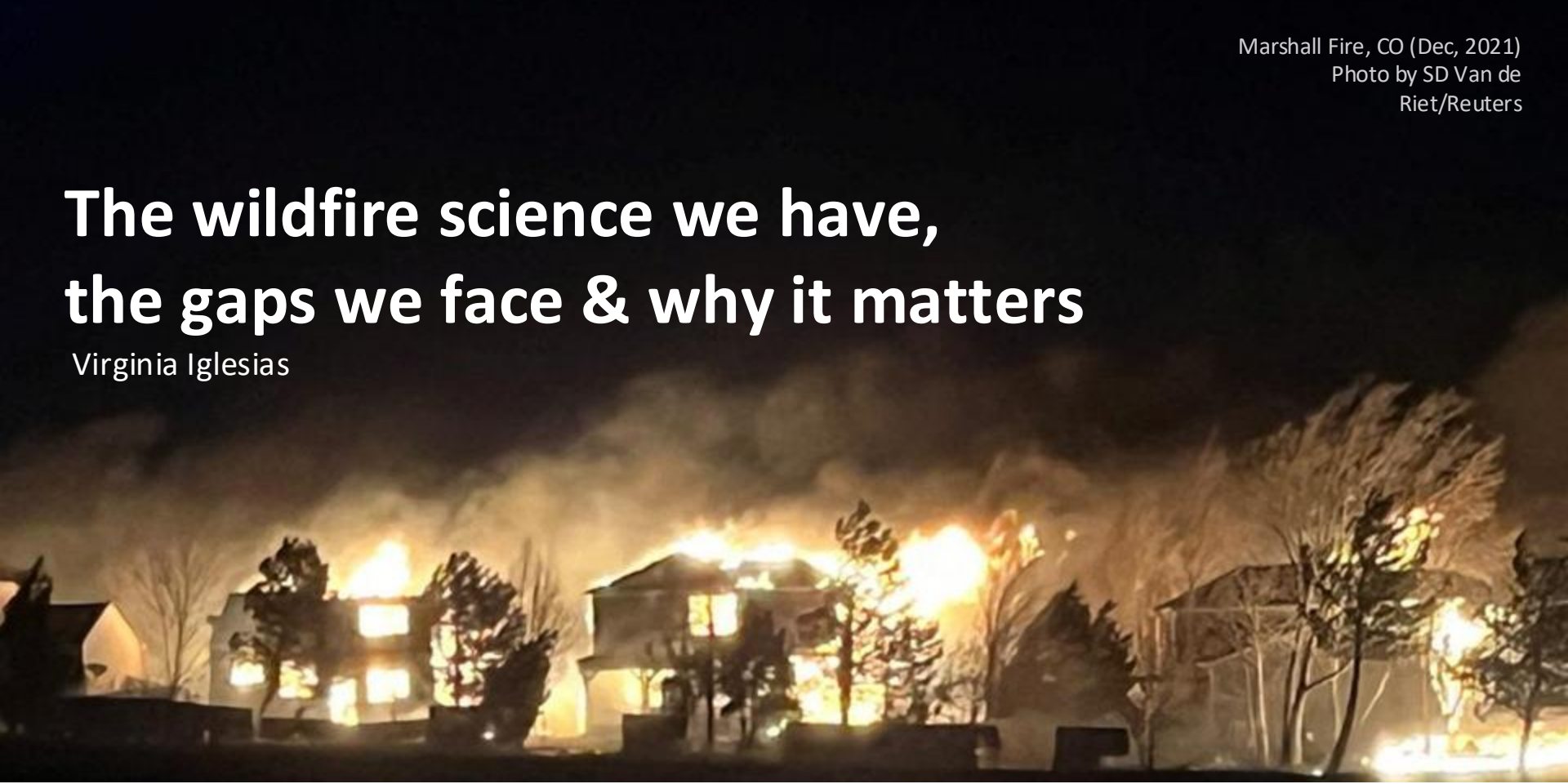

Marshall Fire, CO (Dec, 2021)
Photo by SD Van de Riet/Reuters

The wildfire science we have, the gaps we face & why it matters

Virginia Iglesias

Earth Lab
University of Colorado Boulder
CIRES

USGS
science for a changing world

The Geologic Time Spiral—A Path to the Past

U.S. Department of the Interior
U.S. Geological Survey

Spiral designed by Joseph Graham, William Newman, and John Stacy. Digital preparation by Will Stettner.

