

Beyond Plant Lists:

The ecologically sound way to move your house
(and neighborhood) off the fire freeway



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Where does the fire start?

- Is it really about the plants?
 - We tend to look at things from a human perspective
- What if it's about the houses?
- What if tree survival is directly predicted by distance from houses?





Image: LA Times









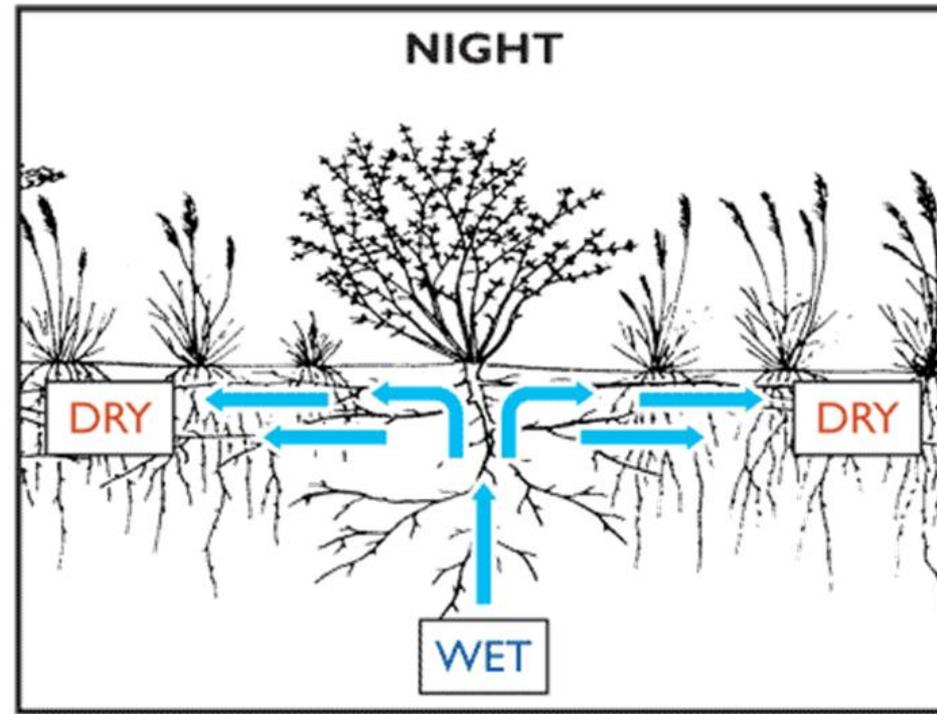
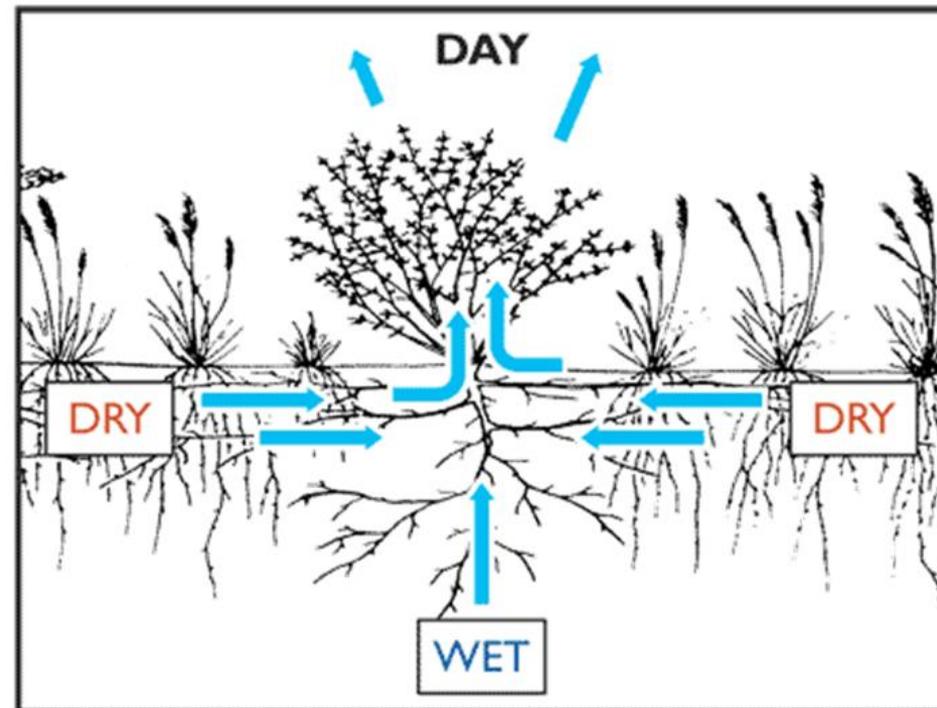


