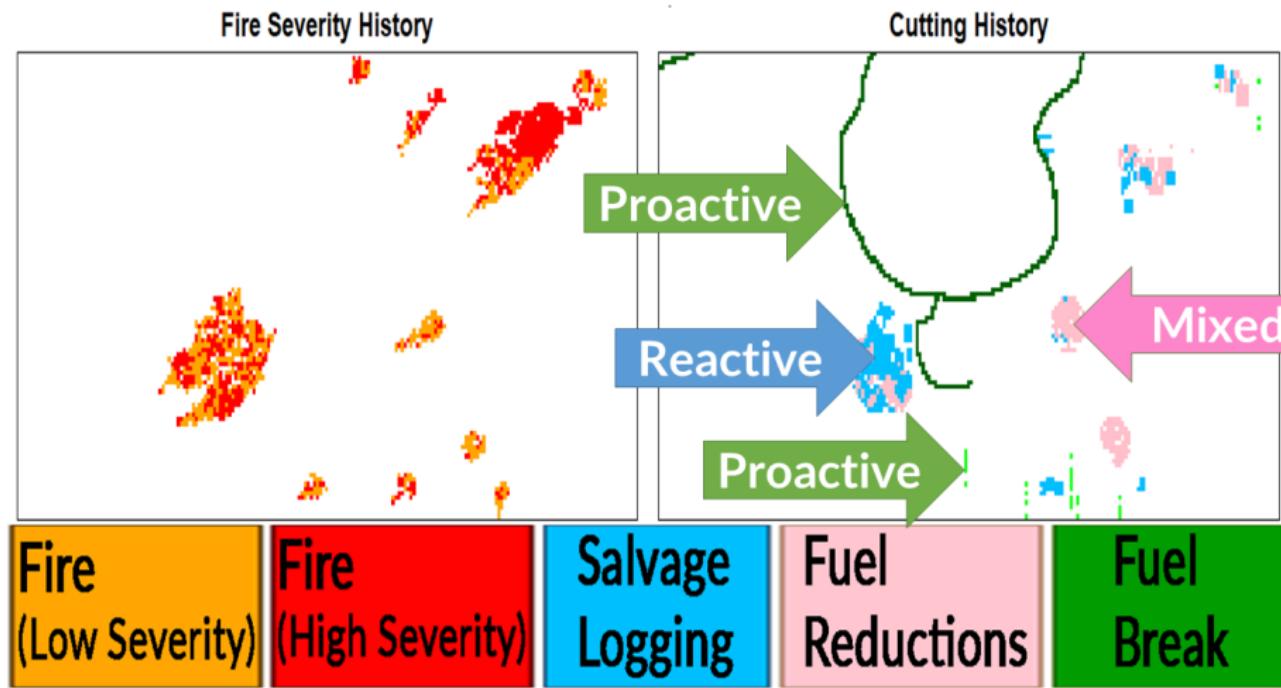
Reactive Response

- Post fire salvage logging was performed on burnt cells and their neighbors if the cells were hit by a fire of severity level between 1 and 3 (where a level 5 fire kills all trees in the cell)