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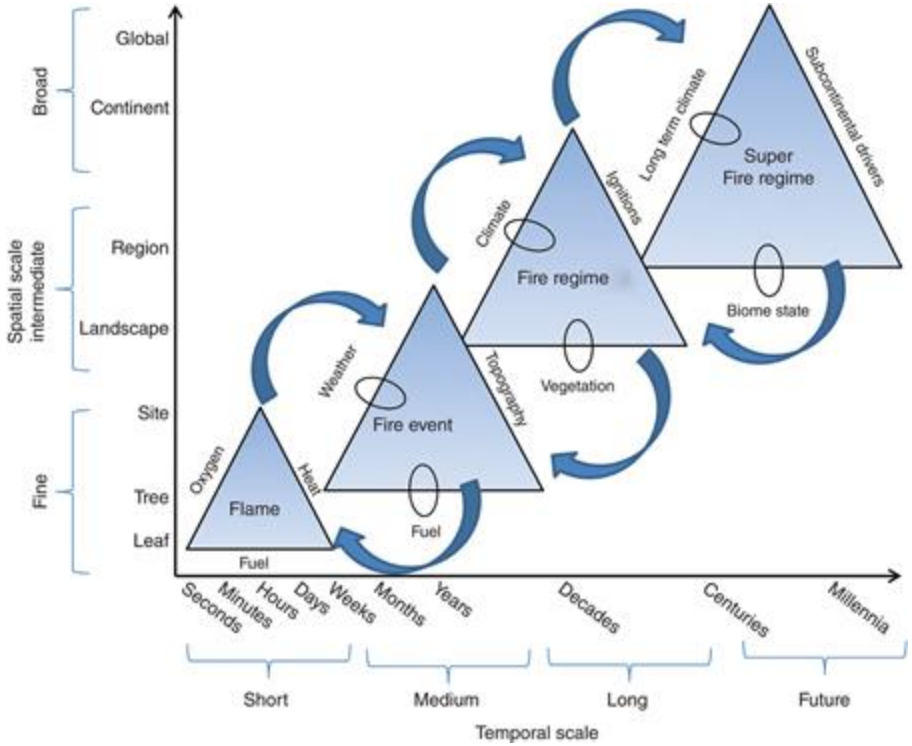
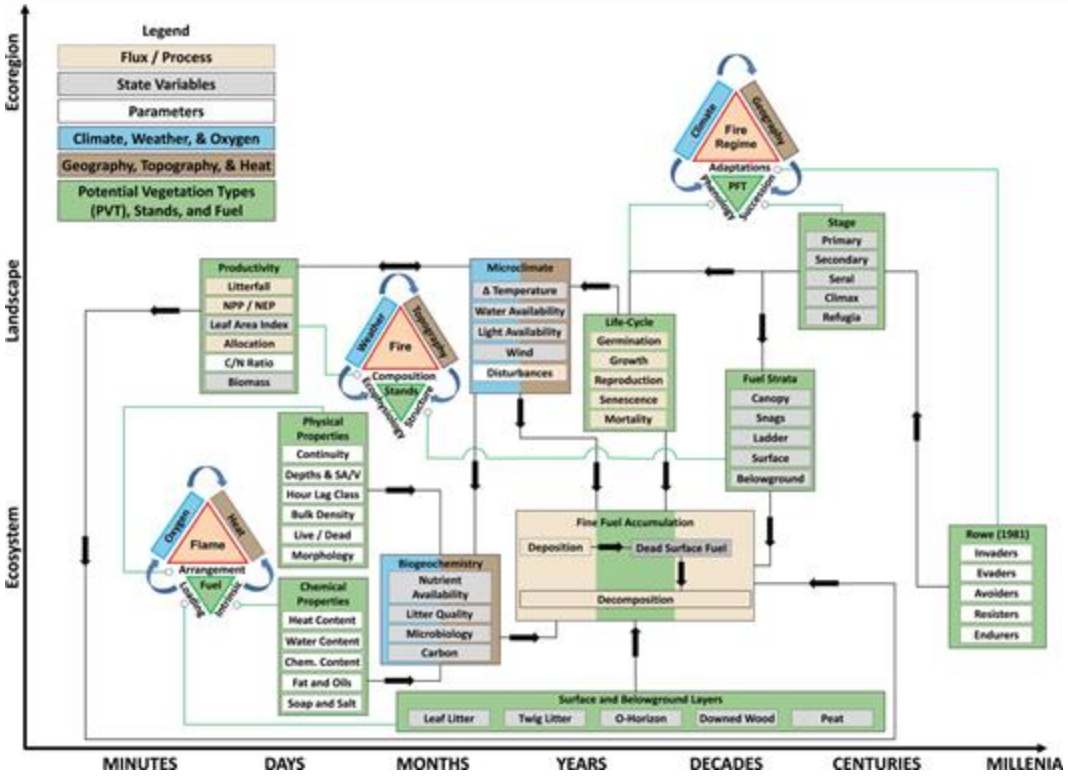
General Interest Publication 66

