

Understanding the hydrologic impacts of wildfire management strategies using MIKE SHE



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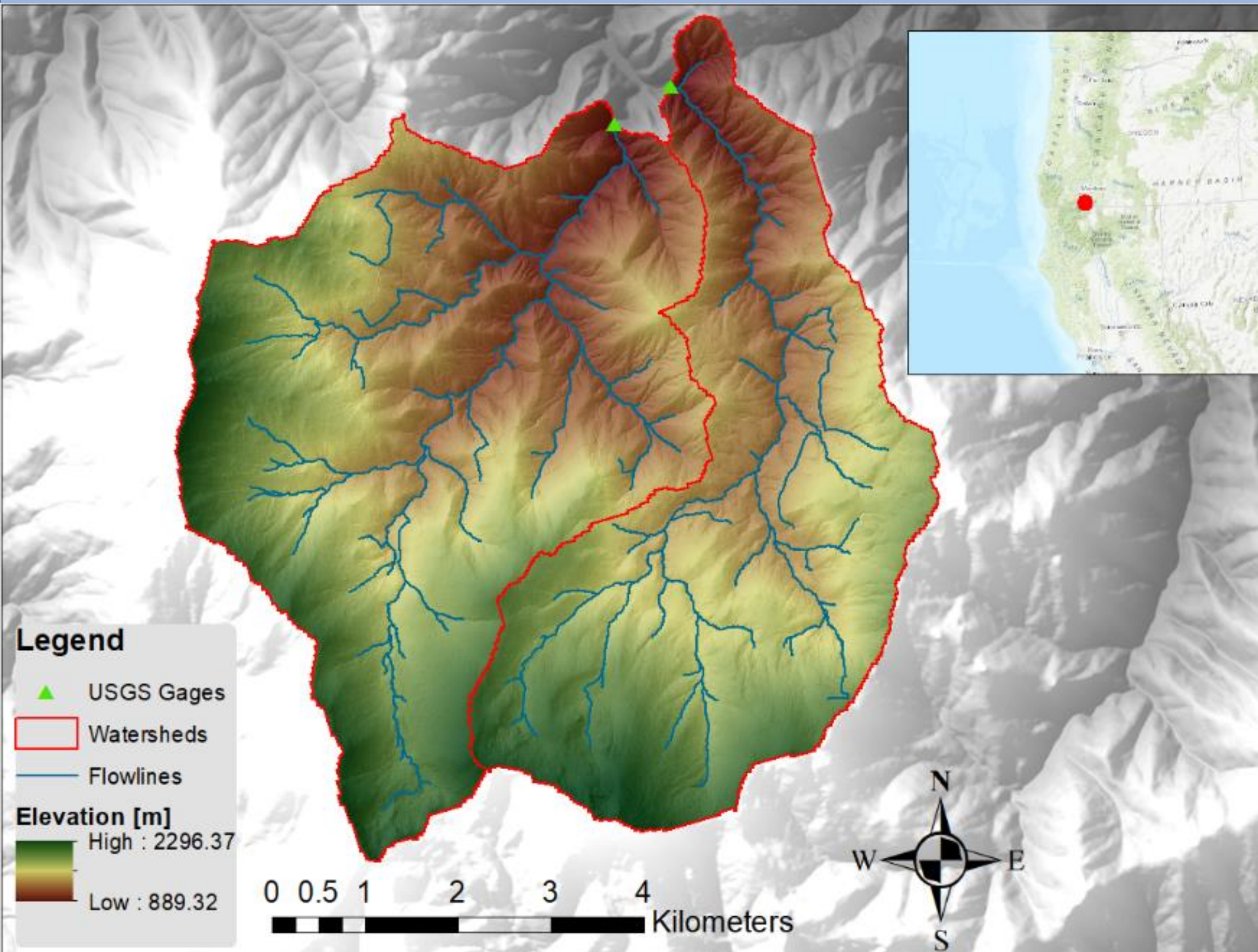


MOTIVATION:

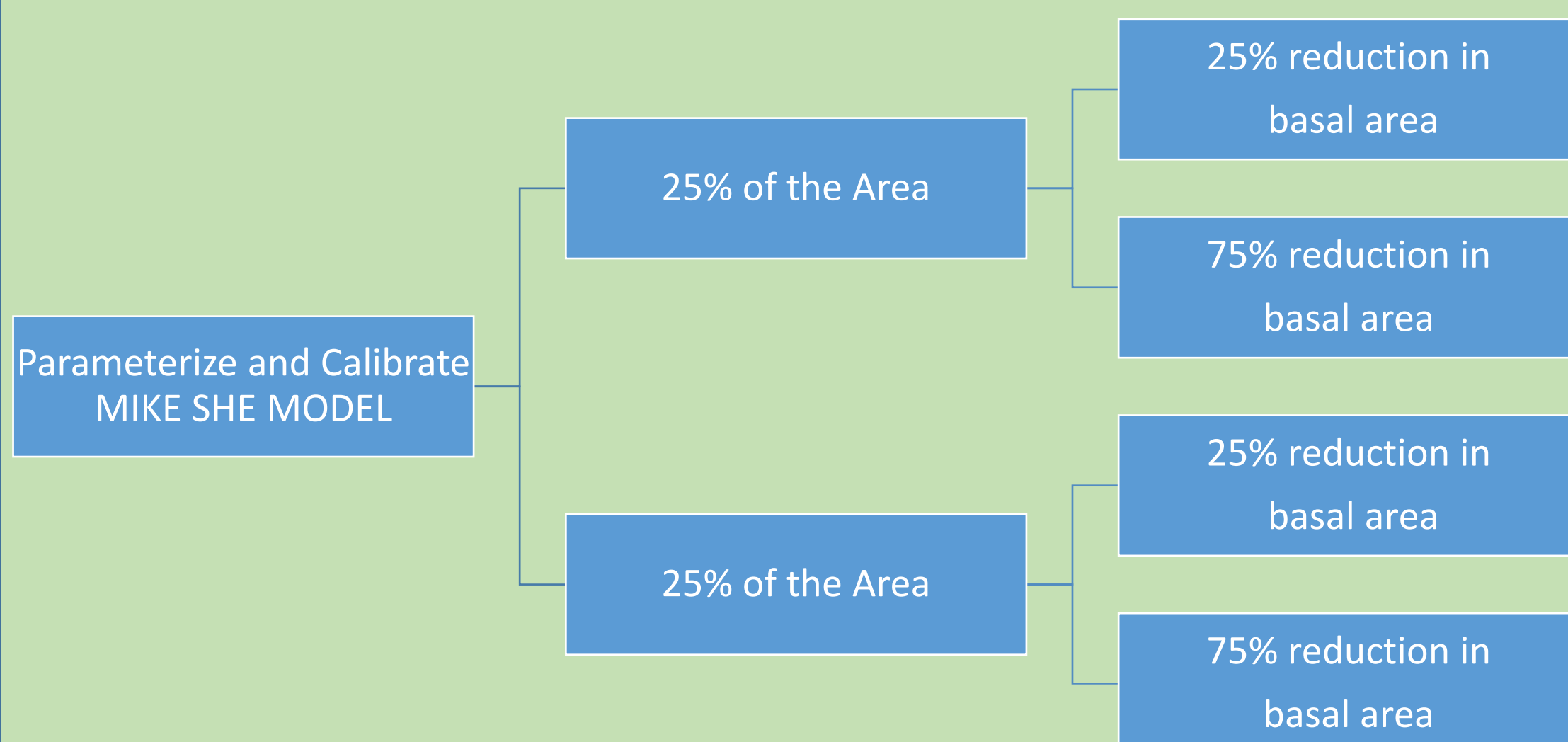
- Snowpack and surface water resources are declining across the Western United States while forest fire frequency and intensity are increasing.
- Forest fires have been well documented to show an increase in surface water yield.
- Is it possible that reductions in forest fire risk through forest management also increase water yield?
- What intensities and scope lead to an increase?

