

Fire Behavior in the Interface

What don't we know

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Fire Behavior -- How the Fire Environment Interacts



The Interface Fire Problem

“In its simplest terms, the fire interface is any point where the fuel feeding a wildfire changes from natural (wildland) to man-made (urban) fuel.”

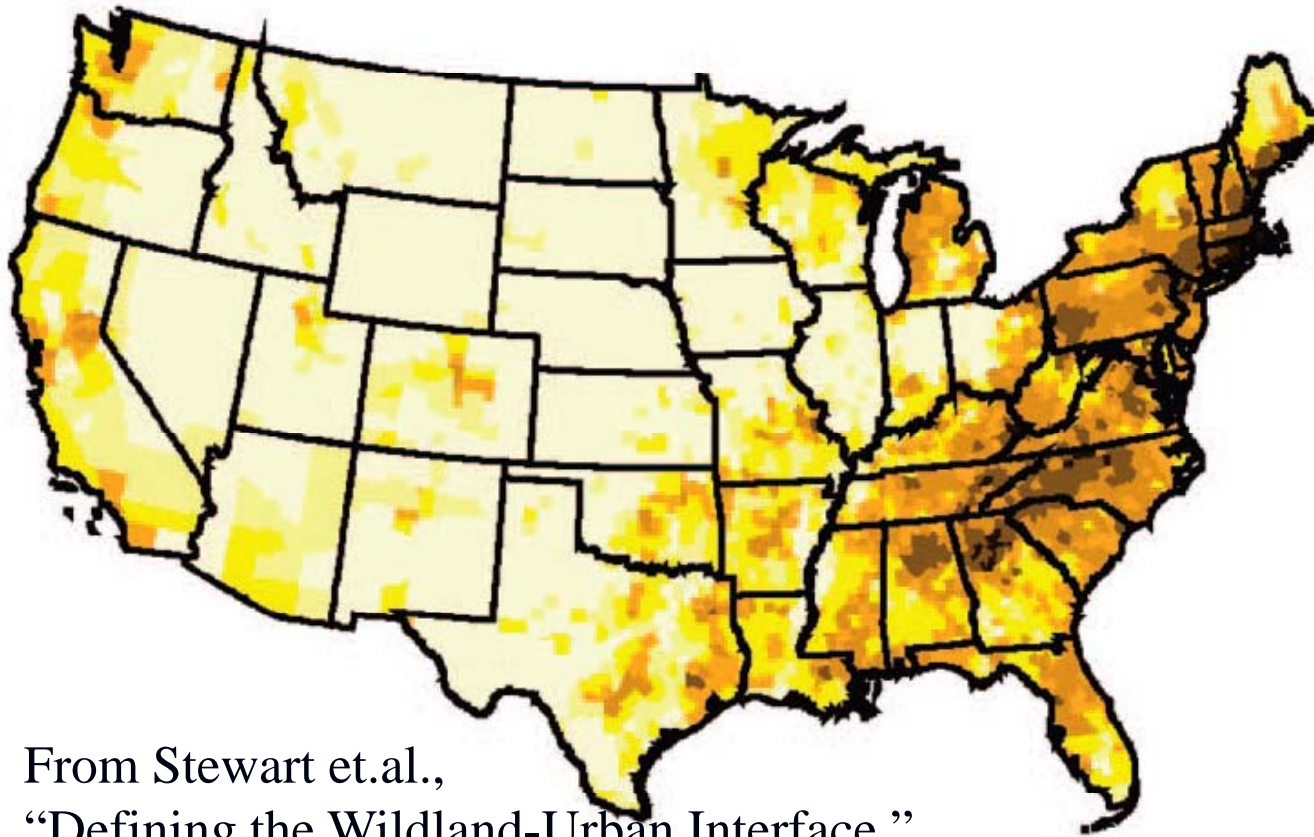
Clay Butler, SRI
Fire Prevention Notes, 1976
California Department of Forestry

Defintions

What (and where) is it?