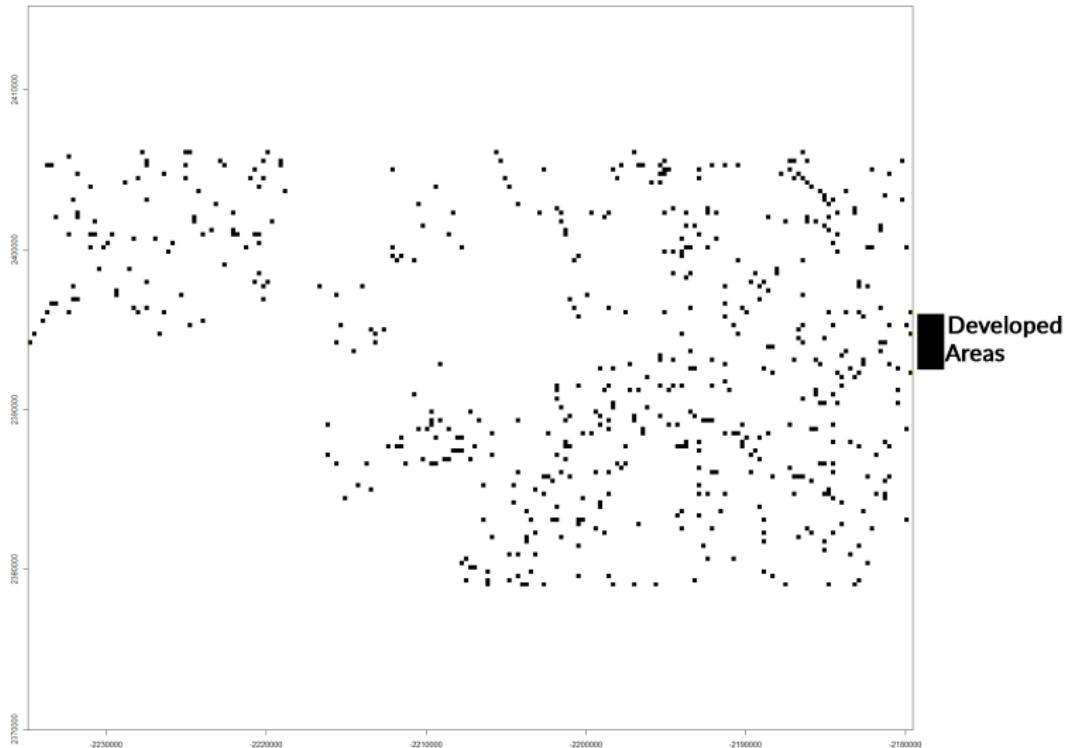
Mixed Response

- Land around developed areas was thinned if there were fires present in more than half the cells in a 9-cell (2.43 km) diameter circle of the developed area

