How will climate change affect fire regimes in the western US?

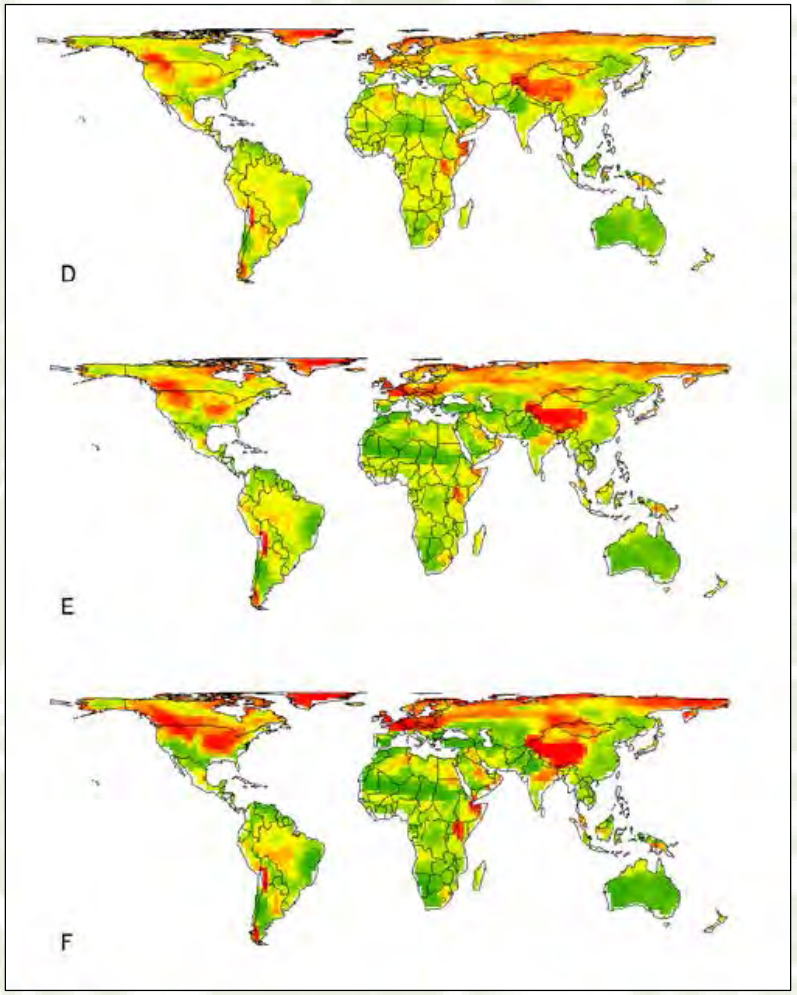
FFACCTS
September 2, 2016

Sean Parks

Aldo Leopold Wilderness Research Institute
Rocky Mountain Research Station
US Forest Service

Background

- Fire regime characteristics are expected to change as the climate warms



Krawchuk et al. (2009)

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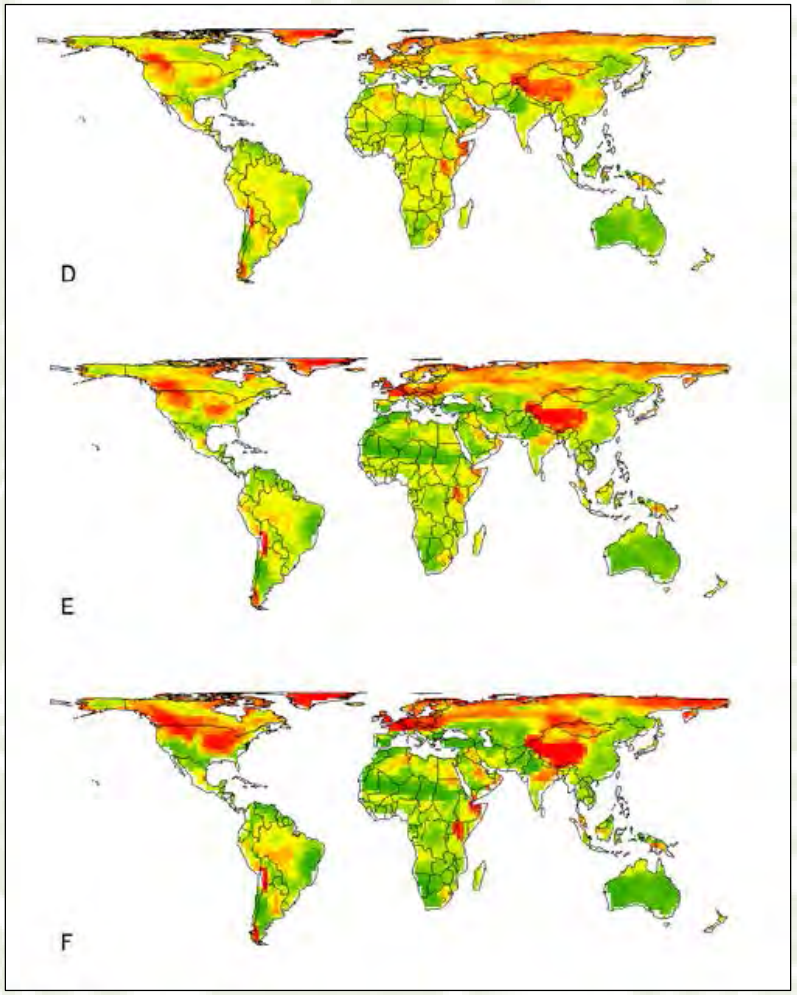
- Several studies have evaluated how fire activity will respond to climate change



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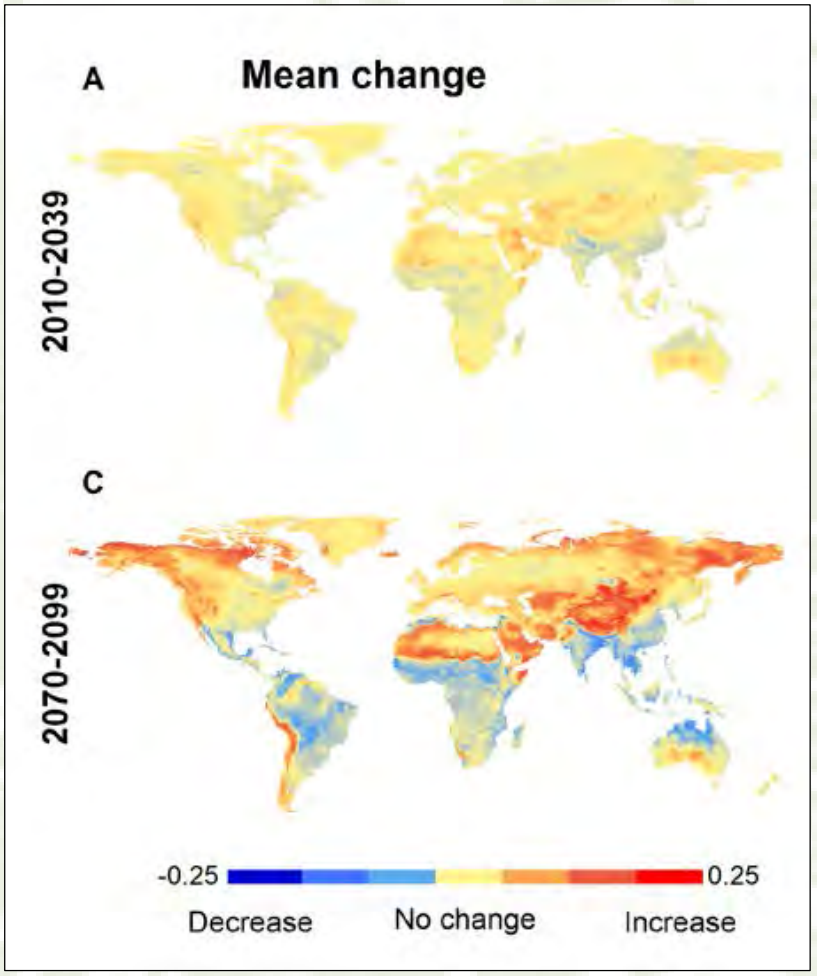

Moritz et al. (2012)

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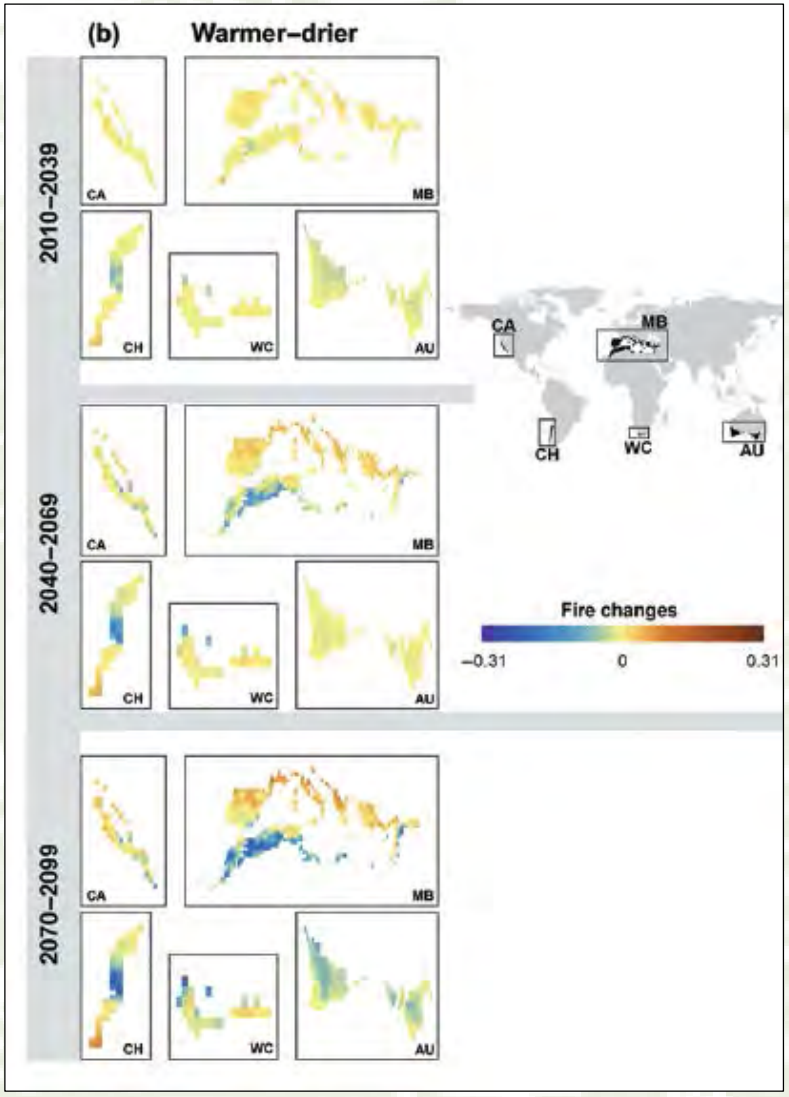

Batllori et al. (2013)

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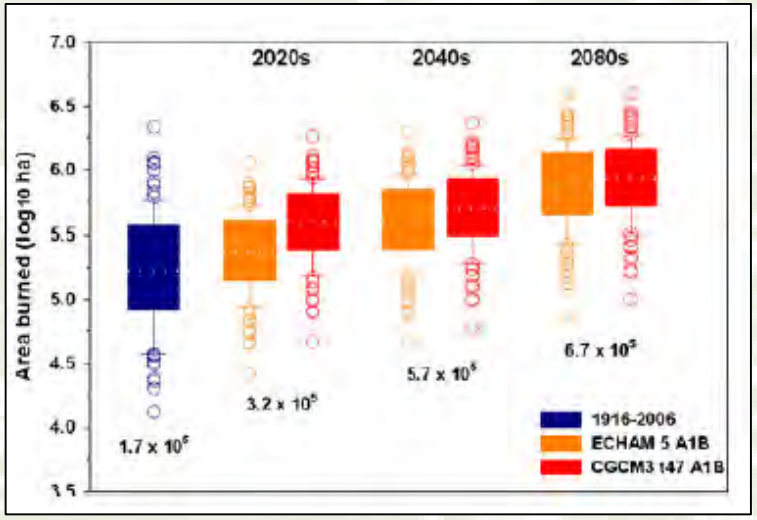
- Littell et al. 2010. Climatic Change.
- Westerling et al. 2011. PNAS.
- And others I'm sure.