STUDY AREA:

- The Ashland watershed consists of two basins, the West (27 km²) and East (21 km²) seen below.
- These two basins have a mixed precipitation regime and supply drinking water to the roughly 21 thousand people of the city of Ashland.



METHODS:



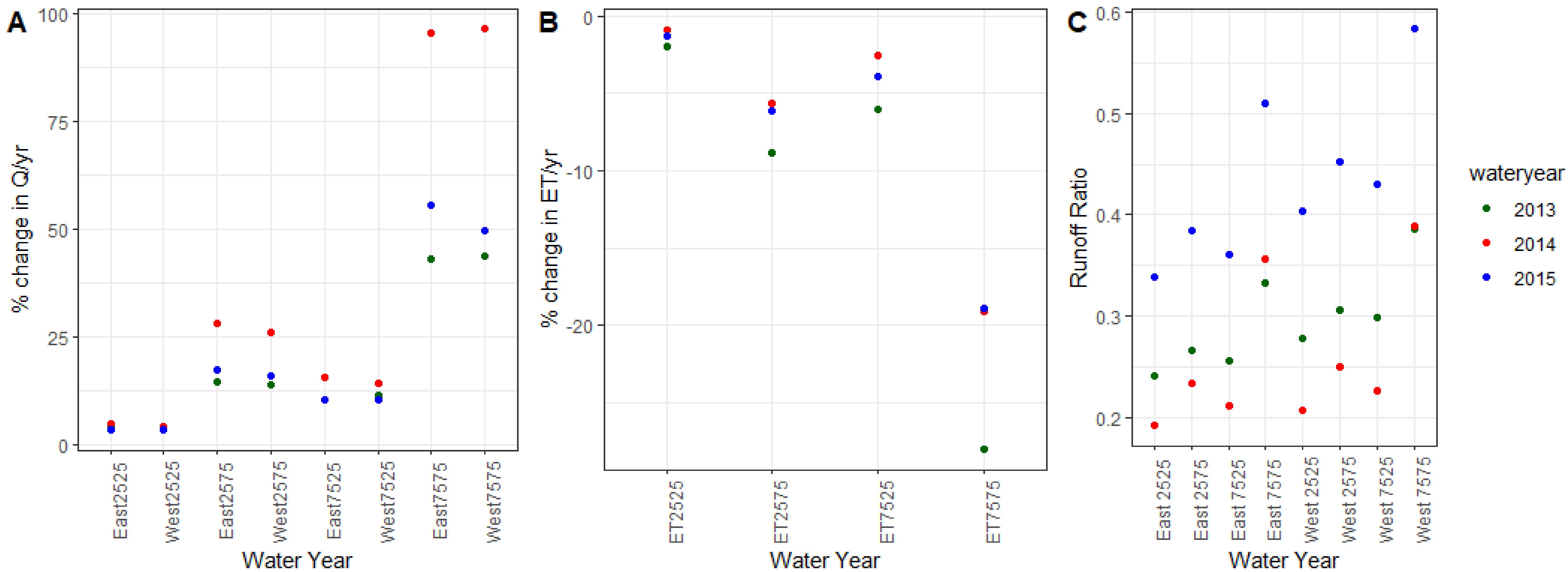
Conclusions:

- All scenarios except the lightest led to significant decreases in evapotranspiration (ET) and subsequent increase in annual discharge.
- Scenario 2 (25% of the area treated with a 75% reduction in BA) had significantly higher water yields than scenario 3 (75% of the area treated with a 25% reduction in BA), implying that intensity has a larger impact than scope.
- Land managers interested in increasing water yield with forest treatments should take this into consideration during planning.