Some Examples

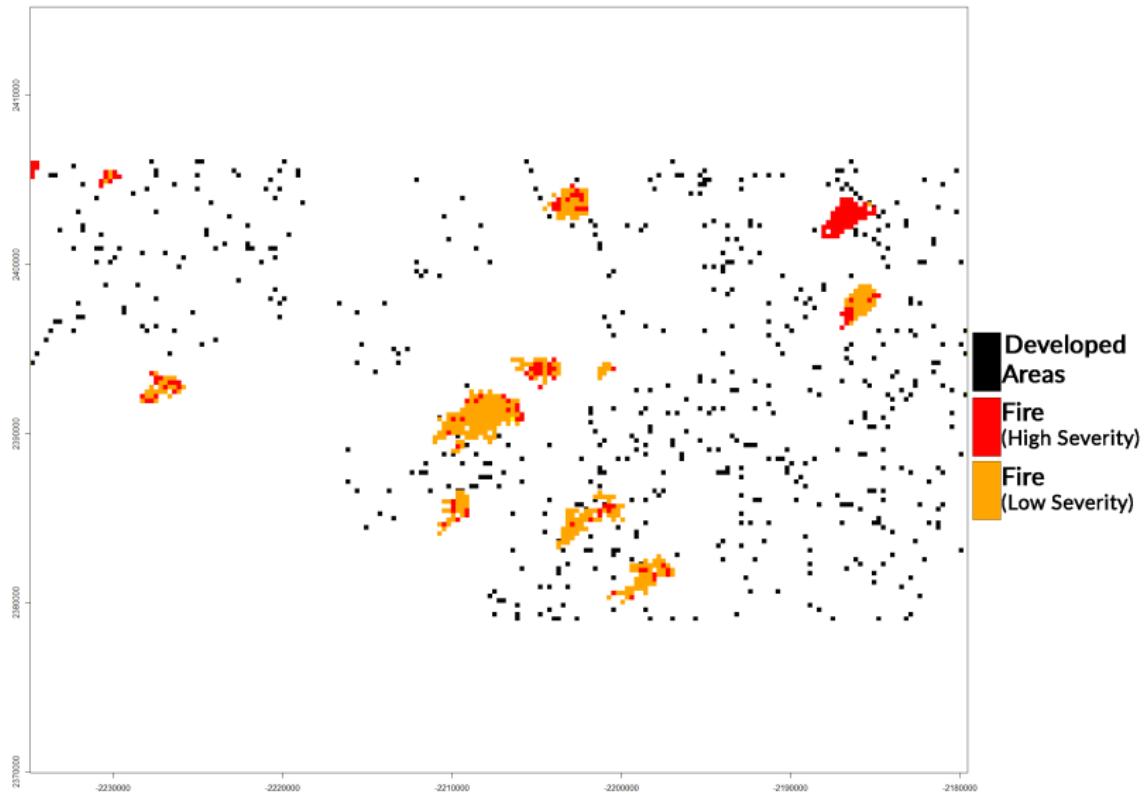


Reactive Actions: Cutting in Response to Fire

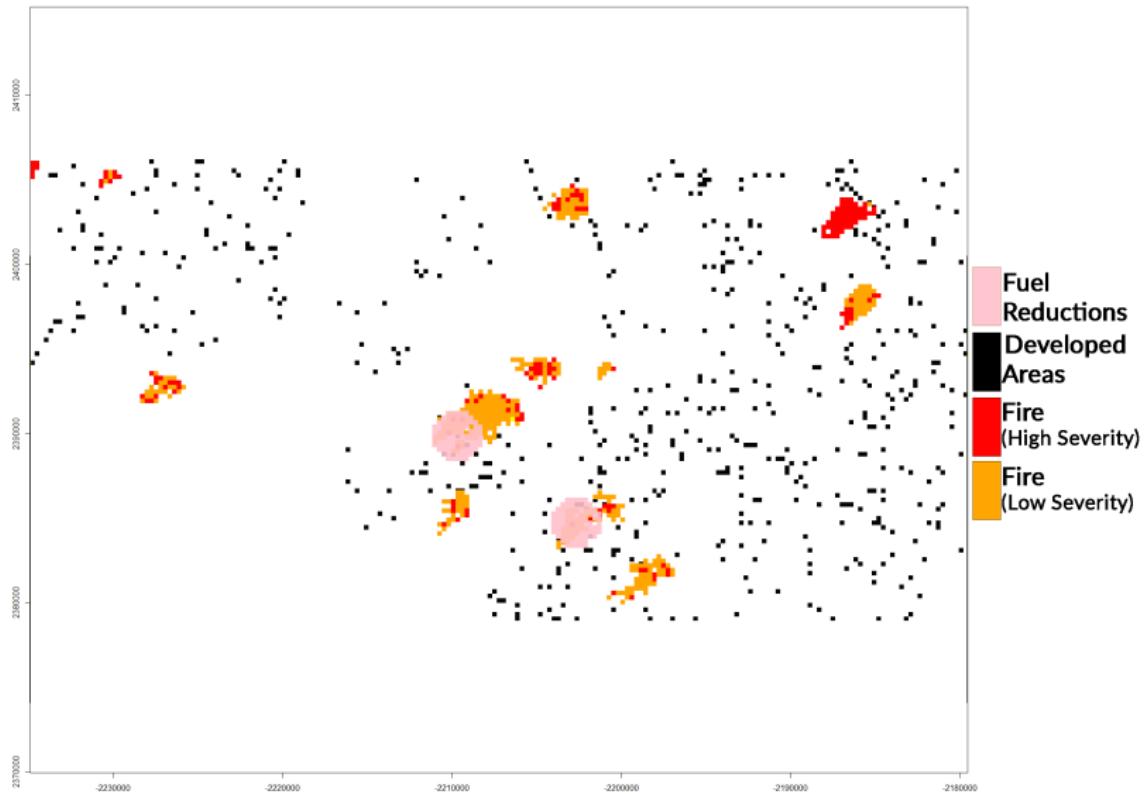


Data from USGS Land Cover Data Viewer