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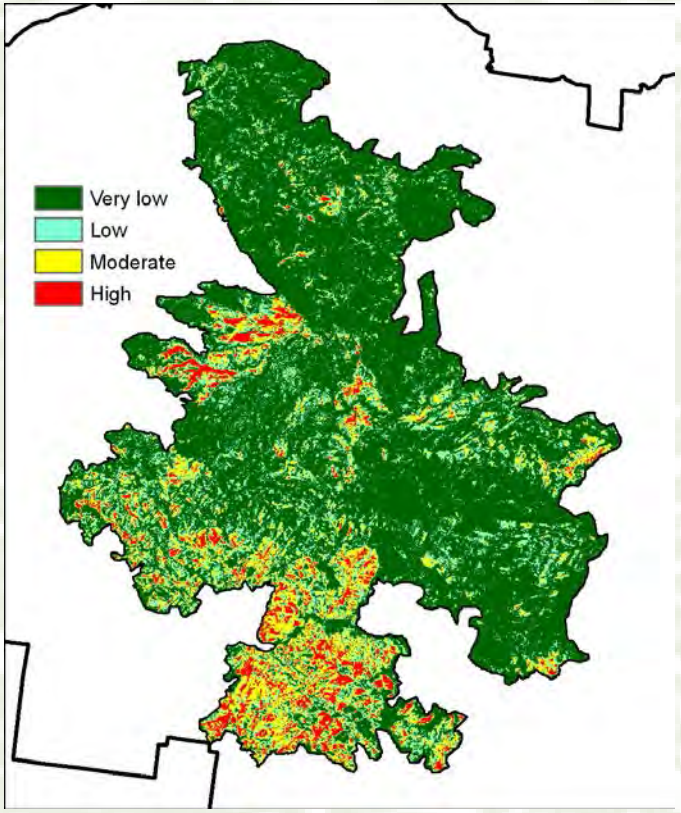
- Fire regimes have many characteristics!



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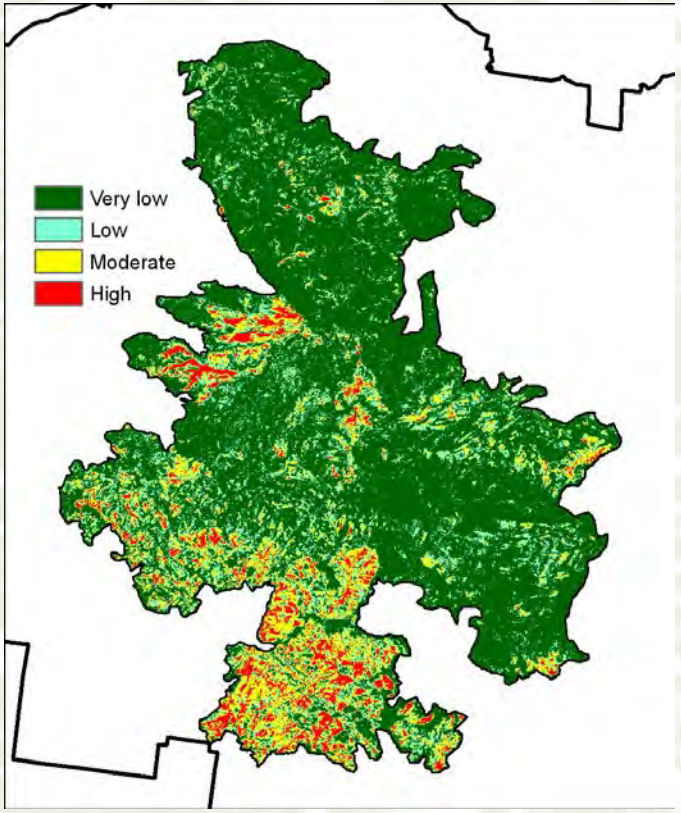
- Fire regimes have many characteristics!
  - Fire frequency (FRI)
  - Fire severity
  - Fire season (timing and length)
  - Fire size distribution
  - Spatial pattern (e.g. high severity patch size)



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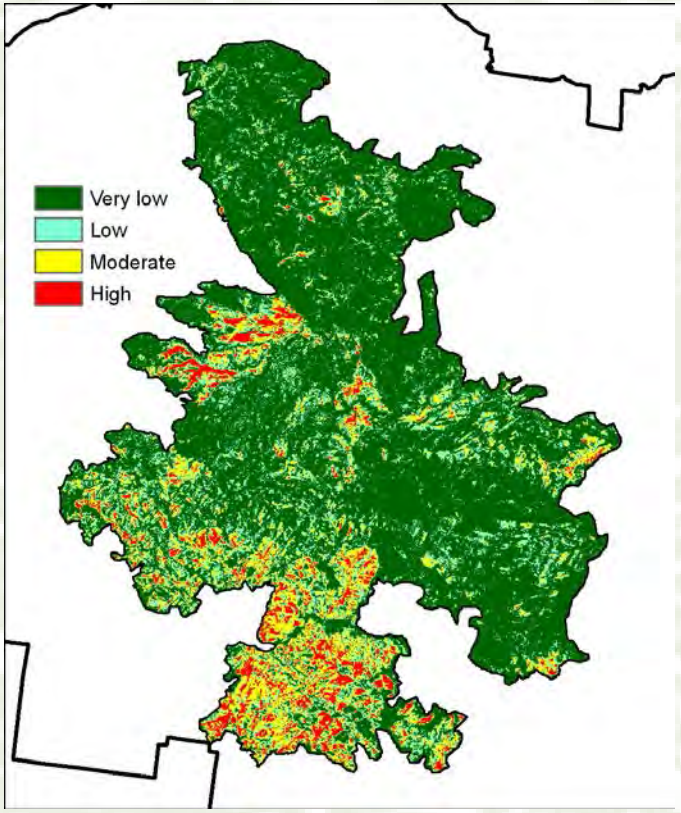

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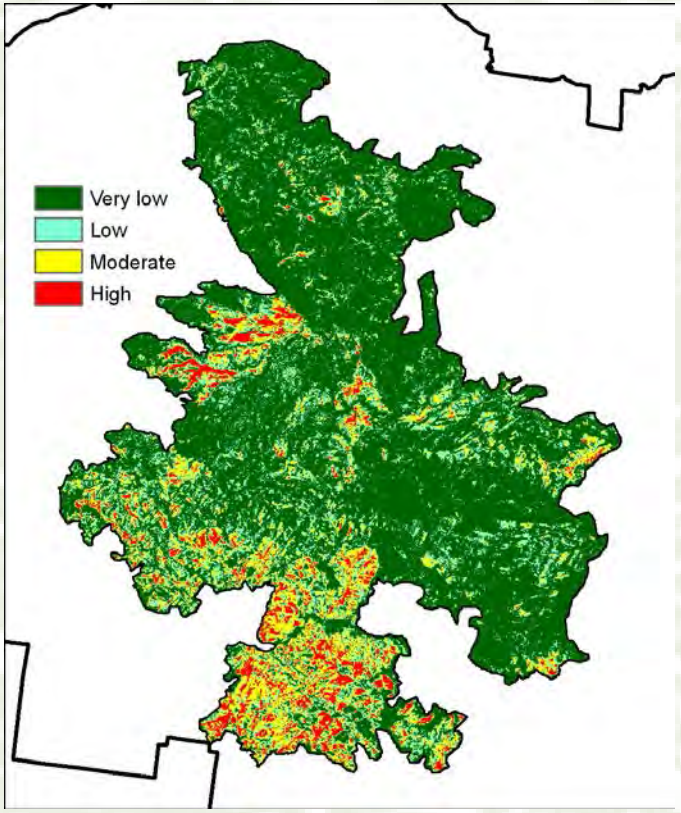