Community

- Plant flammability lists mostly meaningless
 - Some based on wildland fire behavior
- Community structure important
- This is why design and maintenance are important
 - Landscape is a community
- Design: interruption of fuel ladders / conduits
 - Horizontal
 - Vertical
- Maintenance: think moist
 - Remove dead/dry fuels
 - Keep plants hydrated
 - Soils may be dry?
 - Plants manage water

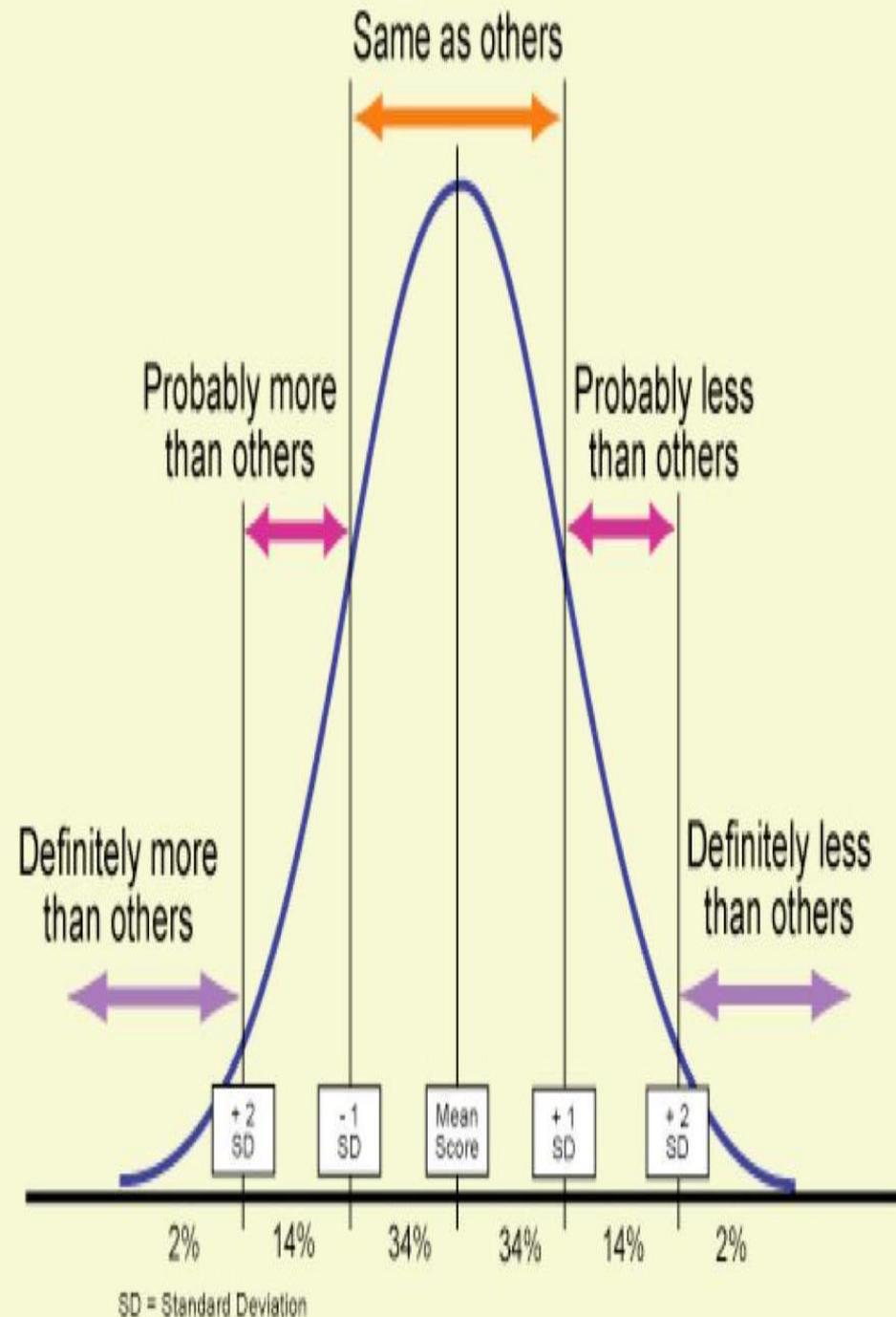
Plants as water managers?

