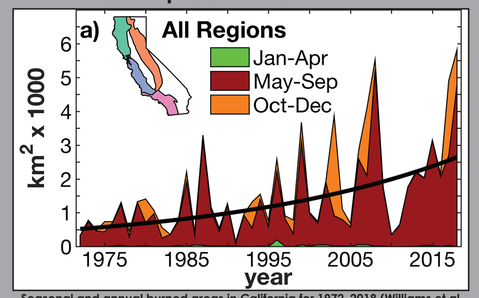
Projecting vegetation condition and fire risk in southern California, 2050-2100

Westin Guthrie, MS student GES - Advisor Chris Lippitt, Assciate Professor, GES

Background

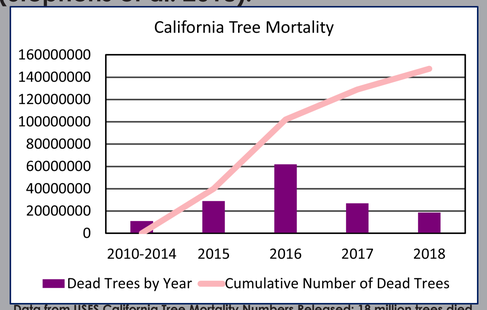
In the West, there has been a notable increase in stand-replacing fires as mean and maximum fire size and annually burned areas have dramatically increased since the 1980s (Miller et al. 2009). During 1972 - 2018 California experienced a fivefold increase in annual burned area, this increase was primarily supported from an eightfold increase in summer forest-fire extent (Williams et al. 2019).



Seasonal and annual burned areas in California for 1972–2018 (Williams et al. 2019)

California has experenced an increased scale of mortality which has presented a greater potential for "mass fire" to exist in the coming decades (Stephens et al. 2018).

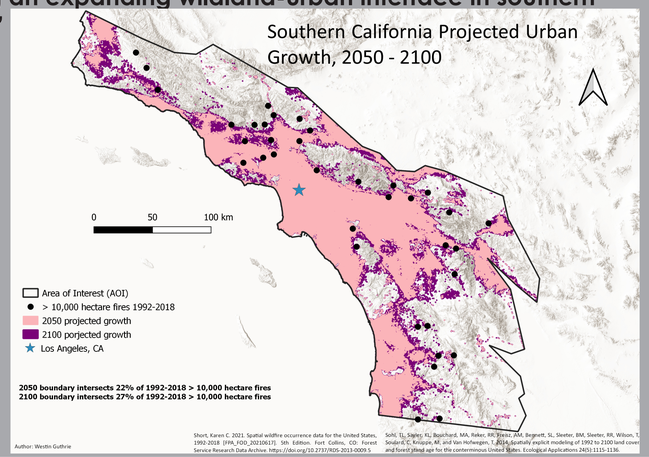
It is important to understand how fire interacts with vegetation and climate to accurately project possible futures for southern California wildland-urban interface fire risks.



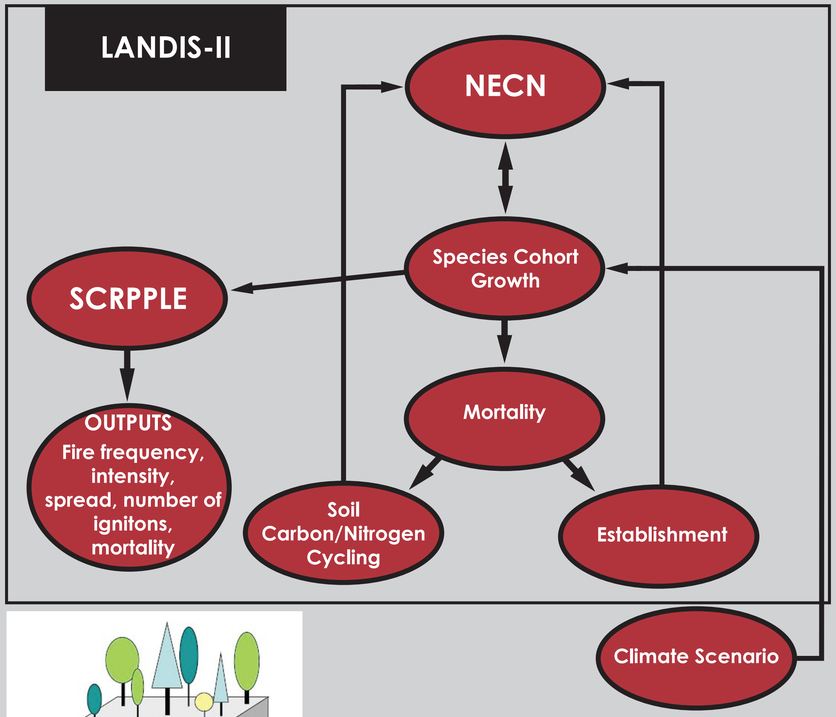
Data from USFS California Tree Mortality Numbers Released: 18 million trees died in 2018

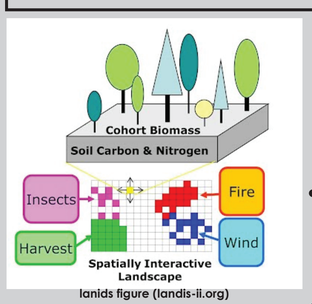
Research Question

"How will contemporary and future climate scenarios impact vegetation dynamics and the frequency and severity of fire projections intersecting an expanding wildland-urban interface in southern California?"



Methods





lanids figure (landis-ii.org)

LANDIS - II

- Landscape change model, simulates forest at decadal to multi-century timescales over vast spatial scales.
- LANDIS-II is highly customizable with dozens of libraries ('extensions') to choose from.

NECN

- NECN (Net Ecosystem Carbon and Nitrogen) Succession extension which calculates how cohorts grow, reproduce, age, and die (Scheller et al. 2022).
- Informed by various climate projections.
- Provides understanding of above ground biomass and cohort growth for SCRPPLE

SCRPPLE

- SCRPPLE (Social-Climate Related Pyrogenic Processes and their Landscape Effects) represents a fire model in the LANDIS-II framework informed by vegetation from NECN.
- LANDIS-II framework provides projections of fuel loads in response to vegetation growth, mortality, and disturbances (Scheller et al. 2019).

Projected Results

SCRPPLE has four primary outputs: Ignition (including human ignitions), Spread (including the effects of suppression and fuel treatments), Fire Intensity, and Fire Mortality (Scheller et al. 2019).

SCRPPLE outputs will allow the ability to understand how different fire variables (intensity, spread, and ignitions) and fire shapes may interact with the wildland-urban interface and intermix zones in the years 2050 and 2100.

Expected Results	2050	2100
Fire Intensity	Burn intensity to increase from 2020-2050	Intensity to have a decrease from 2050-2100
Fire Frequency	Fire frequency to have an increase spurned by lower moisture content fuels and more fuel availability	Frequency to decline as environment starts to become more fuels limited
Fuel Loads	Fuel loads to increase through large scale tree mortality and futher drought stressed vegetation	Fuel loads to decrease from previous fires and poor vegetation regeneration

Next Steps

The use of SCRPPLE and LANDIS-II NECN is new in this environment. There are issues in understanding how to deal with vegetation that become intersected by urban gaps and how that will affect the spatial distribution of fire within the model.

Bibliography

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