The fire triangle



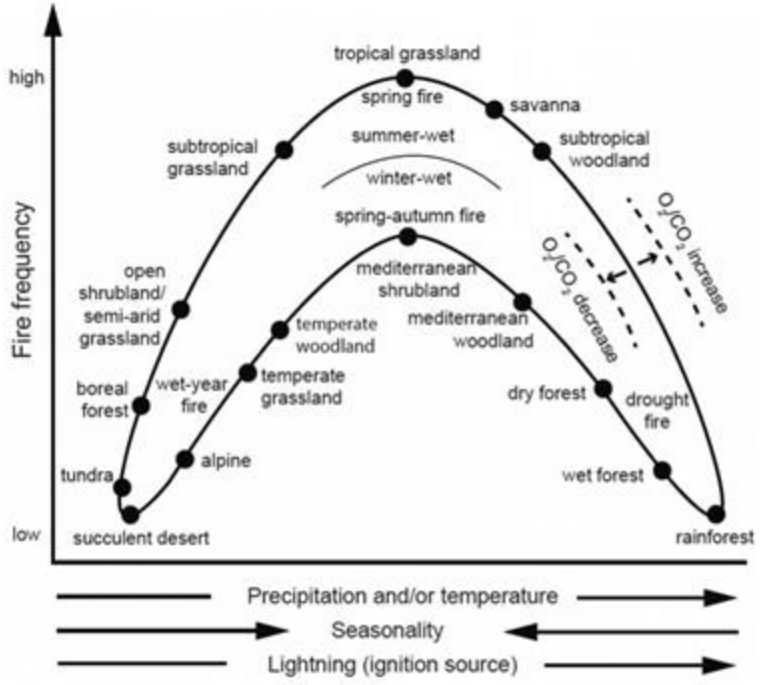
Moritz et al., 2005, *PNAS*.

Parameters, processes & state variables



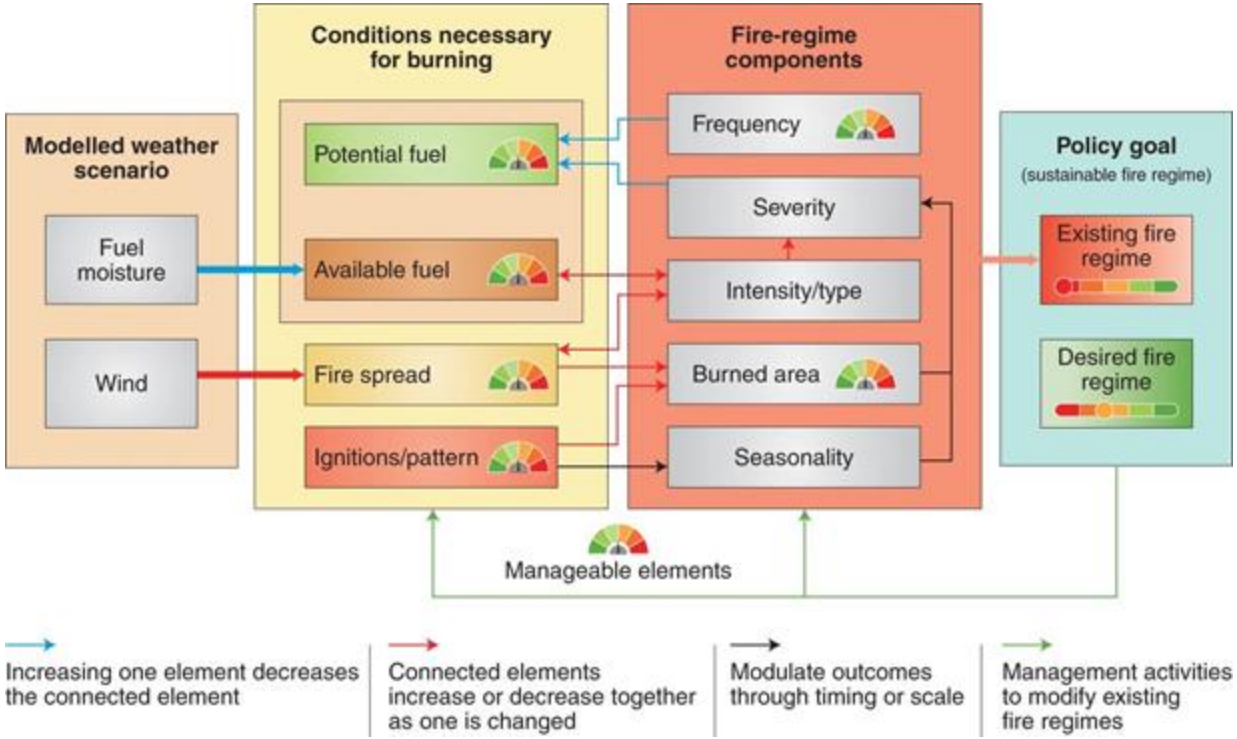
Hanan et al., 2022, *JAMES*.