- The soil community
- By day, as we all learned in school
- At night, water flows to mycorrhizae
 - Transports sugars to fungi
 - Fungi take sugars, use water to digest
 - Water taken up by trees at sunrise



Plant selection

- We don't even know what to evaluate for fire
- We can see differences
 - Even then the lists don't agree
 - But they make a very short list
 - 2% of plant species or less
 - Succulents and forbs
 - Urban ecological disaster?
- Plants serve many roles in the landscape
 - Shade is a critical factor in C use
 - Vegetable gardens
- Natives stay hydrated with little water
 - Wildlife benefits
 - Established communities
 - Look south for plant lists





The C challenge

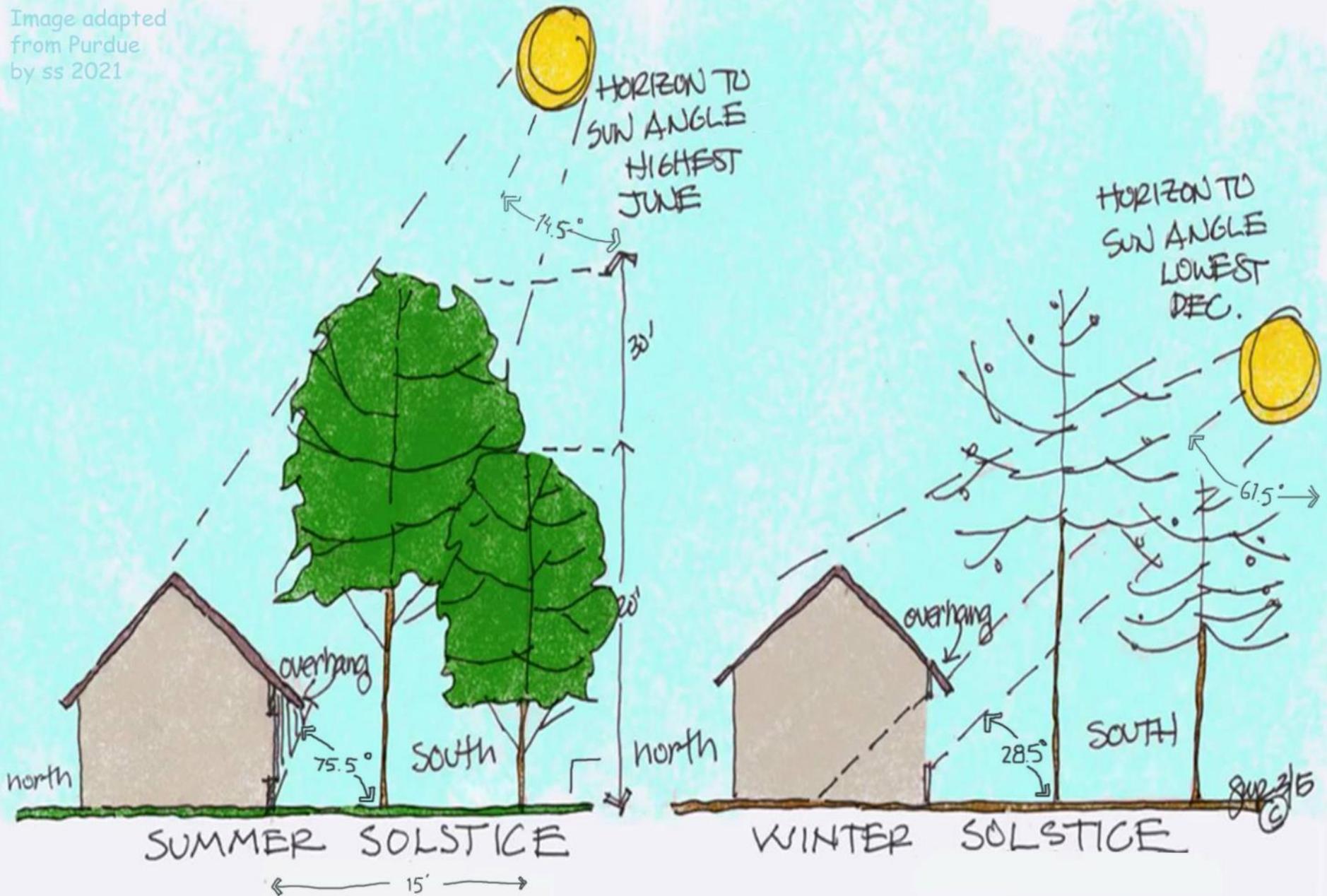
- Global warming
- How to pick plants for an uncertain future
 - Will our future climate be equivalent to a more southern city?
 - Santa Barbara as a proxy for the North Bay?
 - Will our future climate revert to a prehistoric regime?
 - Monsoon rainy season?
 - Engleman oaks?
- Carbon sequestration?