- Areas where vegetations fuels mix with human settlement – people and property at risk
- Result: Enormous ranges in fire environment
- US WUI mapping:
 - any area down with settlement density down to 1 house/16 ha and within 3 km of wildlands
- At the margins this gives us:
 - Open space with a few scattered homes
 - Dense urban -- $<.1$ ha parcels, adjacent to wildlands

Total WUI



From Stewart et.al.,
“Defining the Wildland-Urban Interface.”
J. of Forestry June 2007



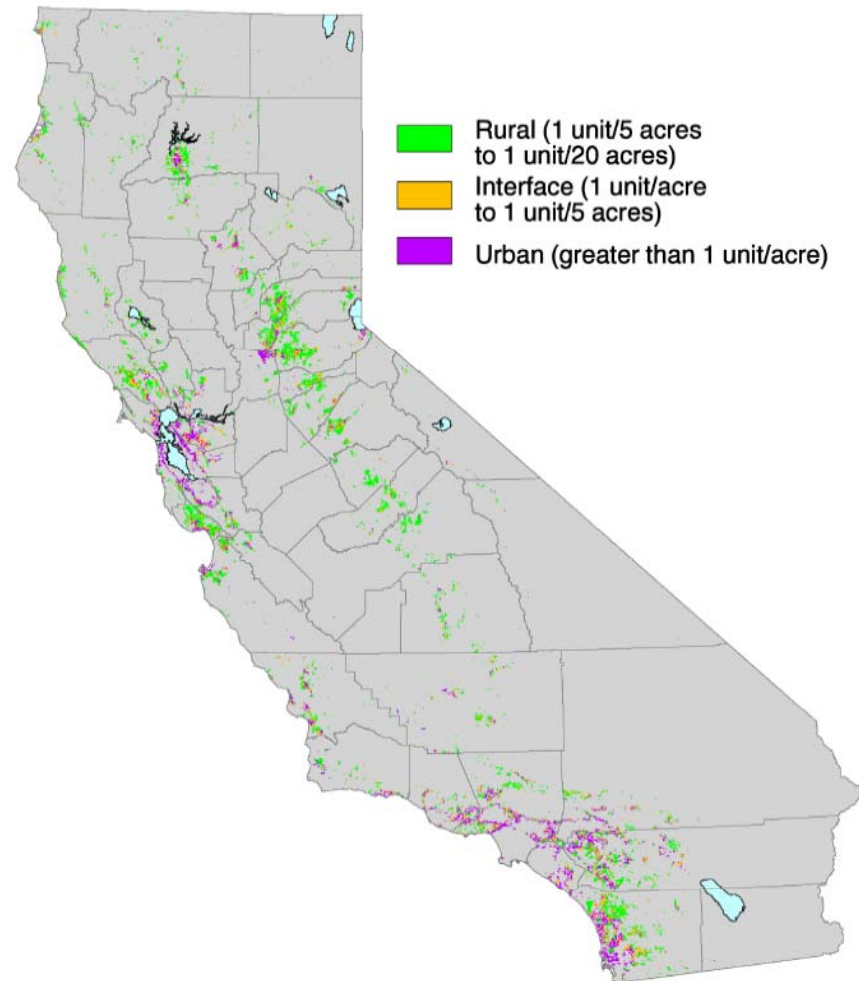
Where is the Problem

??????

Distribution of
WUI area and
housing units.
% of county
(area) “in” the
WUI.