Climate- vs. fuel-limited



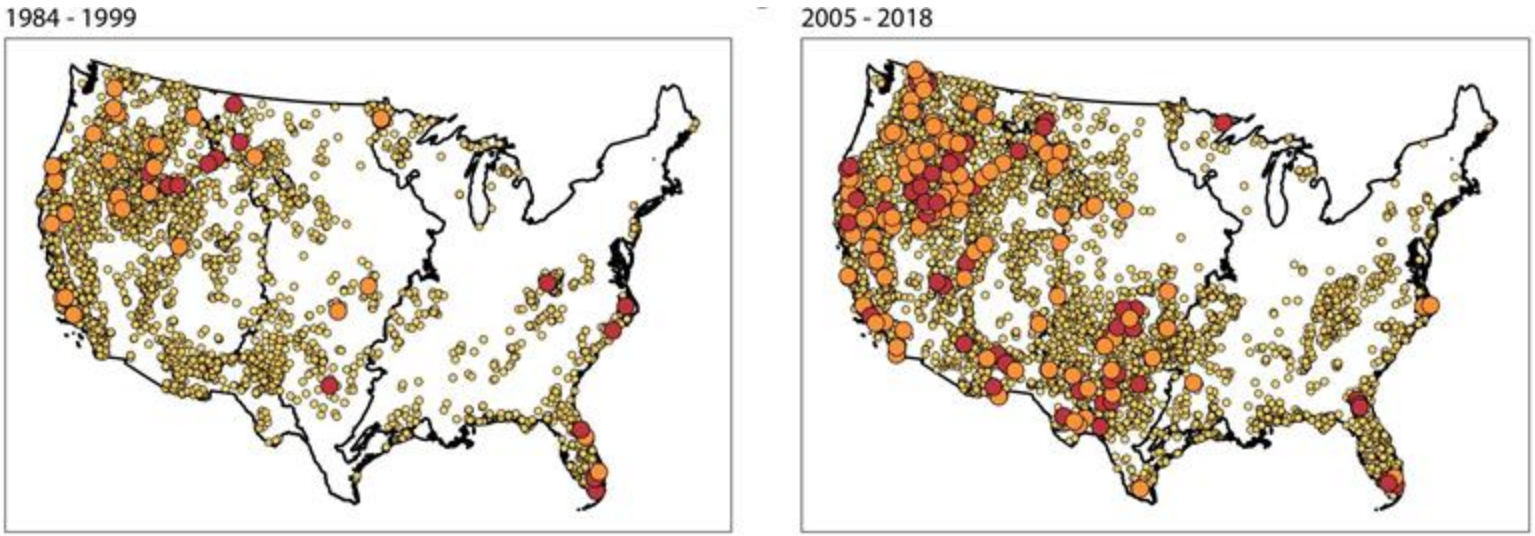
Lamont, 2022, *Plant Ecol*.