The C challenge

- Urban trees have an outsized C impact
- C sequestration in California summers?
 - Only if there's water (cities?)
 - $6\text{CO}_2 + 6\text{H}_2\text{O} > \text{sunlight} > \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- Placement is key
 - Location specific
 - Generally not on the north or south sides of house
 - Locations west of the house are typically the best
 - Locations east for can work well for deciduous trees



Image adapted from Purdue by ss 2021



Where does the fire start?

- So, if you want to save your house, don't start with the plants
 - Start with the house.
- Because the biggest threat to the average home isn't the plants.
- It's the (your) house itself. Really.
 - <https://ucanr.edu/sites/fire/Prepare/Building/>
 - And if it isn't your house ...
 - *It's your neighbor's house.*

It's about community

- The biggest threat from a wildfire?
 - Embers
- The biggest threat from an *urban* fire?
 - Your neighbor's house?
 - How do we fight fires as neighborhoods?



It's about community

- Neighborhood planning
 - Neighborhood meetings
 - Community gutter cleaning?
 - Escape routes
 - More than one!
- City planning
 - Roads
 - Building standards
 - Permits



Table 2. WUI Types classified by structure separation distance (SSD) and typical parcel size.

Type #	WUI Type Name	SSD (ft)	Typical Parcel Size (ac)	Typical Housing Density (struct/ac)
1	High Density Interface – Perimeter	6 ^a to 30	< 0.5	2 to 8 +
2	High Density Interface – Interior ^b	6 ^a to 30	< 0.5	2 to 8 +
3	Medium Density Interface – Perimeter	30 to 100	0.5 to 1+	< 2
4	Medium Density Interface – Interior ^b	30 to 100	0.5 to 1+	< 2
5	Medium Density Intermix	30 to 100	0.5 to 1+	< 2
6	Low Density Interface	100+	1+	< 1
7	Low Density Intermix	100+	1+	< 1