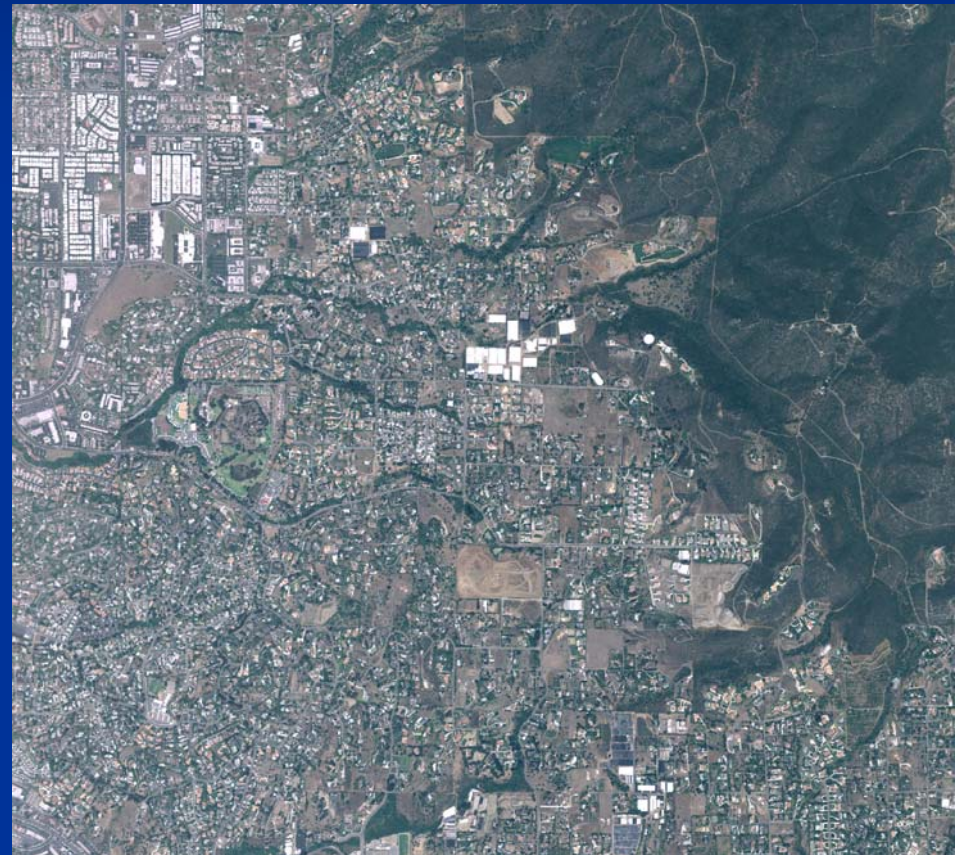
- CAL FIRE's definition – similar, but more restrictive

Figure 2. Wildland urban interface (WUI) susceptible to High, Very High, and Extreme threat by housing unit density, 2000



Source: FRAP Wildland Urban Interface, v03_1

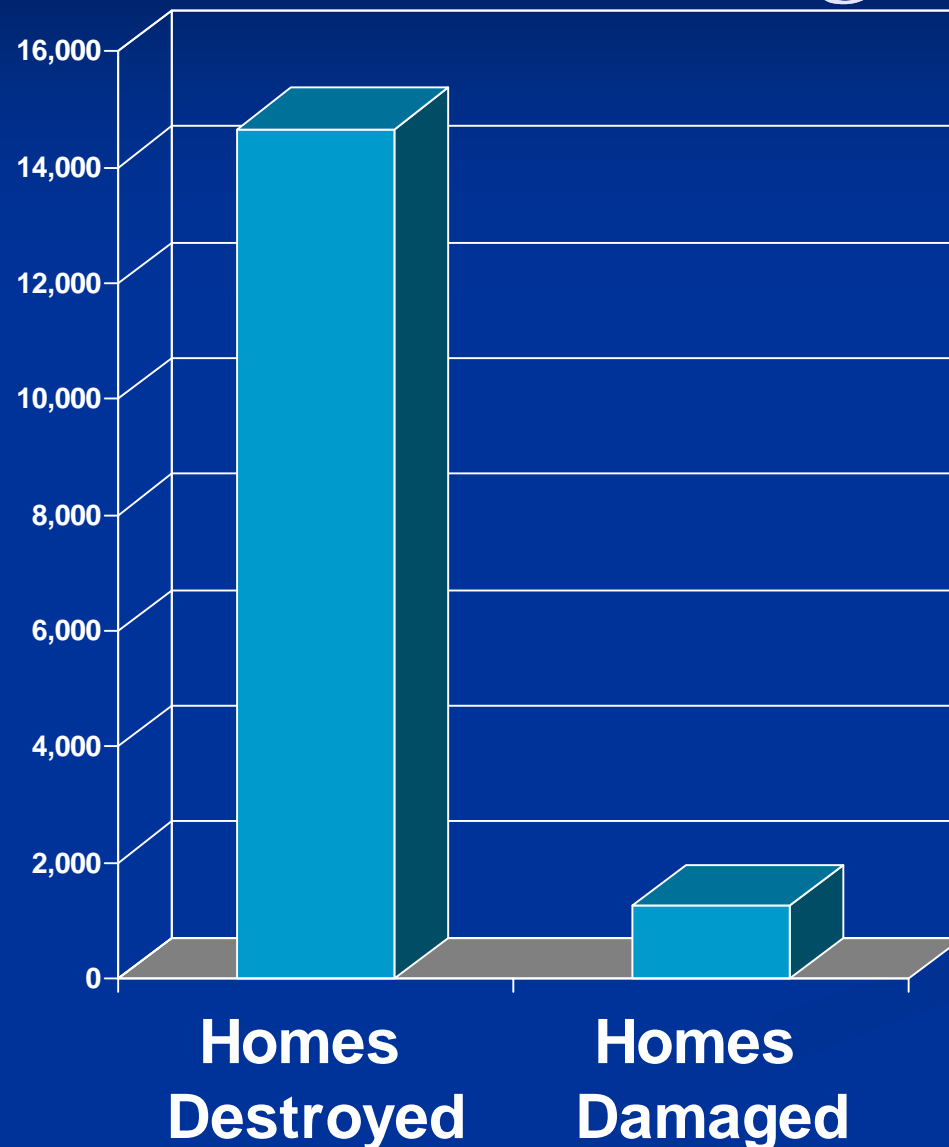
See any difference?