The fire regime



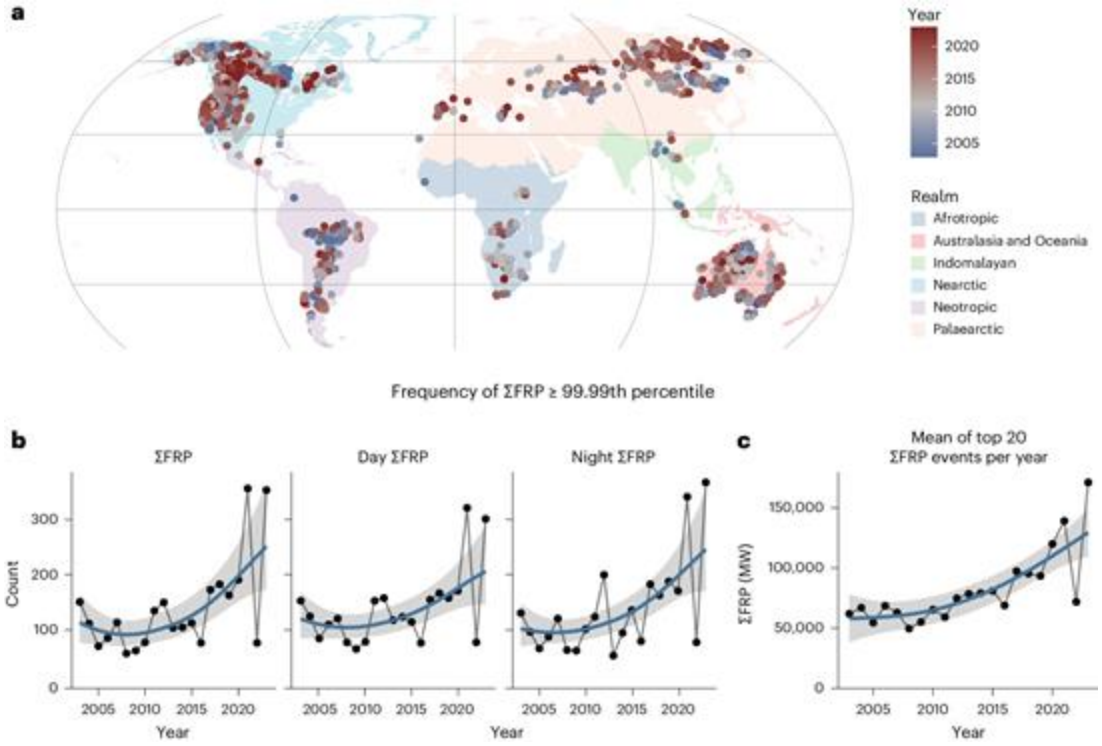
Cochrane & Bowman, 2021, *Nature Geoscience*.

4 times **larger**, 3 times **more frequent**



Iglesias et al., 2022, *Science Advances*.

Fires are more **intense**



Cunningham et al., 2024, *Nature Ecology & Evolution*

Balch et al., 2025, *Science*.

Photo: Al Zulkifli; Getty Images

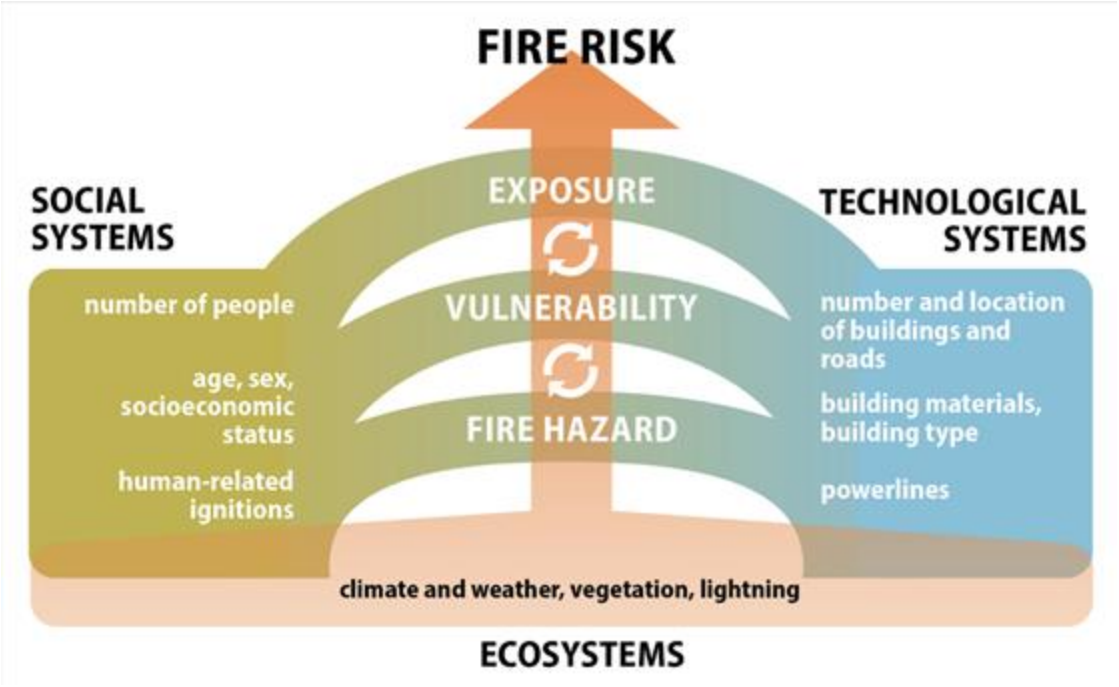
Joint Economic Committee report, 2023.