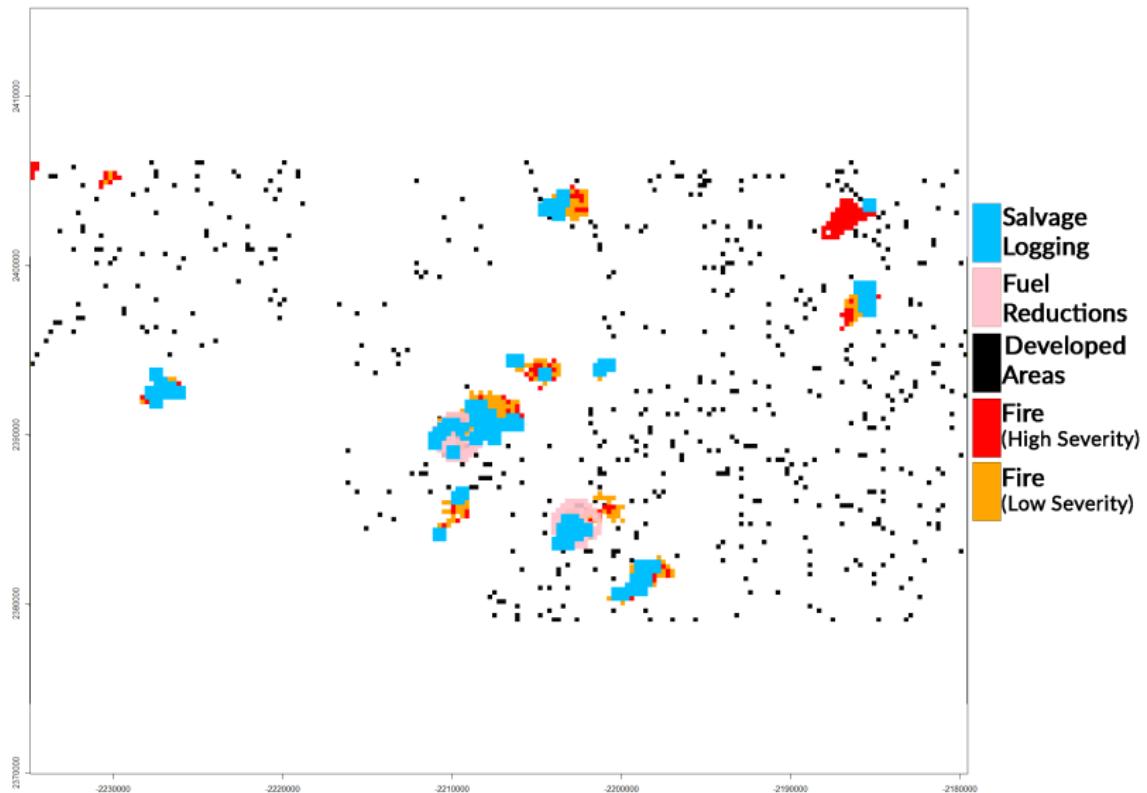
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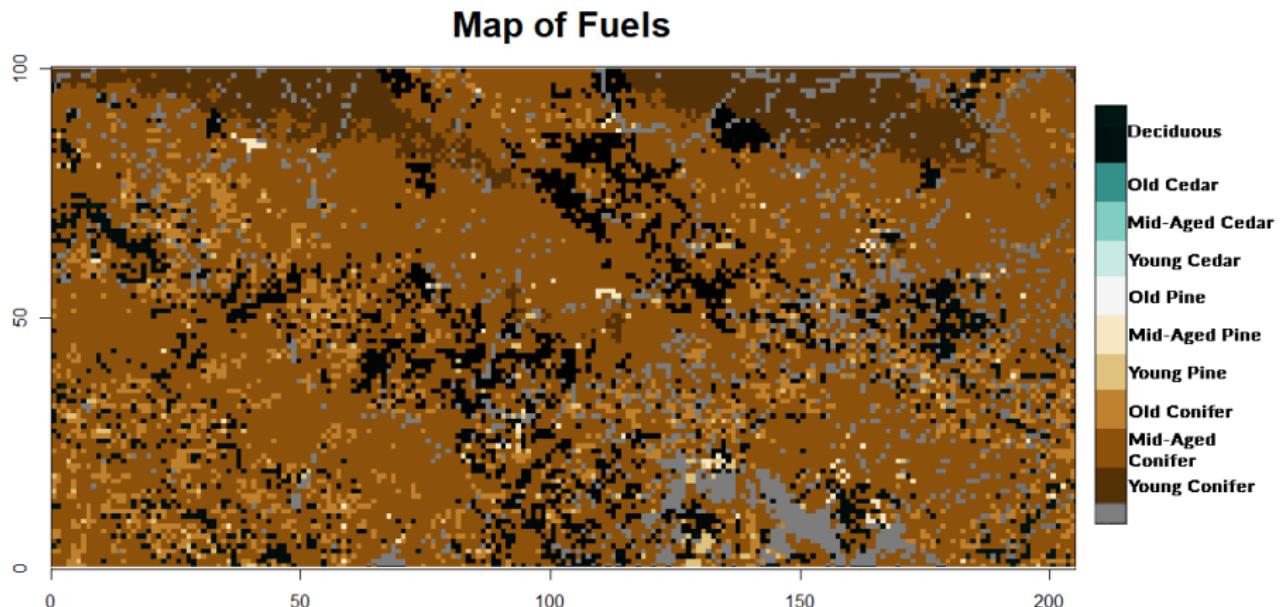
Reactive Actions: Cutting in Response to Fire