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  - Fire return interval (FRI)
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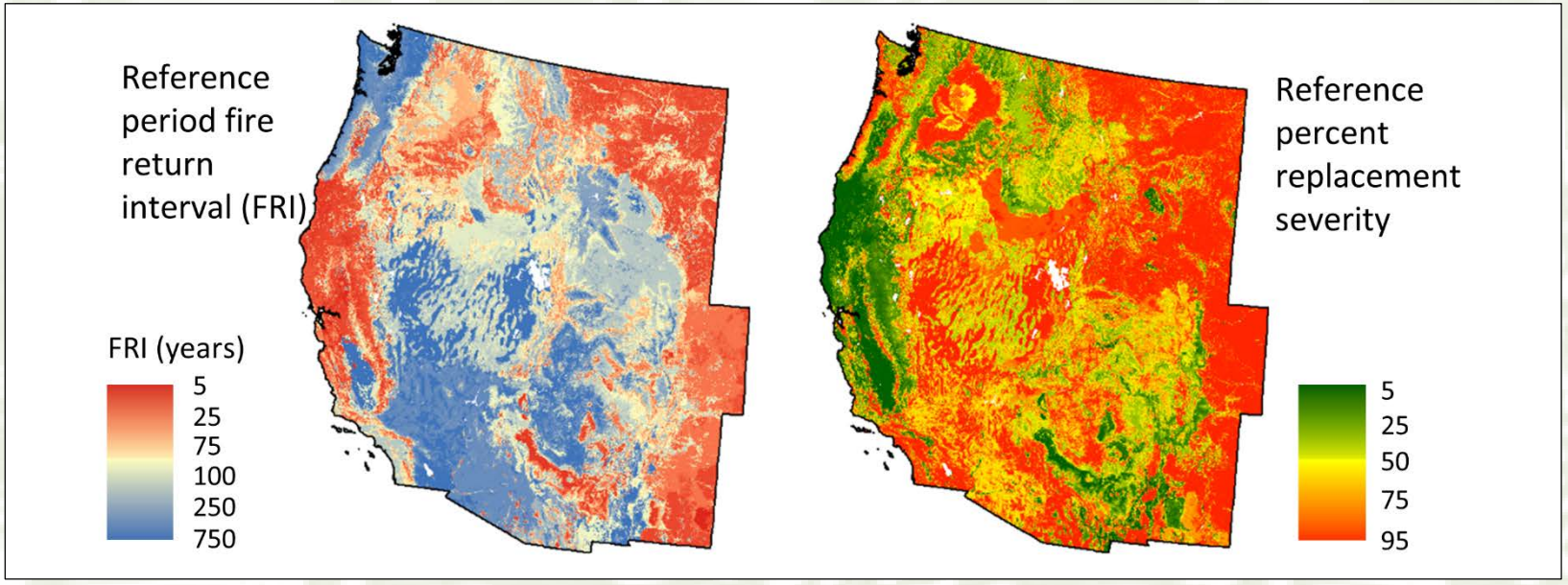
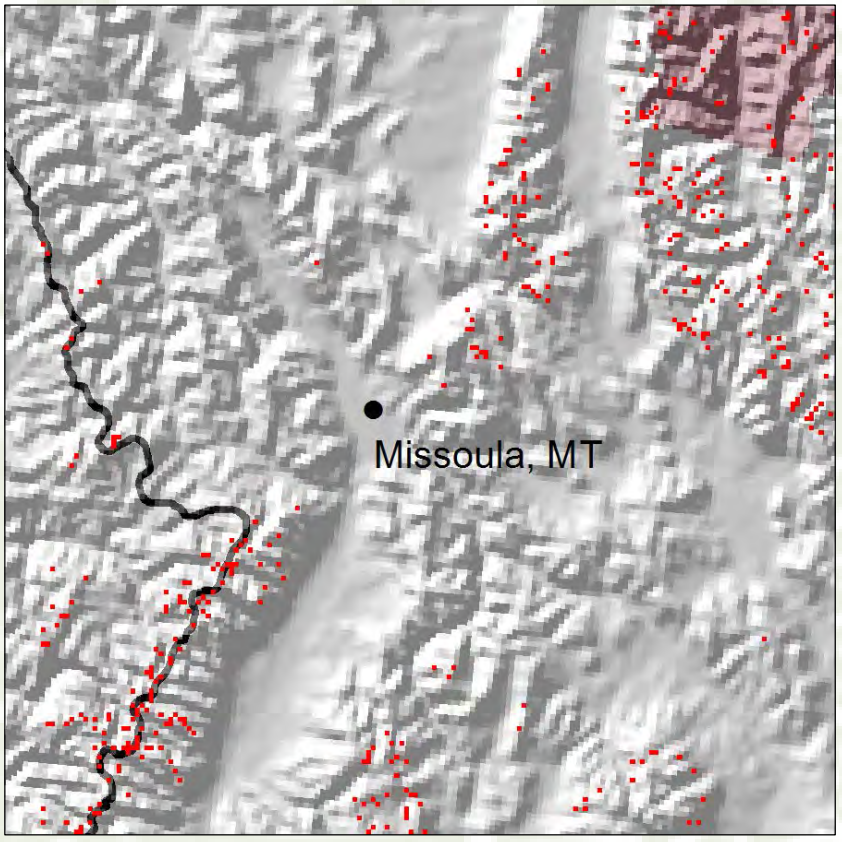


Source: Landfire

Climate analog

Definition:

Pixels having similar climatic characteristics in one time period to a given pixel of interest (in another time period).



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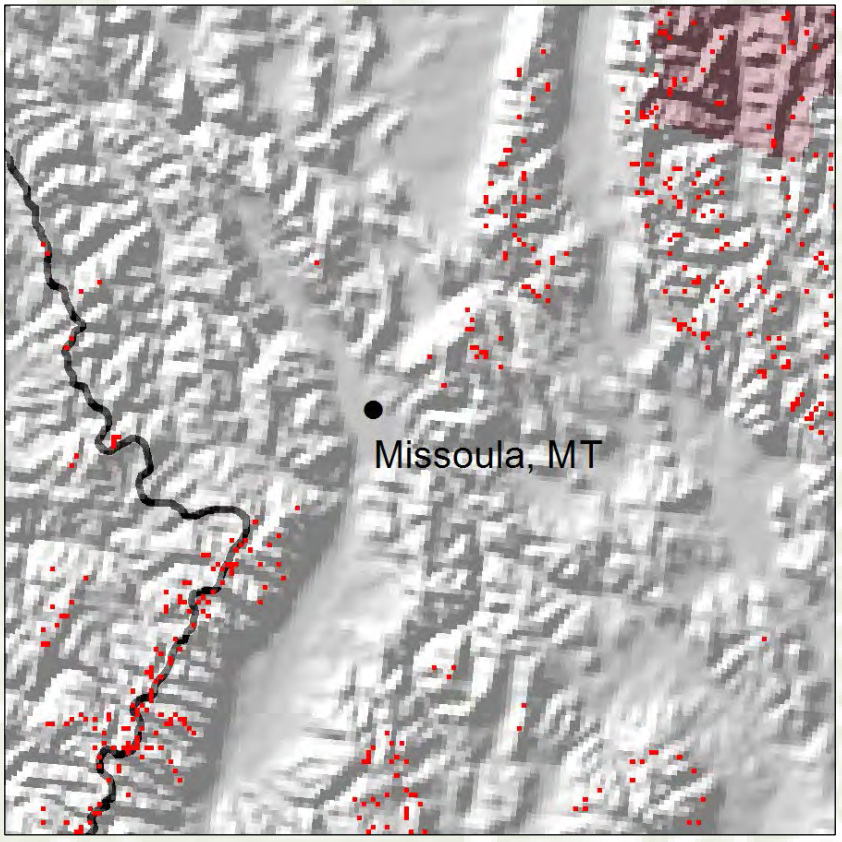
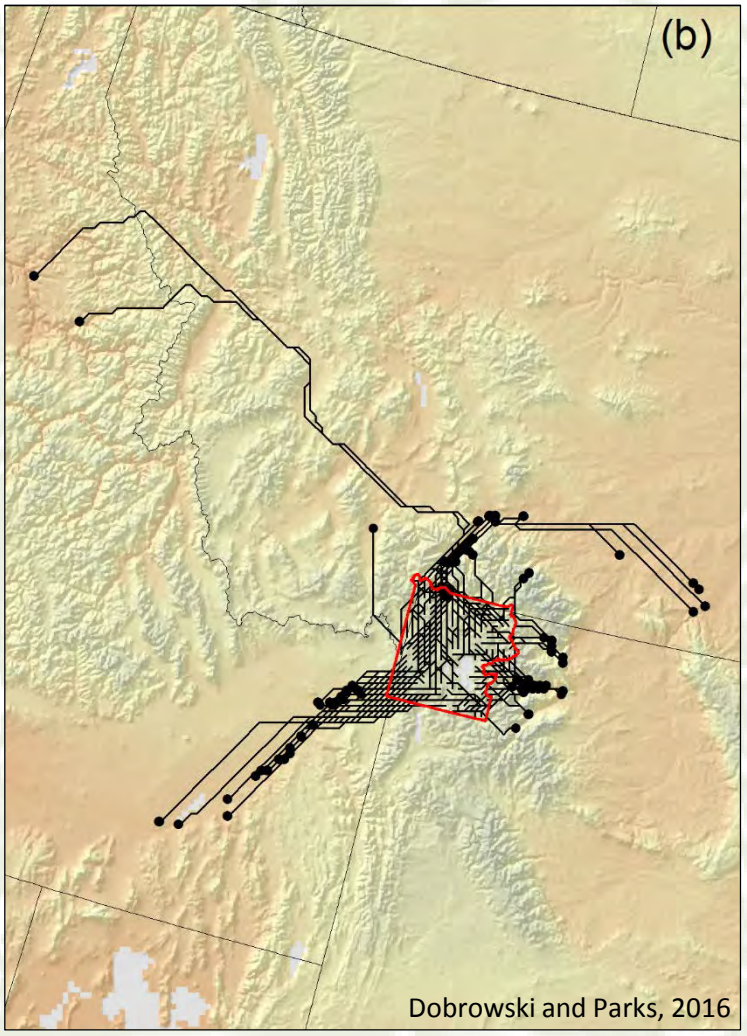


- Reference period mean annual temperature: 7.5 °C (Missoula, MT)
- Red pixels show locations where mean annual temperature = 7.5 °C in 2085

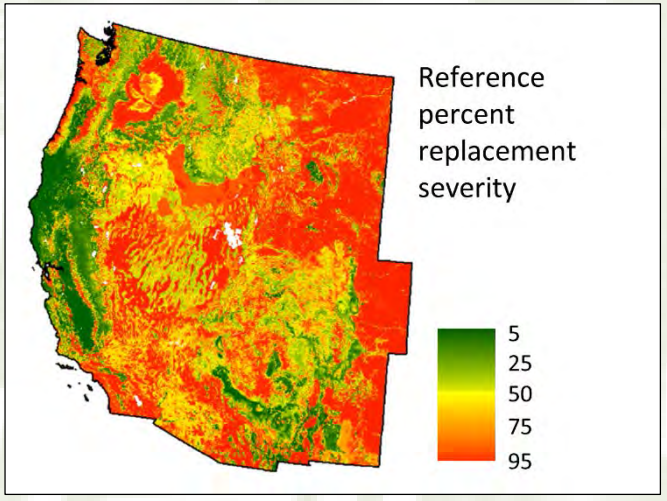
Climate analog

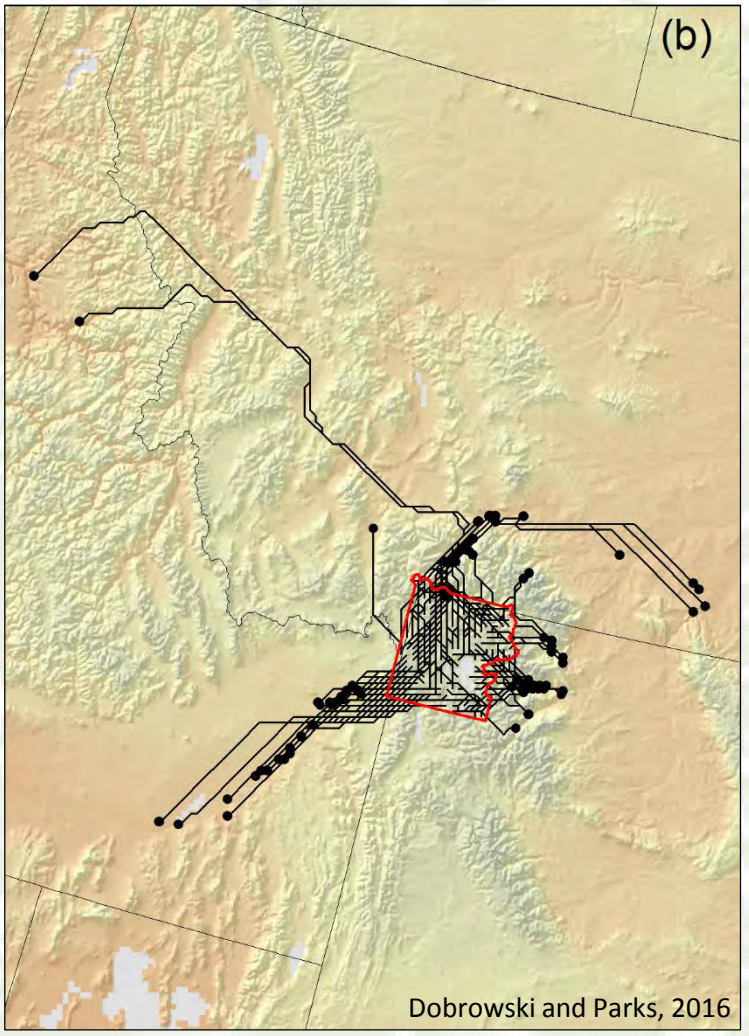
- What can we learn from climate analogs?