$394 - 893 billion

Experiencing wildfires increases willingness-to-pay for climate mitigation policy

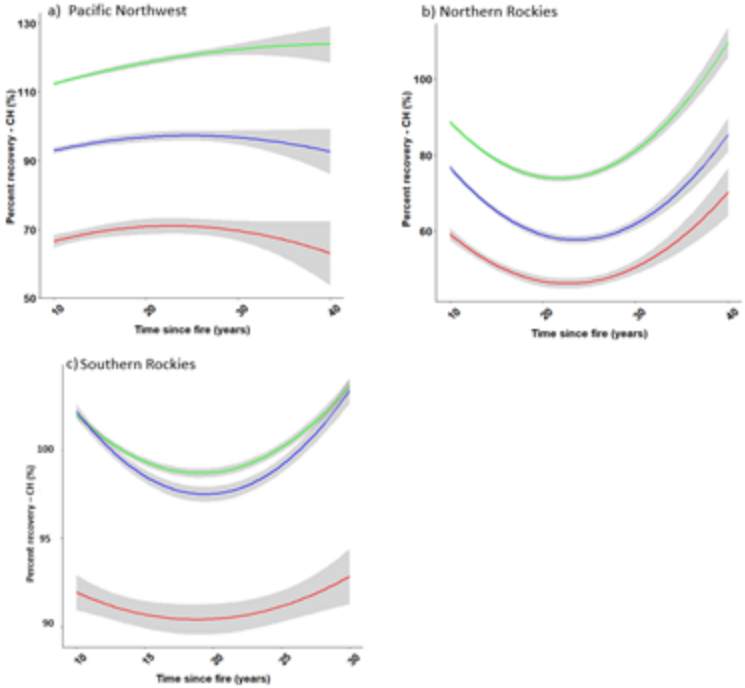
Gould et al., 2024. *Global Environmental Change.*

Fire **risk** is the potential for damage



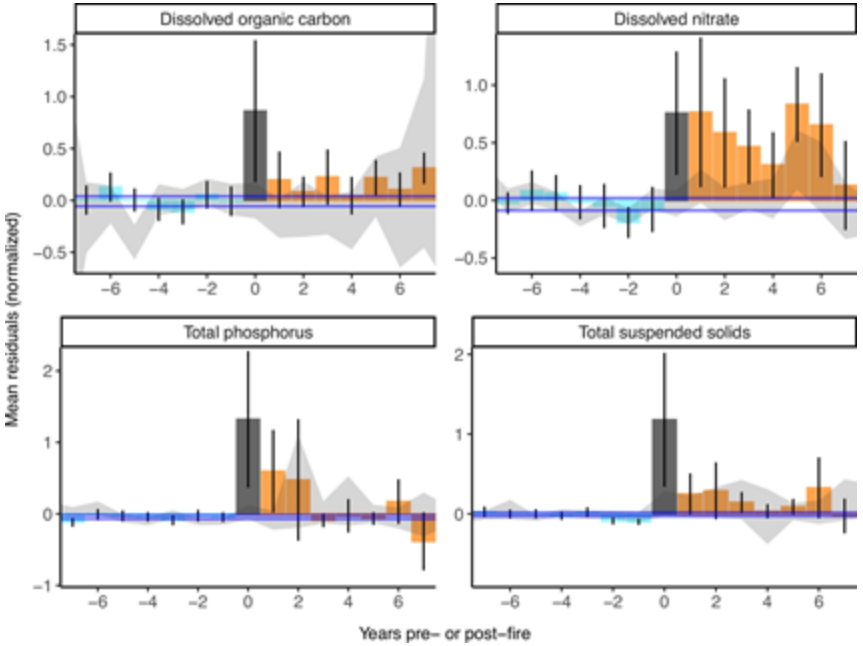
Iglesias et al., 2022, *Environmental Research Letters*.