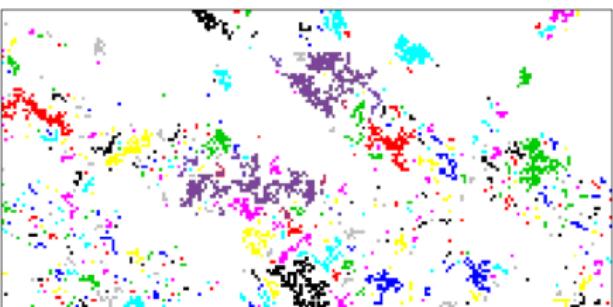
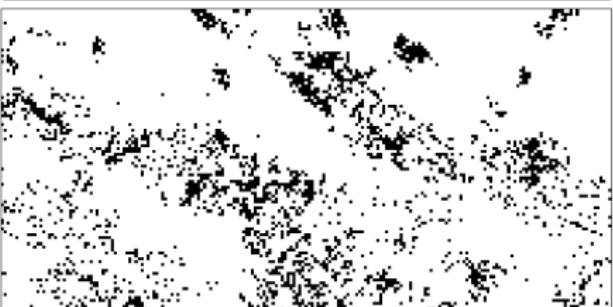
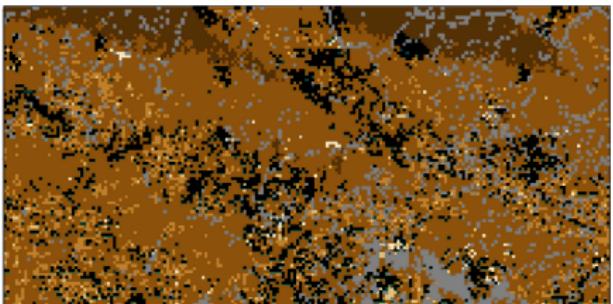


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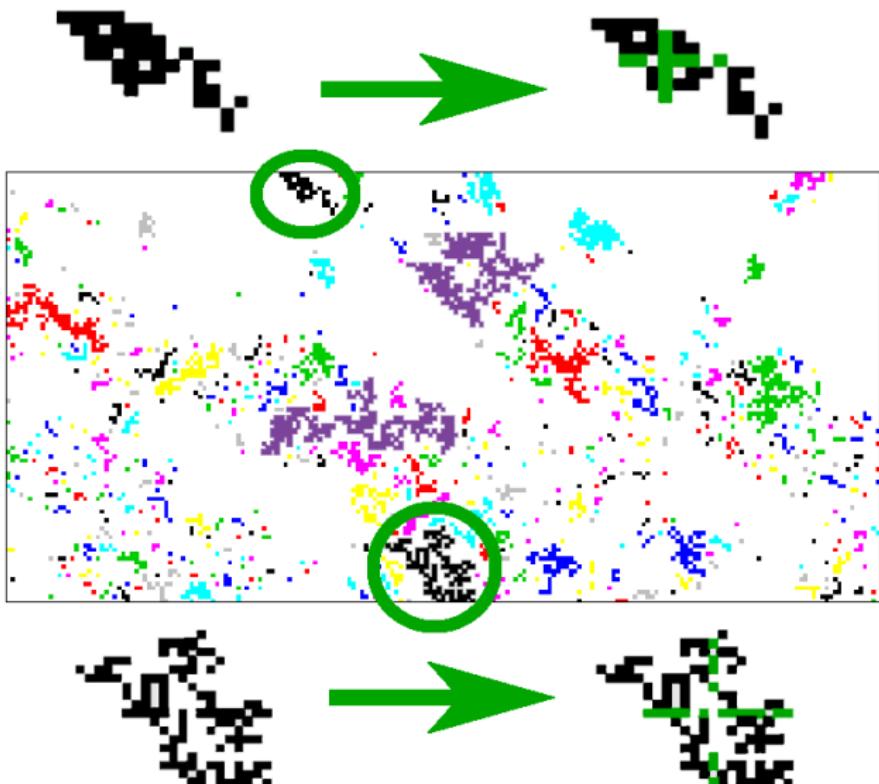