Climate analog

- What can we learn from climate analogs?
- Can we learn something about changing fire regimes?
- Fire regime analog?



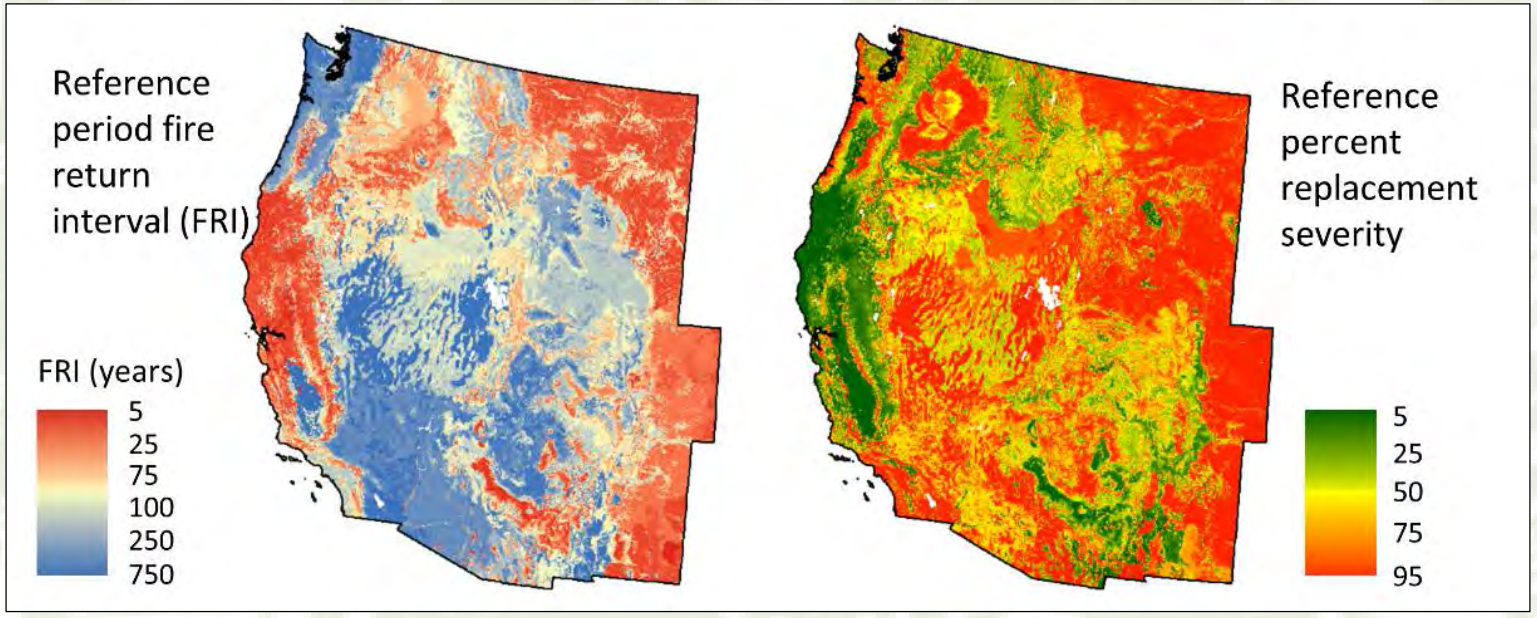


Fire regime analog

- Two fire regime characteristics
  - Fire return interval (FRI)
  - Percent replacement severity (PRS)

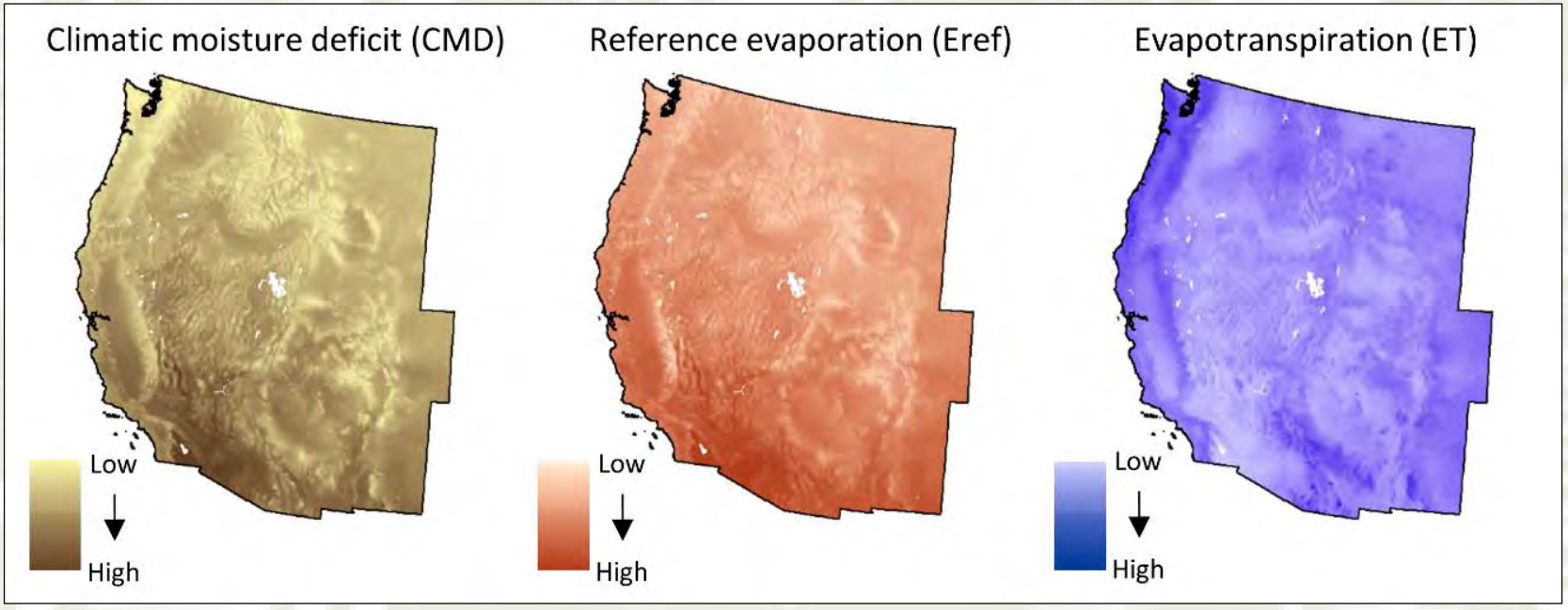
Resampled to 1km resolution to match climate data

Source: LANDFIRE



Fire regime analog

- Three climate variables (resolution = 1 km)
  - Climatic moisture deficit (CMD)
  - Reference evaporation (Eref)
  - Evapotranspiration (ET)



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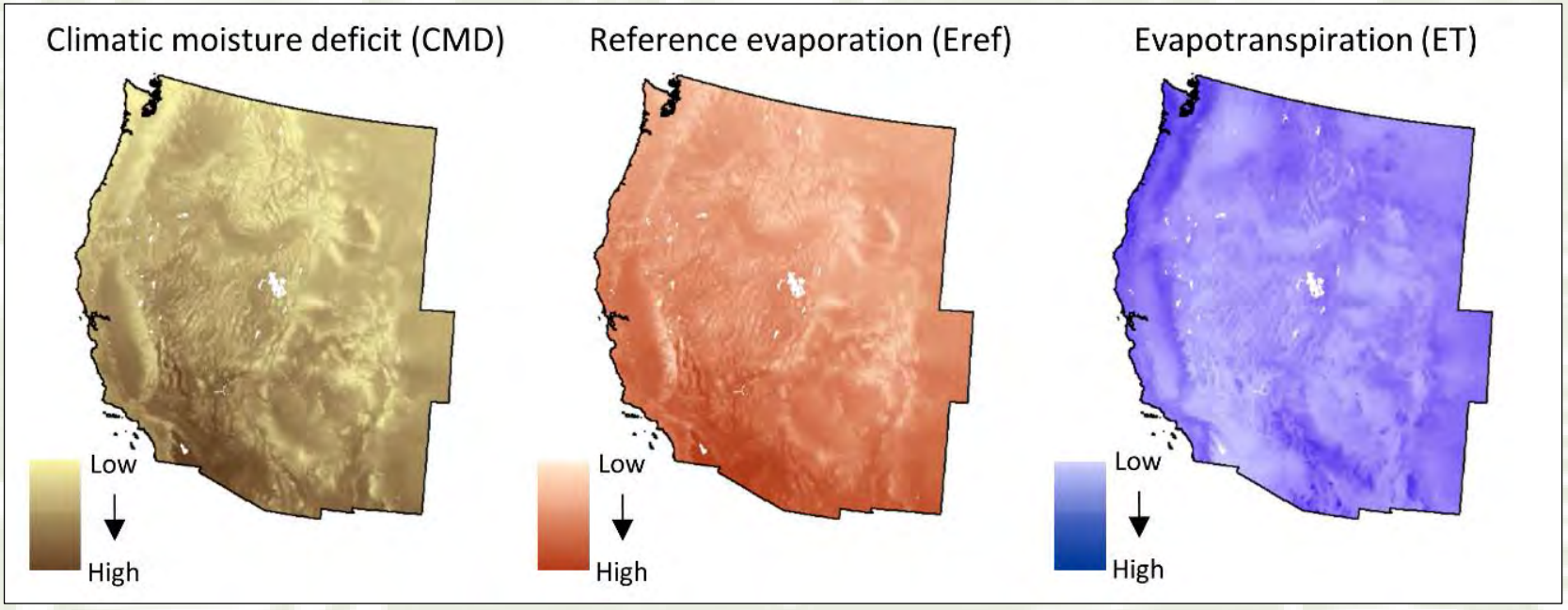
All related to temperature and precipitation (amount and timing)



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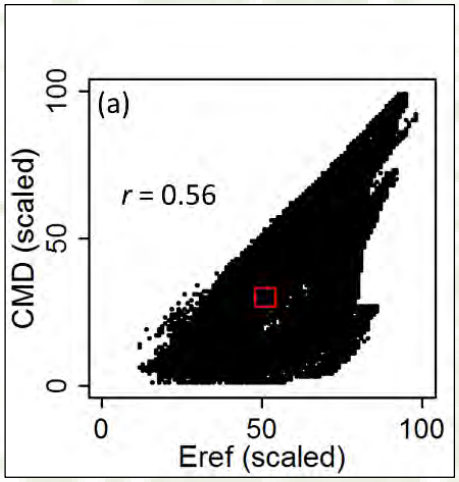