Vegetation & water quality

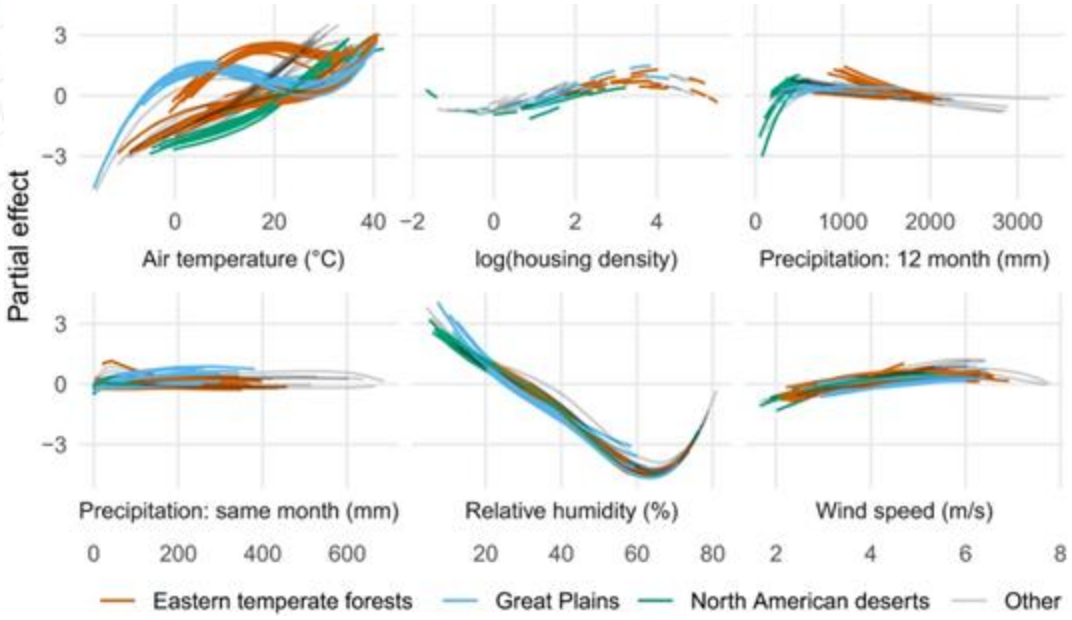


Ilangakoon et al., in review, *Environmental Research Letters*.

Brucker et al., 2025, *Nature Comm. Earth & Env.*



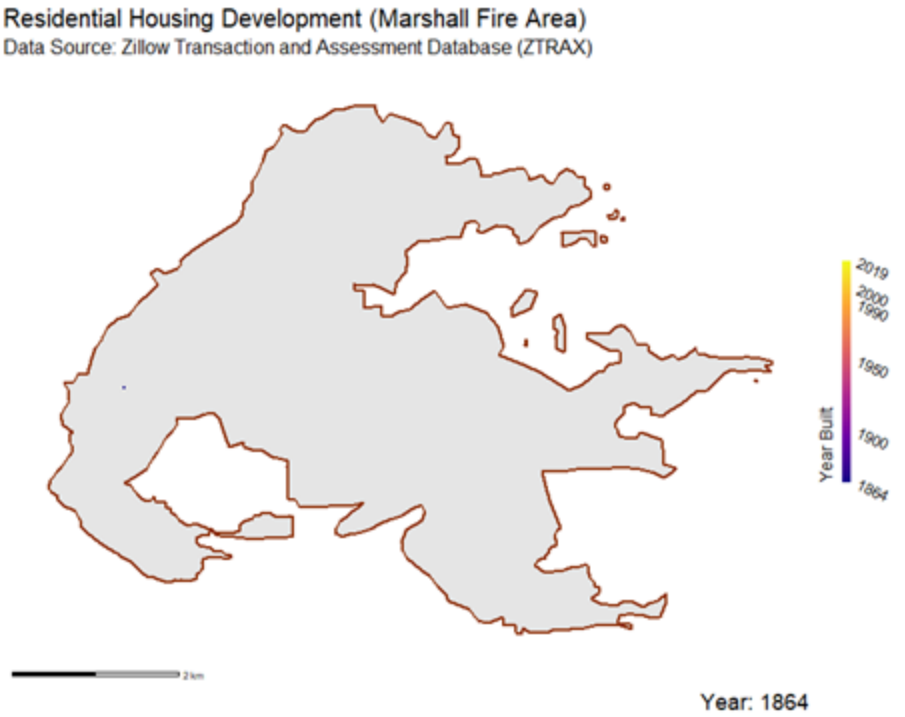
Skewed distributions: Bayesian finite sample maxima