Intensity of treatments has a larger impact than scope on the hydrologic response

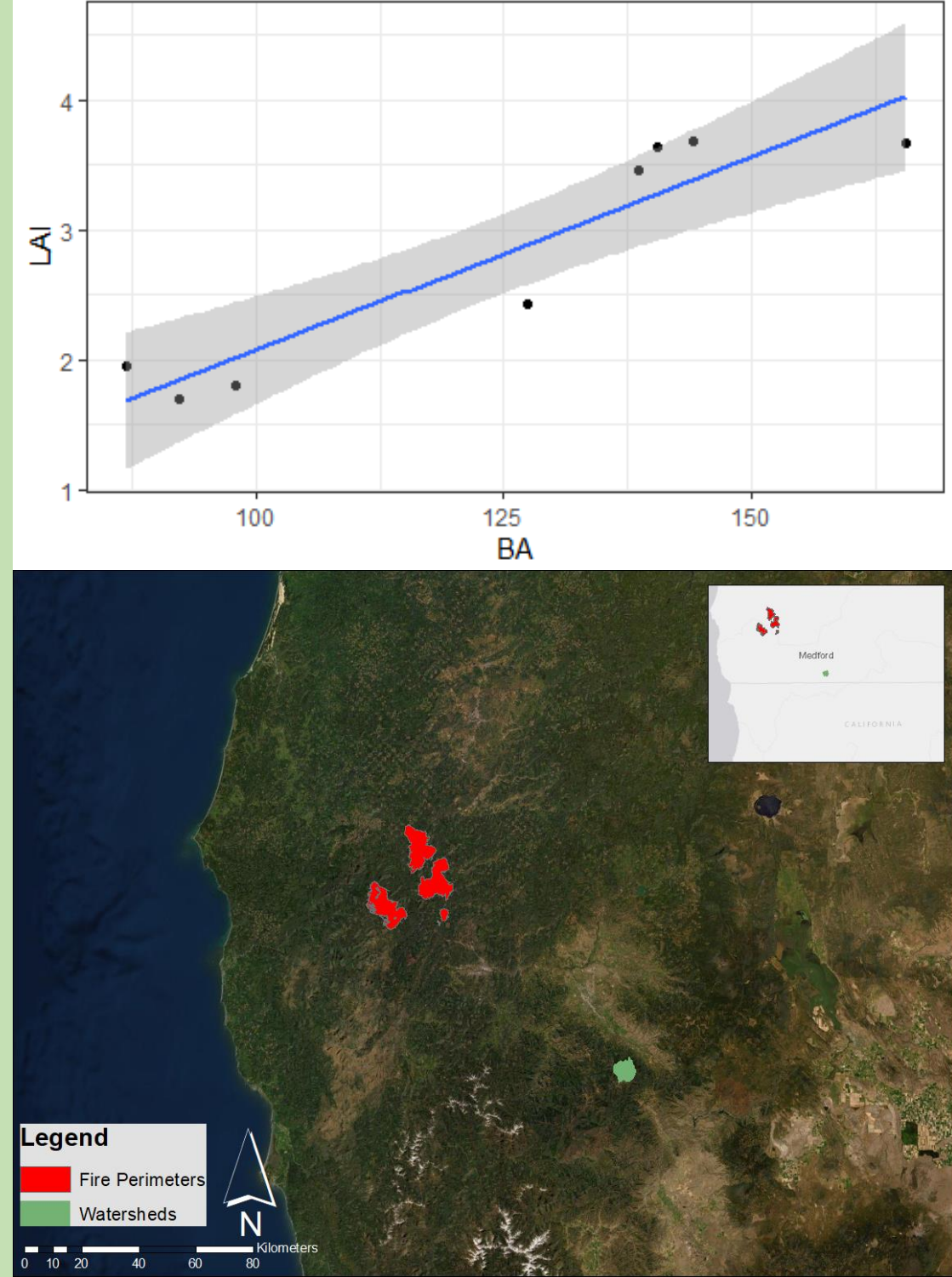


Photo: Sean Bagshaw



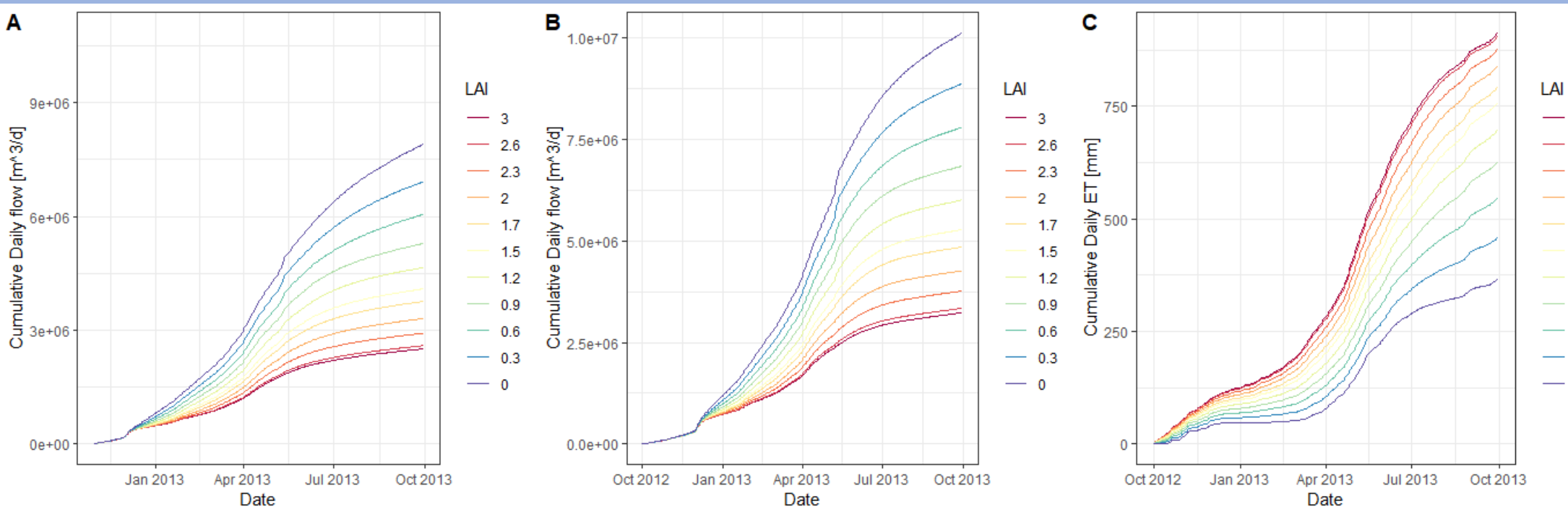
Model outputs from MIKE SHE: Figure A shows the percent change in total annual water yield from the control. Figure B shows the percent change in total annual ET from the control. Figure C shows the runoff ratios for the four different simulations. 2525 refers to 25% of the area treated with a 25% reduction in BA. 2575 refers to 25% of the area being treated with a 75% reduction in BA. Points are then color coded by water year, with 2013 being an average water year (green), 2014 being a drought year (red), and 2015 being an above average water year (blue).