- Bivariate combinations used to identify climate analogs

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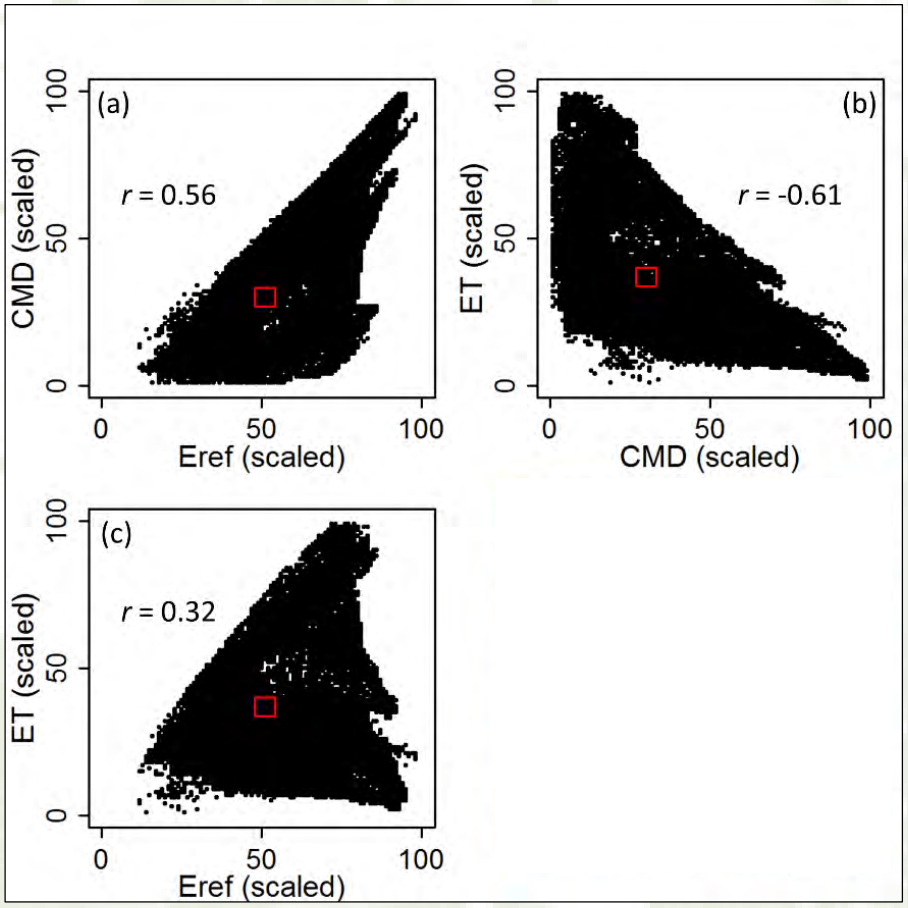

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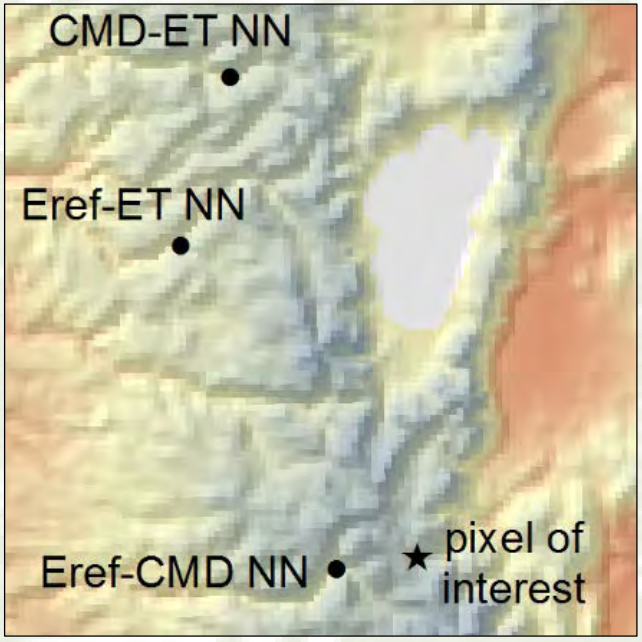

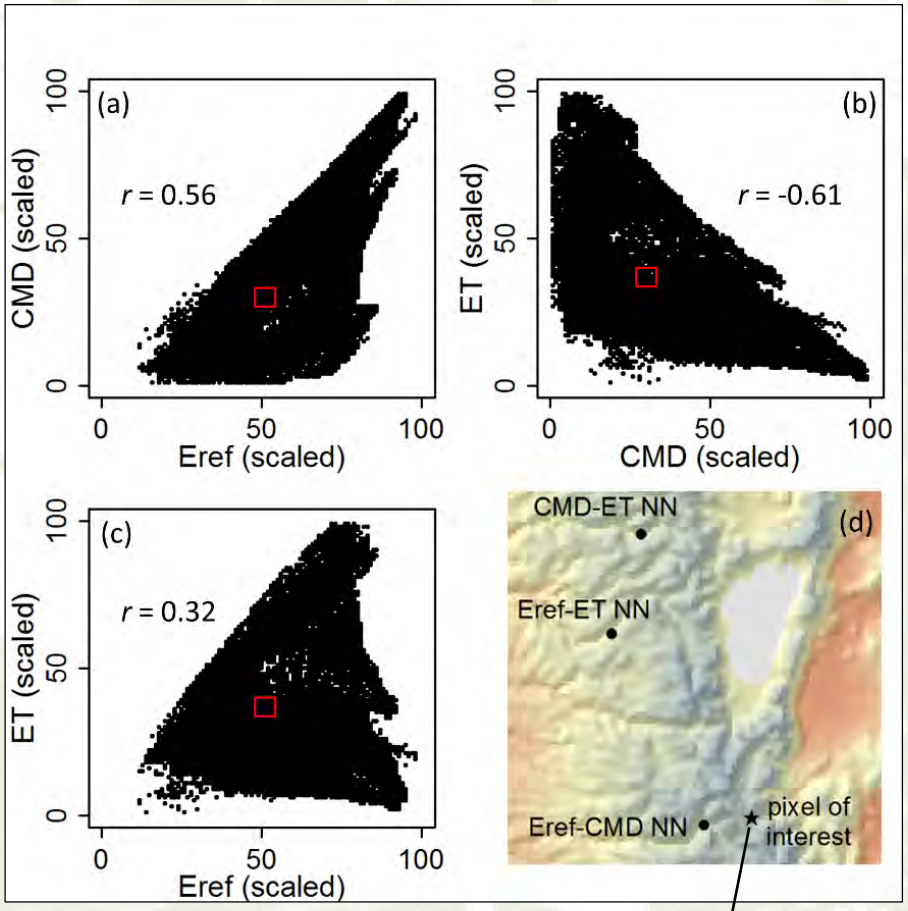

Future climate values

CMD=30
Eref = 51
ET=37

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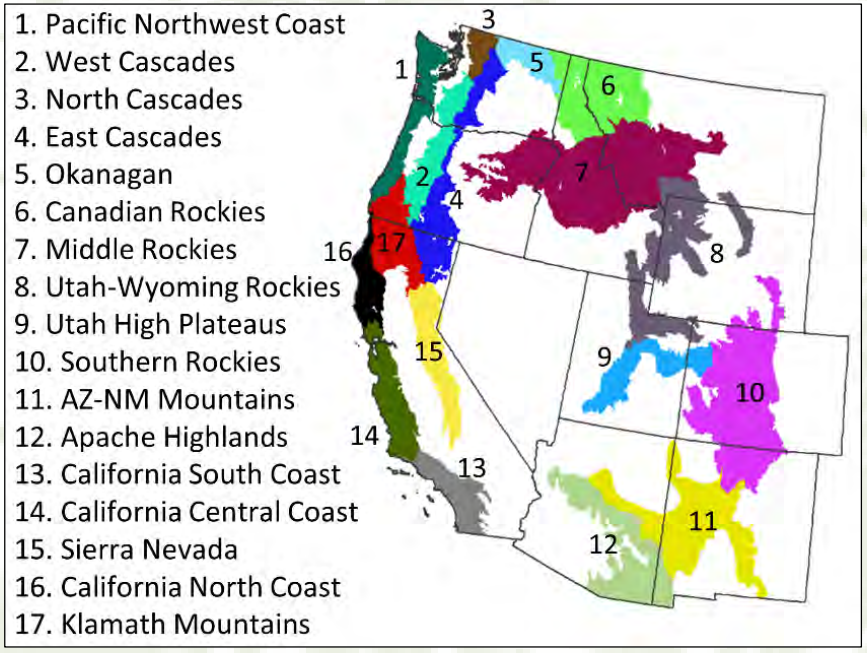
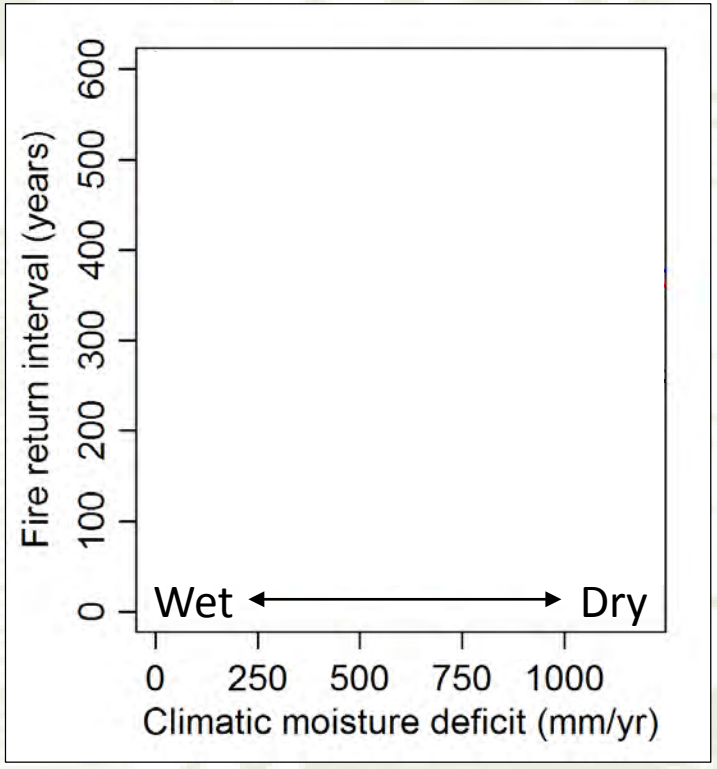
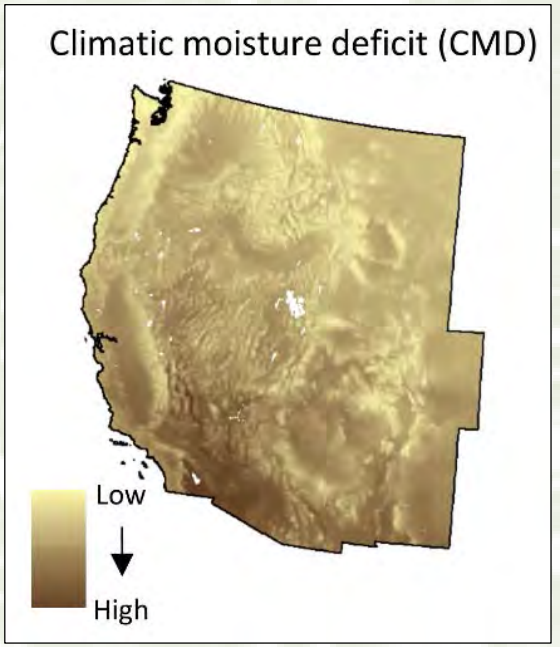