Joseph et al., 2019, *Ecological monographs.*

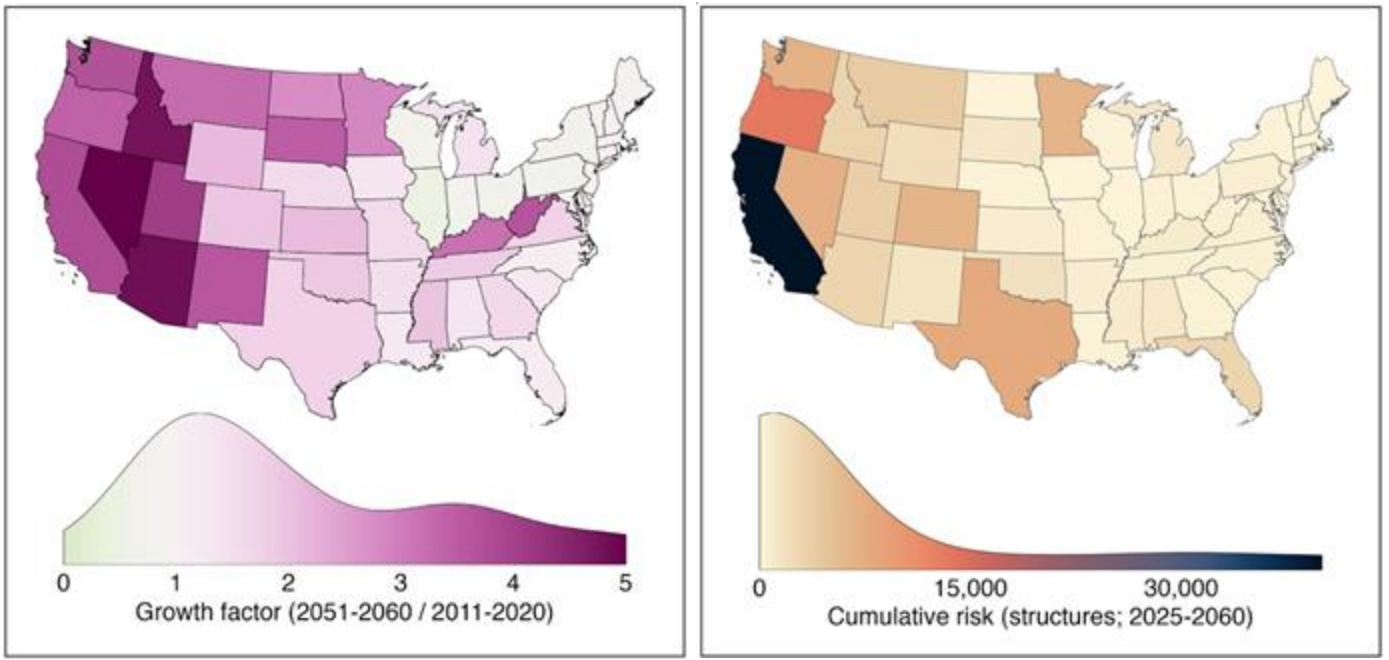

Wildfire (WFIGS)
New Wildfire - Past 24 hours
See Prescribed Fire (WFIGS)
See Other Fire (WFIGS)
Smoke
See Potential Fire
See Watches & Warnings
Smoke - Light Density
Source: GOES-WEST Satellite Image
North Pacific Ocean
North Atlantic Ocean
Bering Sea
Calgary
Quebec
Toronto
Boston
Chicago
New York
United States
San Francisco
Houston
Mexico
Havana
Cuba
Mexico City
Guatemala
mapbox
Source: The Wildland Fire Interagency Geospatial Service(WFIGS), Canadian Interagency Forest Fire Centre (CIFFC), NOAA Office of Satellite and Product Operations

Development in hotspots 3x higher than national mean



Iglesias et al., 2021, *Earth's Future*; Animation: Max Cook

Fire risk nearly risk triples nationwide by mid-century



Iglesias et al., in review, *Science Advances*

How vulnerable is the built environment to wildfires?

Camp Fire, CA (Nov, 2018)
Photo by N. Berger/AP

Needs

Near-term forecasts with fully specified uncertainties >> mitigation & resource allocation

Long-term projections >> range of plausible outcomes & counterfactual experimentation >> fully coupled fire-vegetation-climate-human

AI >> (near-)real time

Fire speed & intensity

Seasonality, wind, (coupled) extreme events, ignition, built-environment as fuel

Thank you!

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