Proactive Actions: Reducing Connected Fuels



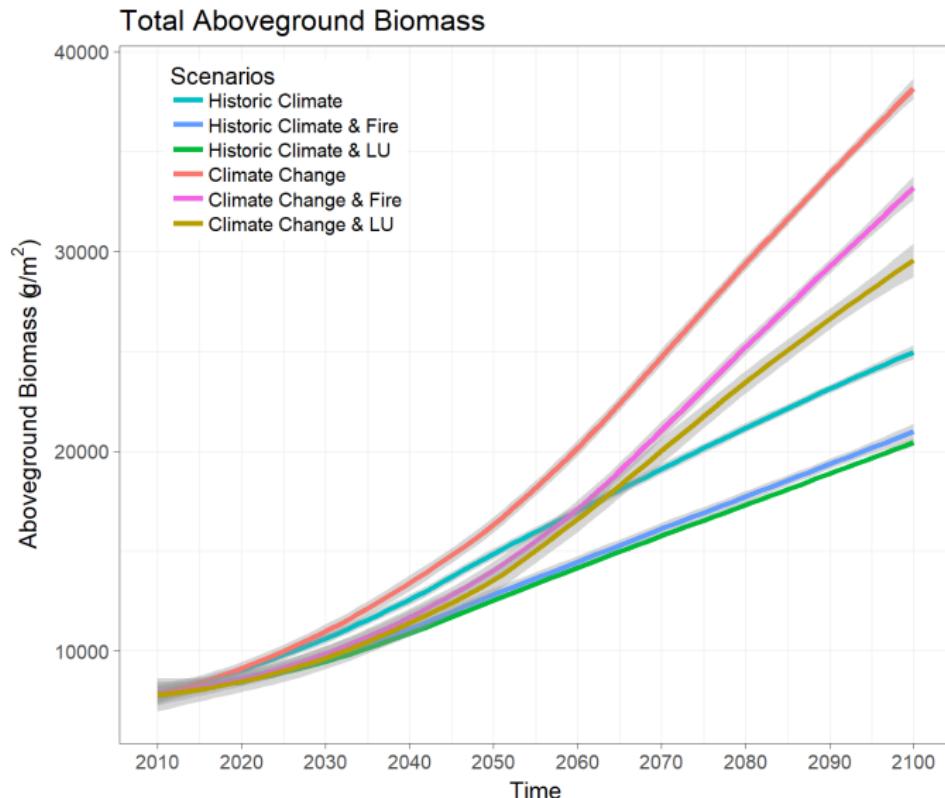


Breaking up Connected Fuels

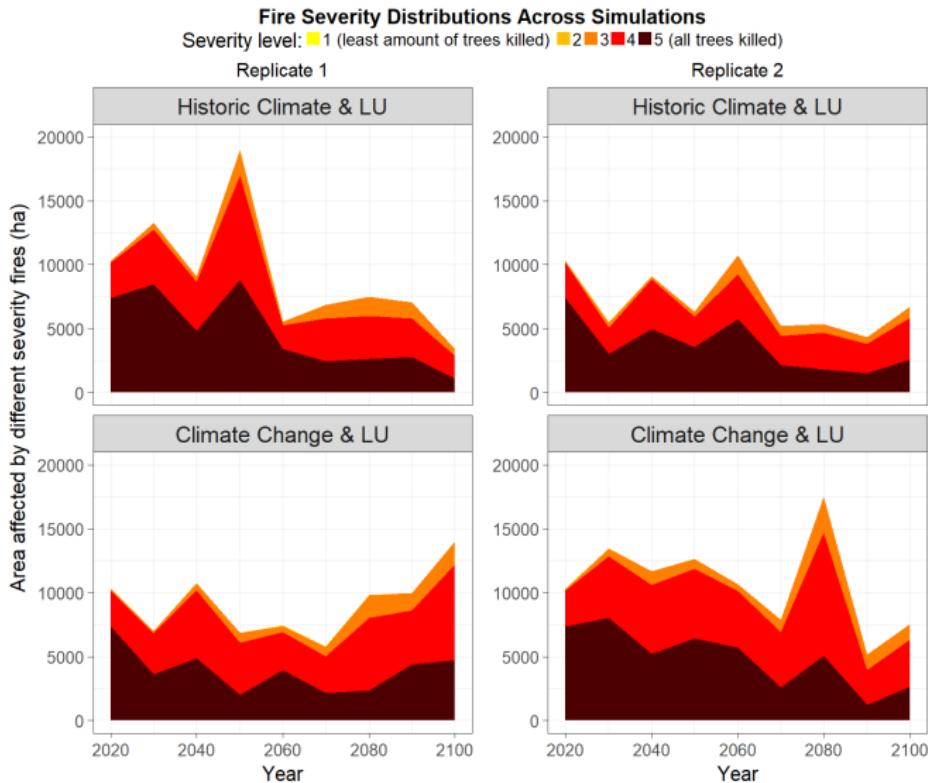


Putting the Pieces Together in a GIF

Total Aboveground Biomass



The Need for Replicates



Questions?