Predicted changes to fire regimes

Data from all mountainous ecoregions





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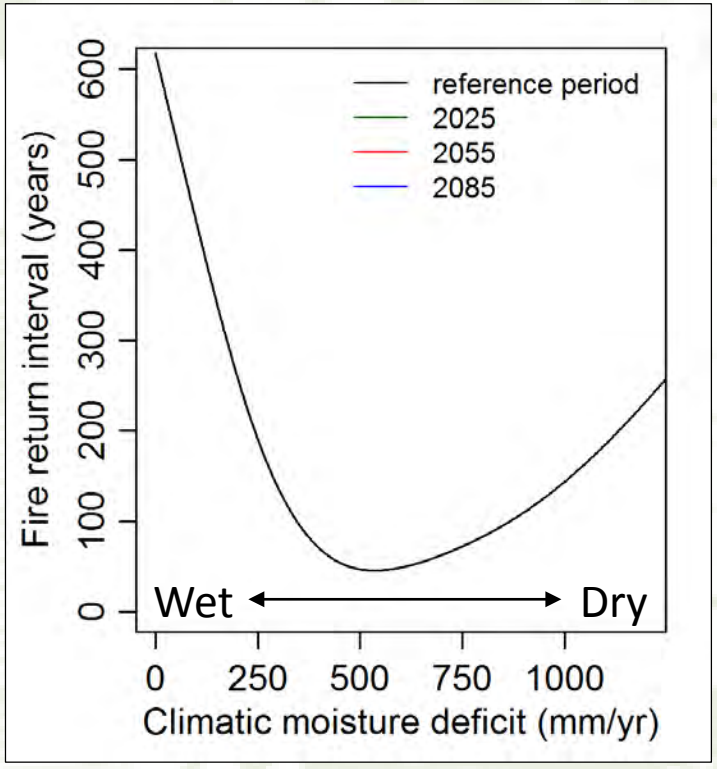

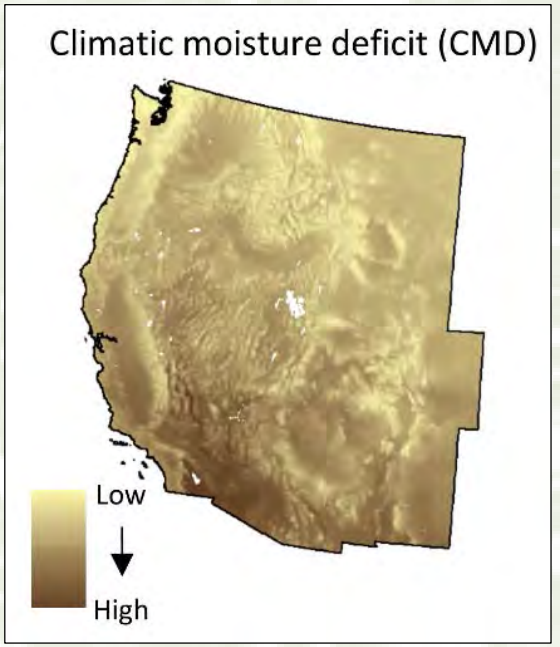

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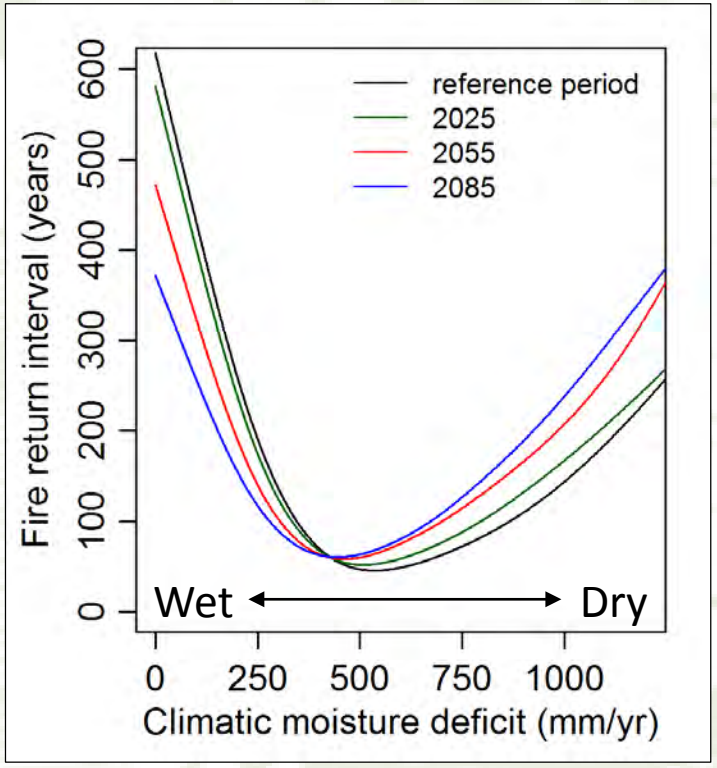

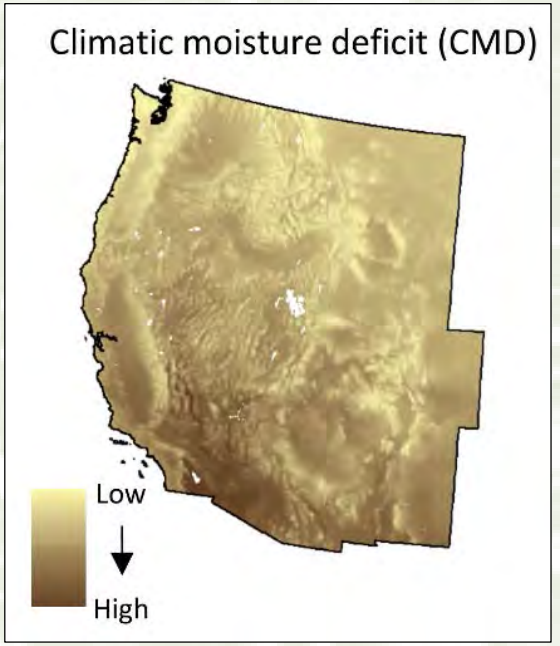

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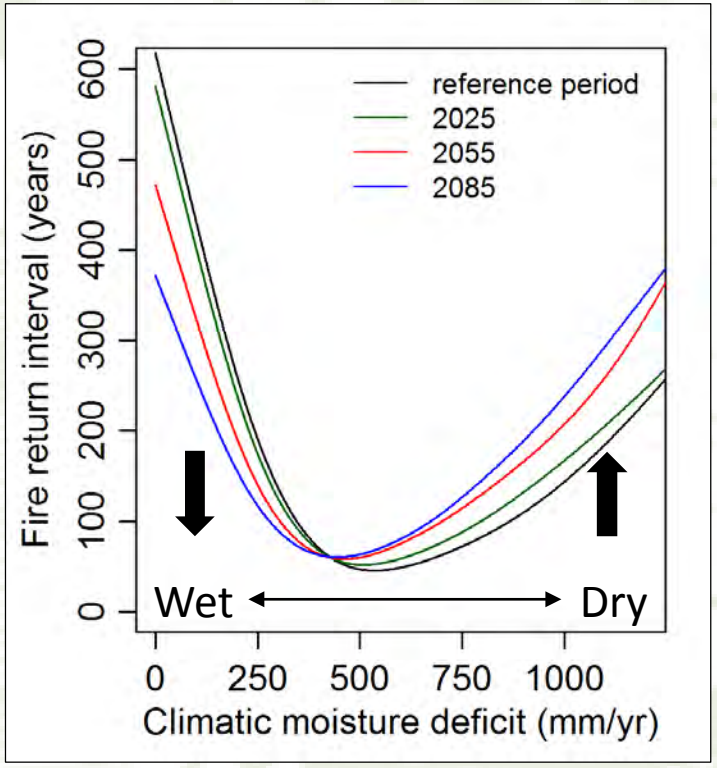

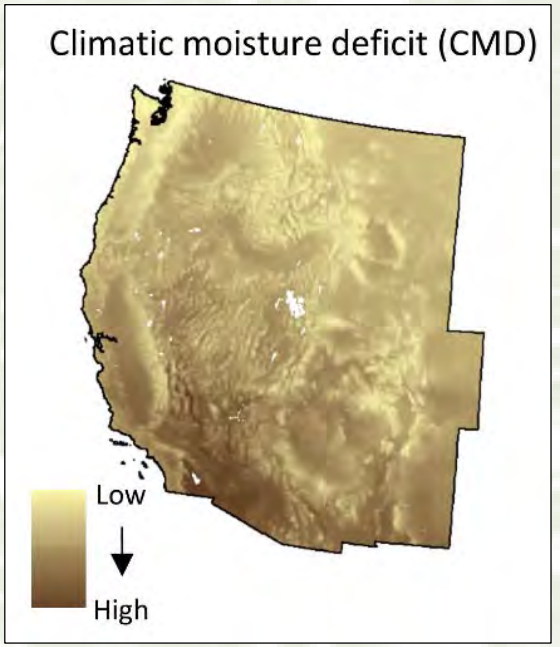

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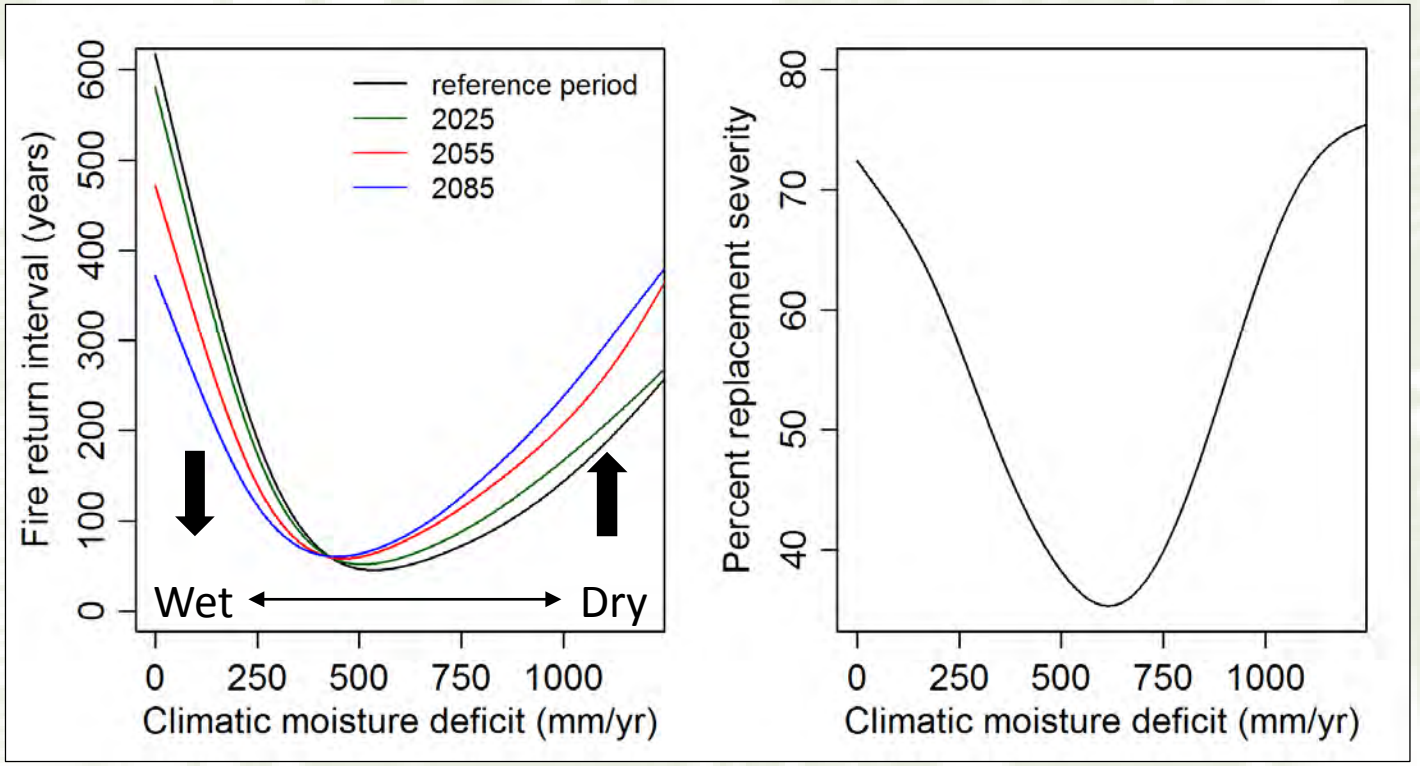