Fuel Variability in the Interface

- Houses are unique
 - Both Fuel and asset
 - Very large, coarse fuel elements, slow to ignite, stationary, but once fully involved are very intense (flaming, radiation, firebrands)
 - Increasing settlement density typically results in less fuel continuity and less fine fuel cover
 - Must ignite to influence fire spread?
 - Alter suppression allocations and tactics (redirected from perimeter containment)
 - But how do they actually ignite and burn?

California Interface Loss due to Conflagrations?



**Once ignited,
90% of homes on
interface fires are
completely
destroyed.**

- Cursory survey of 253 interface fires from 1923 thru 2004 with a total of 22,837 structures burned.

Common Elements of the Problem

THE URBAN/WILDLAND FIRE INTERFACE

By C. P. Butler, Senior Fellow
California Academy of Science
San Francisco, California

- Vegetation fire under extreme conditions:
- Exterior fire exposure to buildings:
- Rapid fire spread to ignitable buildings.
- Fire department resources overwhelmed.

CALIFORNIA DEPARTMENT OF FORESTRY



FIRE PREVENTION NOTES

OFFICE OF THE DIRECTOR
—SACRAMENTO—

No. 10

September 1976

Extreme Fire Weather

- Stochastic
- In fire season, Low RH% High winds
- At best we get a probability surface based on frequency meeting threshold requirements
- Currently poor demographics -- i.e., spatial resolution of data lacks precision
- Result: We recognize critical requirements for WUI conflagrations, but have not effectively mapped them according to likelihood

What does all this mean?

- Good: Fundamentals of combustion still stand
- Bad:
 - Lots of components are probabilistic (near field winds, firebrand production, transport, ignition)
 - Lots of variables are not really characterizable at scales relevant scales (e.g., debris in a rain gutter)
 - Extreme Fire Behavior – no working model currently
 - Problem seems to getting worse, despite increases expenditures – but is this directly due to fire behavior, and if so, can we manage it?

Some Key US/Aust Interface Fire Research Issues

- What & where is the problem? Refine the problem area
- Interface Fire Hazard (behavior) vs. Risk
- Mechanisms of building ignition (not always a wall of flames)
- Building survival potential after building ignition?
- Building survival potential with direct flame contact exposure?
- Role of building-to-building fire spread (flames & embers) during interface disasters?
- Can massive fire suppression response significantly mitigate disastrous interface fire spread?