Results

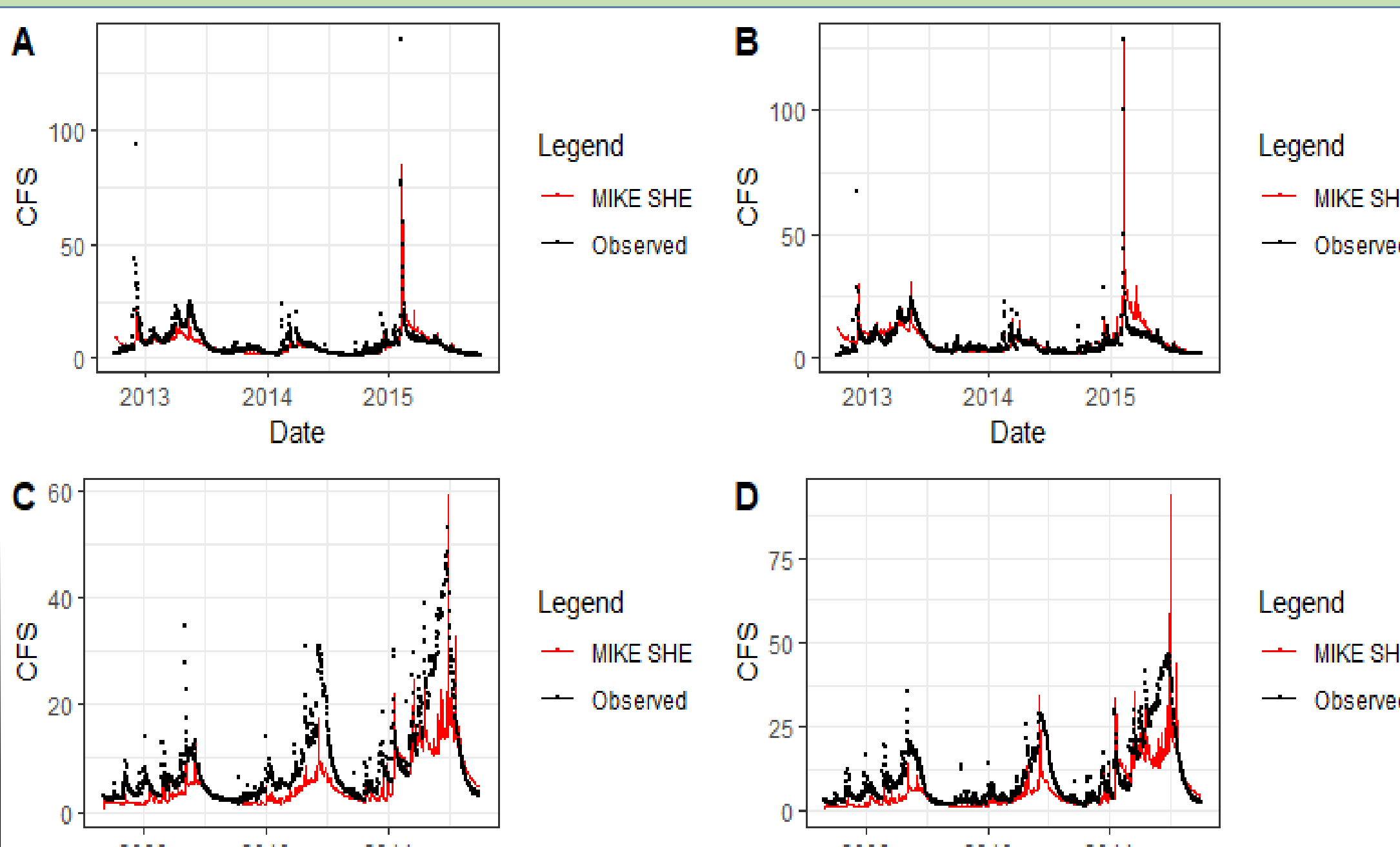


MIKE SHE uses leaf area index (LAI) to represent forest structure where foresters use basal area (BA). We compared BA and LAI at four regional wildfires, pre and post disturbance to create this relationship. Although this represents a small sample n=8, we found a strong correlation ($r^2 = 0.87$, $p < 0.05$). A 25% reduction in BA = 29% LAI.

MIKE SHE sensitivity to LAI: Plot A shows the cumulative daily flow for the East basin with varying values of LAI. Plot B shows the cumulative daily flow for the West basin with varying values of LAI. Plot C shows the cumulative daily ET for both basins with varying values of LAI. As LAI decreases flow increases and ET decreases.



Calibration and validation: Figure A is the calibration comparison for the East basin. Figure B is the calibration comparison for the West basin. Figure C is the validation comparison for the East basin, and Figure D is the validation comparison for the West basin.



	Calibration		Validation	
	East	West	East	West
NSE	0.58	0.52	0.59	0.47
Correlation	0.79	0.72	0.81	0.79
RMSE	0.15	0.14	0.2	0.2
PBIAS	-13.5	17.4	-42.9	-37.5

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