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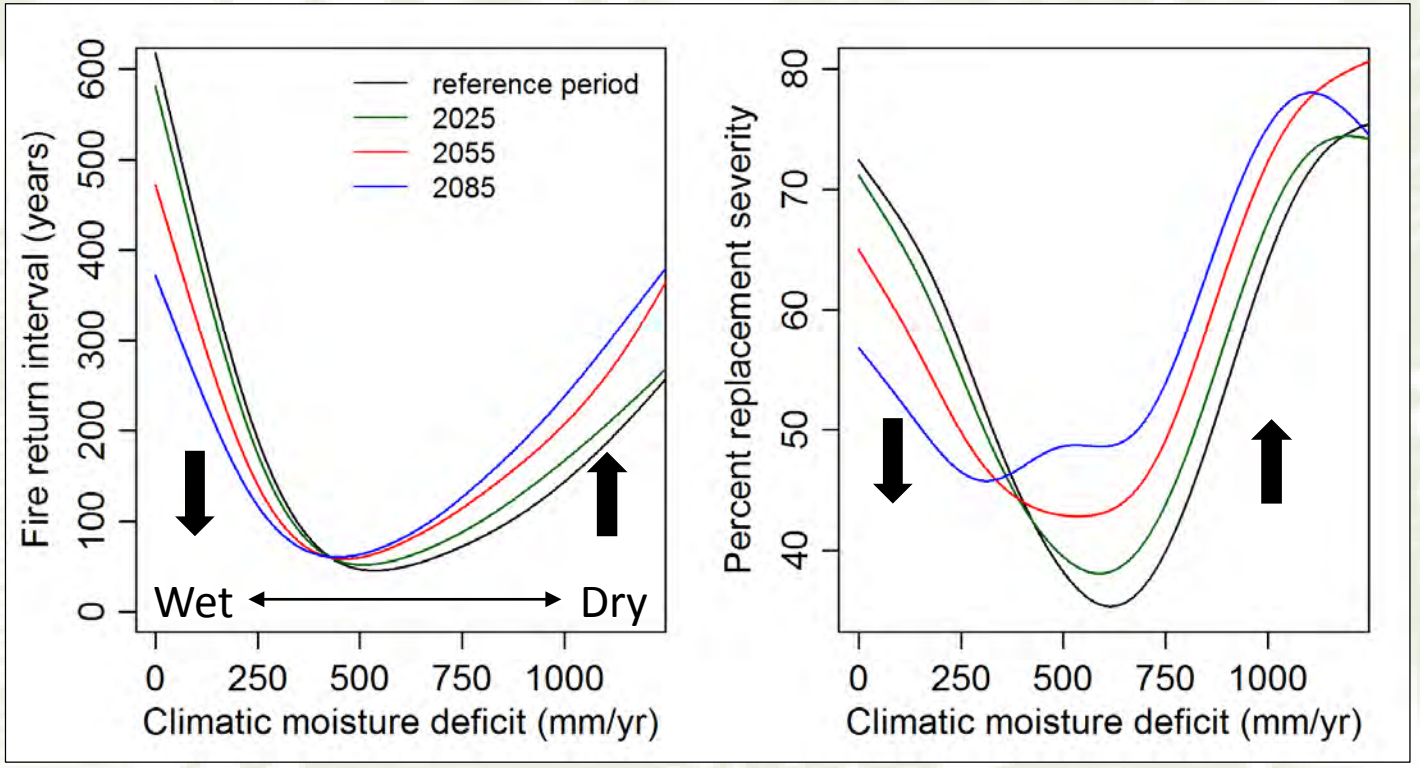

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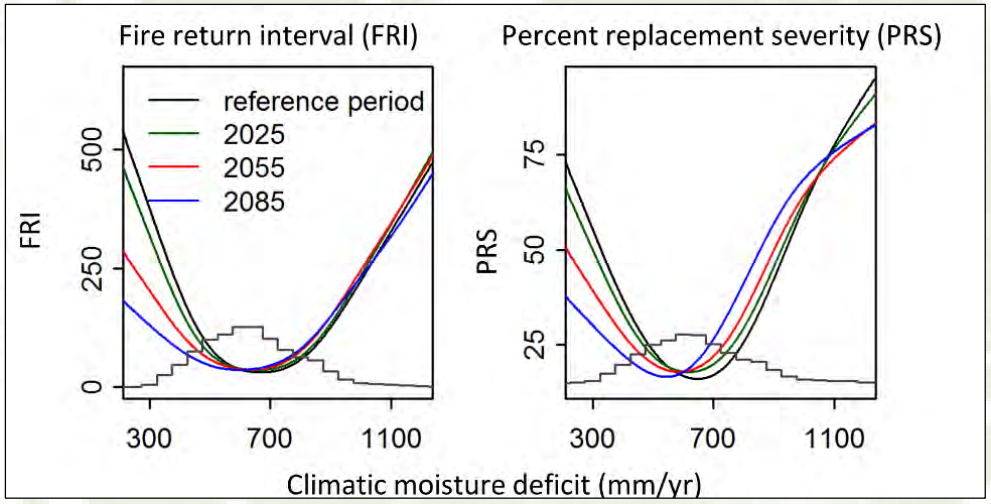
Sierra Nevada ecoregion



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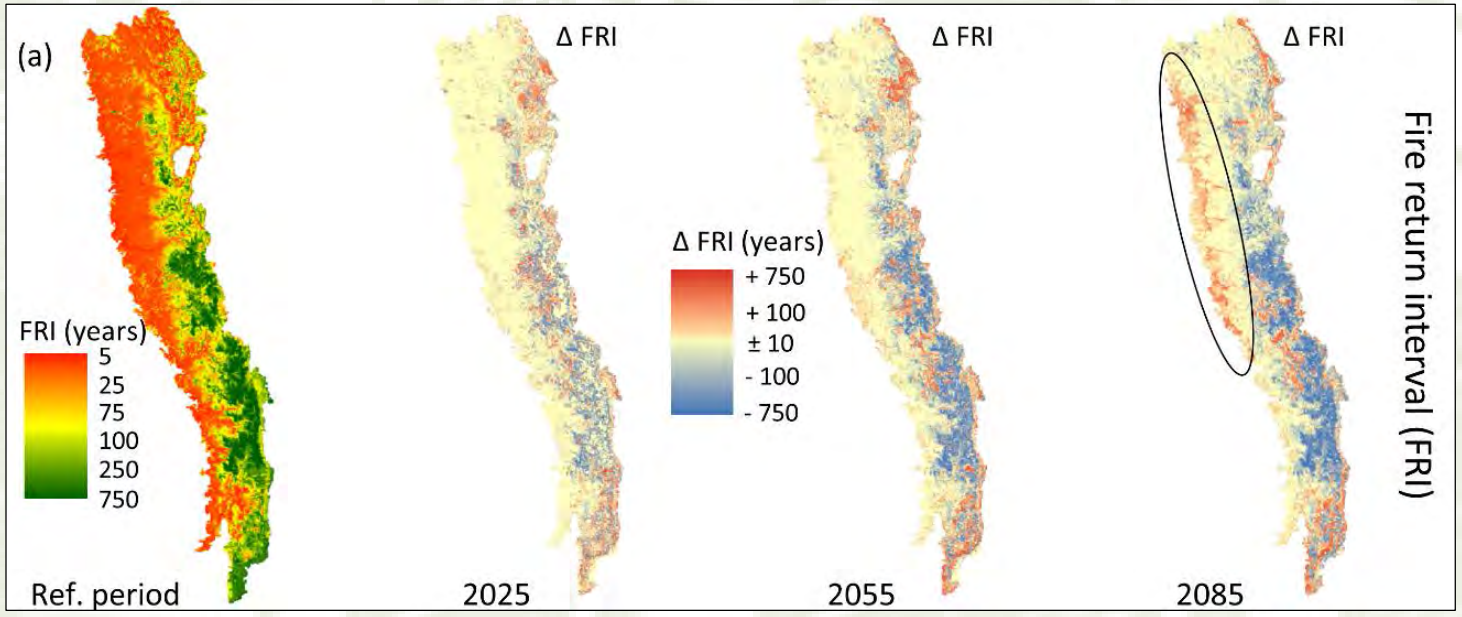

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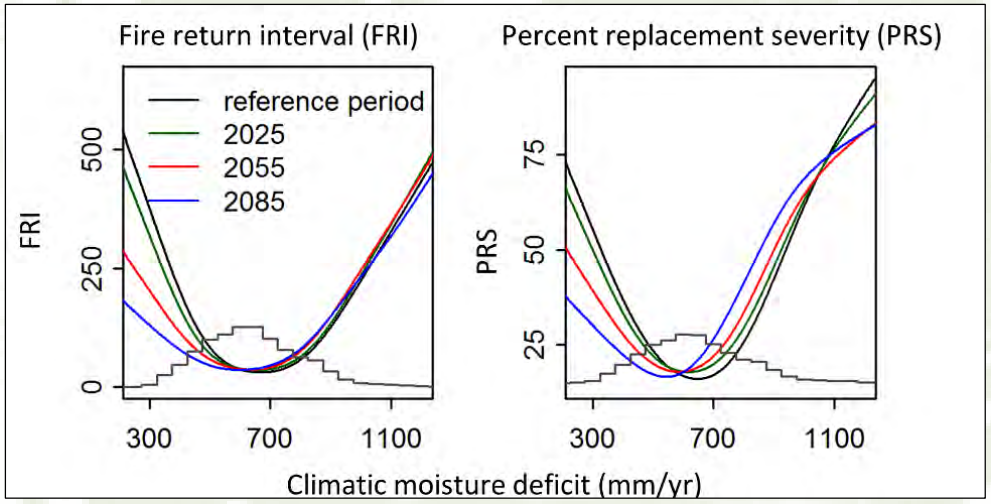

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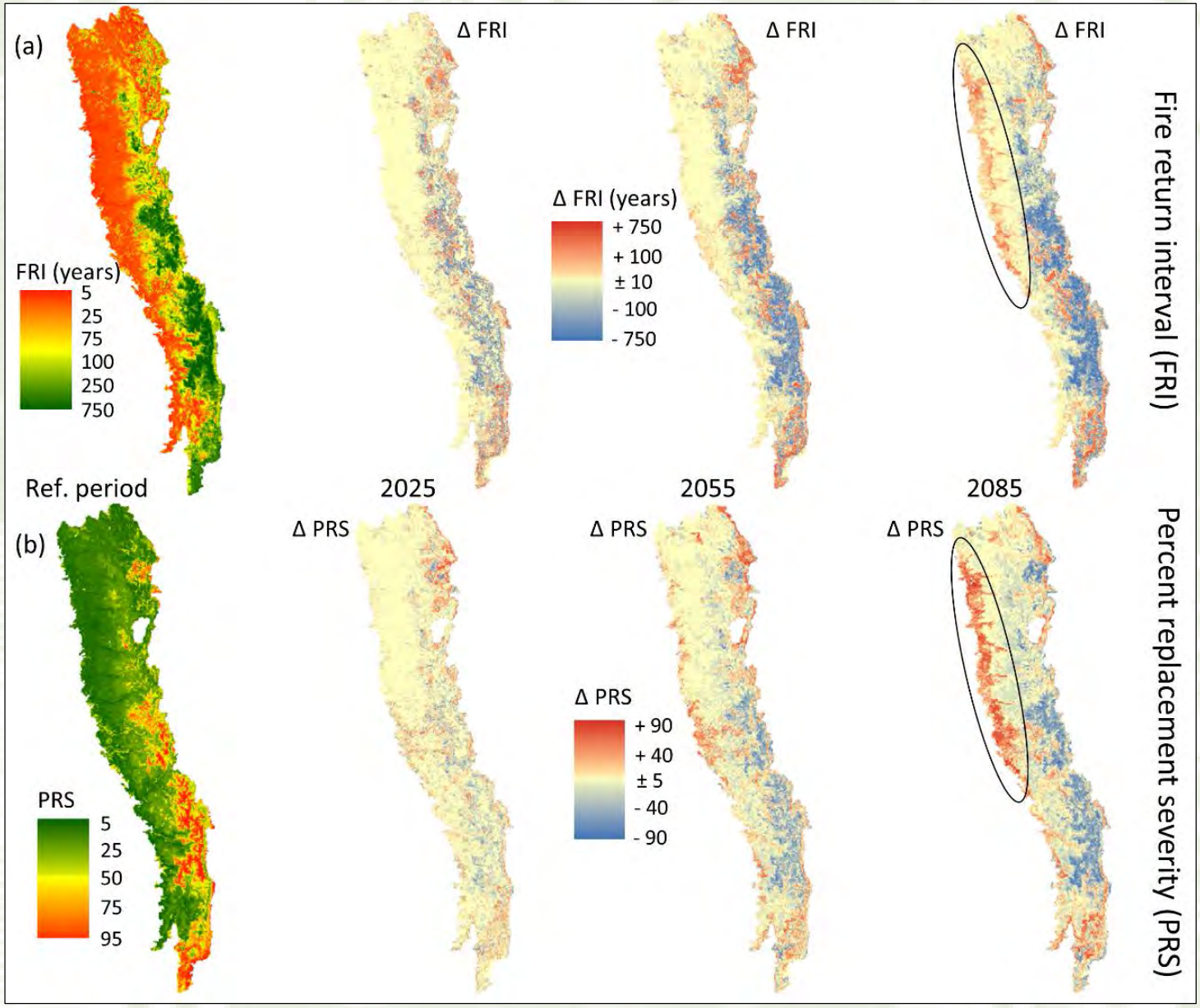

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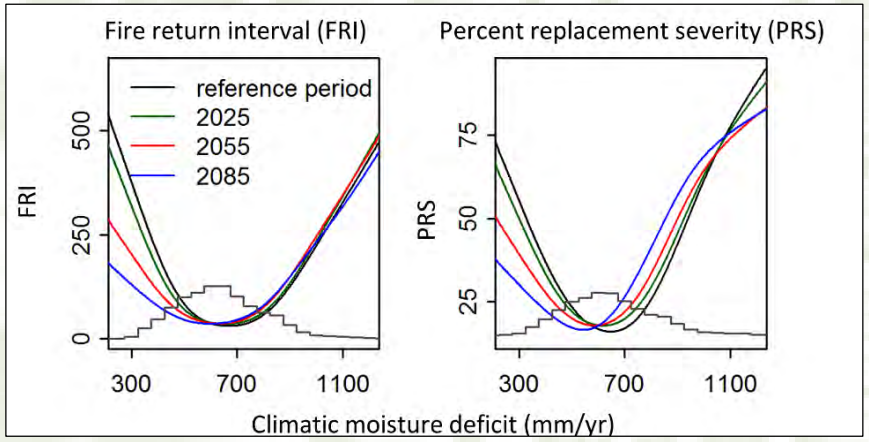

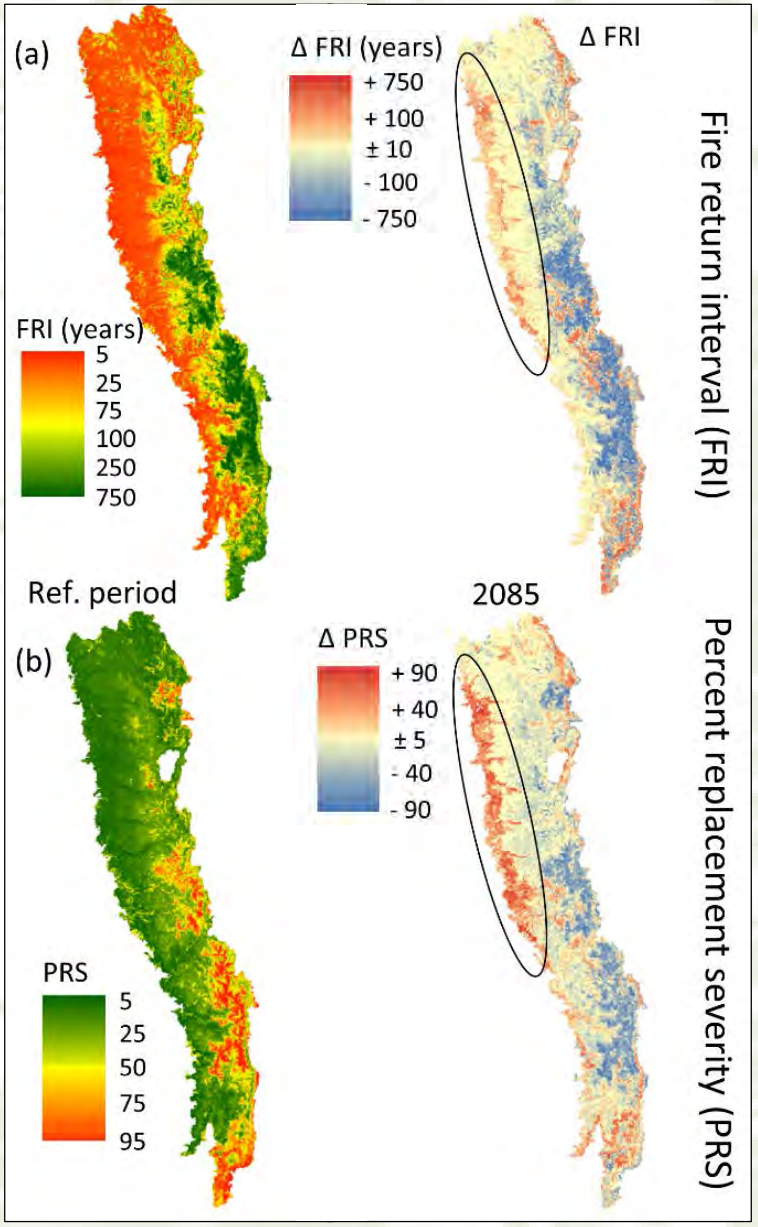

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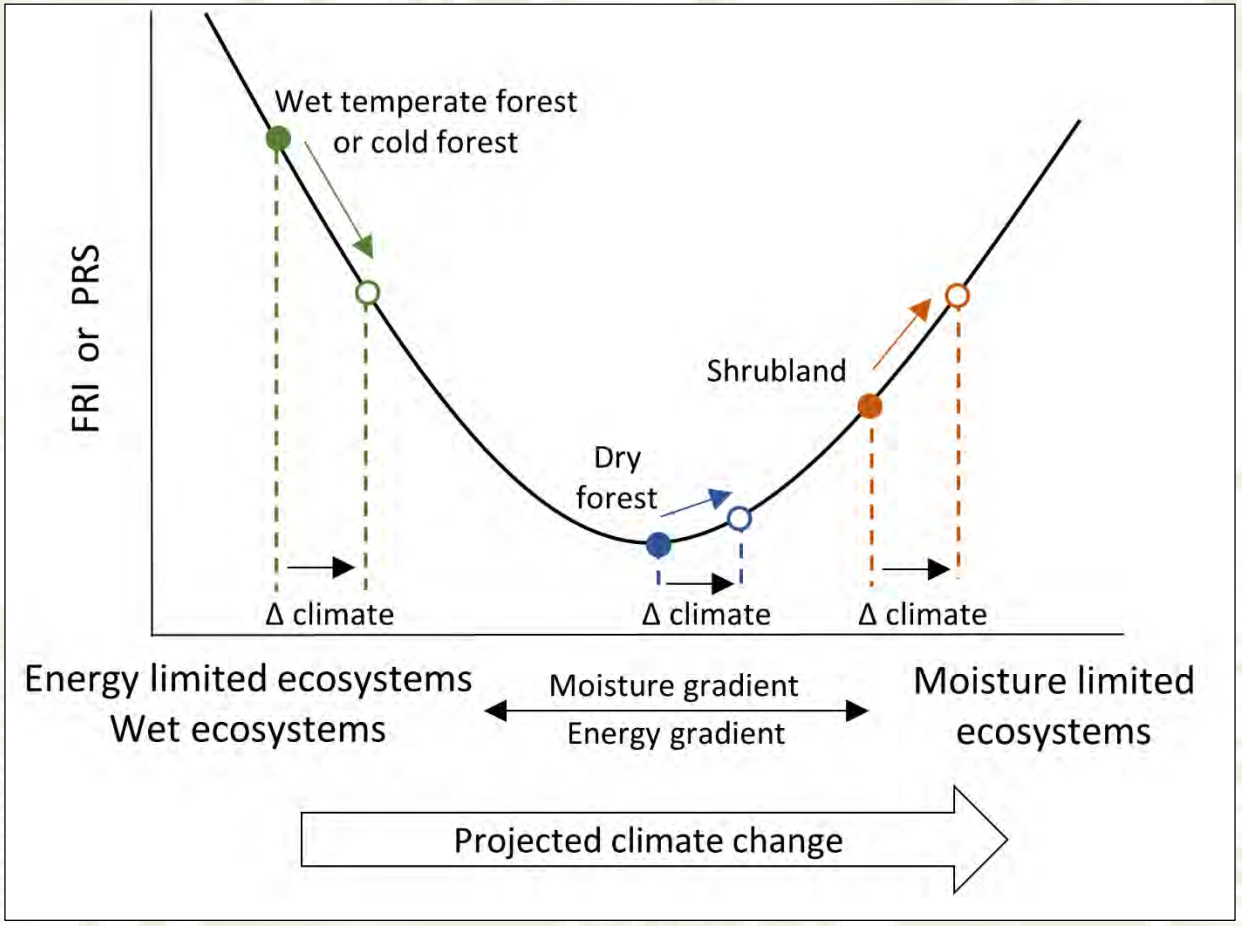
Conceptual model



Questions?

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Collaborators:
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Marc Parisien
Lisa Holsinger

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