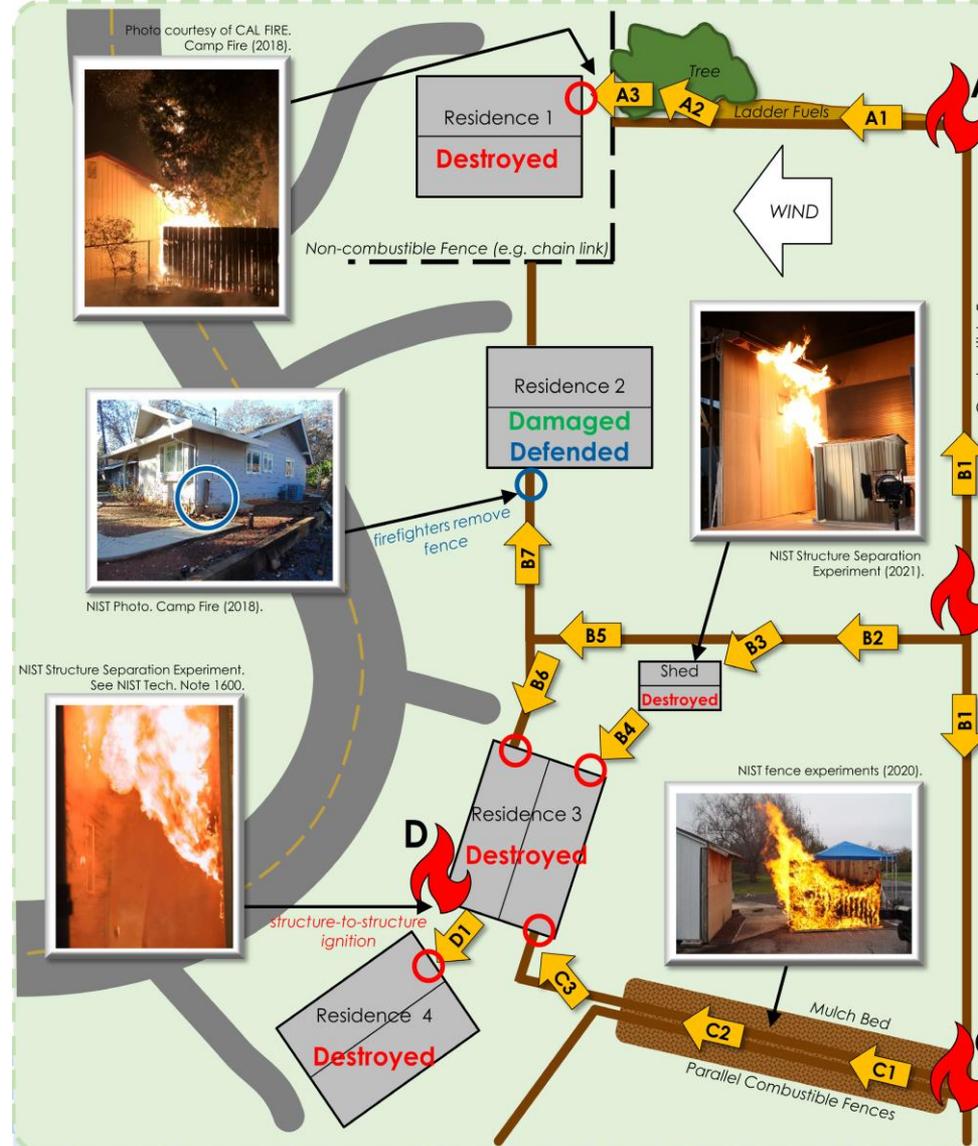
For SI: 1 ft = 0.305 m, 1 ac = 0.4 ha

^a representative of parcels with a 3 ft setback (common for new construction of sprinklered residences)

^b interior of community defined as > 0.25 mi (400 m) from wildlands

Structure Separation Distance (SSD)

- Houses
- Sheds and other outbuildings
- Significant woody vegetation
- RV's
- Woodpiles
- Other combustibles
- Maximize separation between these (at least 25 feet)
- Fences are conduits. Keep away from structures, or use non-flammable fence materials



Embers can bring fire into communities. Once fire has started, fire spreads along multiple pathways:

A: Spot fire ignites fence, burning along ladder fuels (A1) to larger vegetation (A2), and ignites Residence 1 on adjacent parcel (A3).

B: Fence ignition propagates fire on multiple parcels (B1, B2). Fence ignites shed (B3). Exposures from shed and fence ignite Residence 3 (B4, B6).

Fence ignites Residence 2 (B7). Defensive actions save Residence 2.

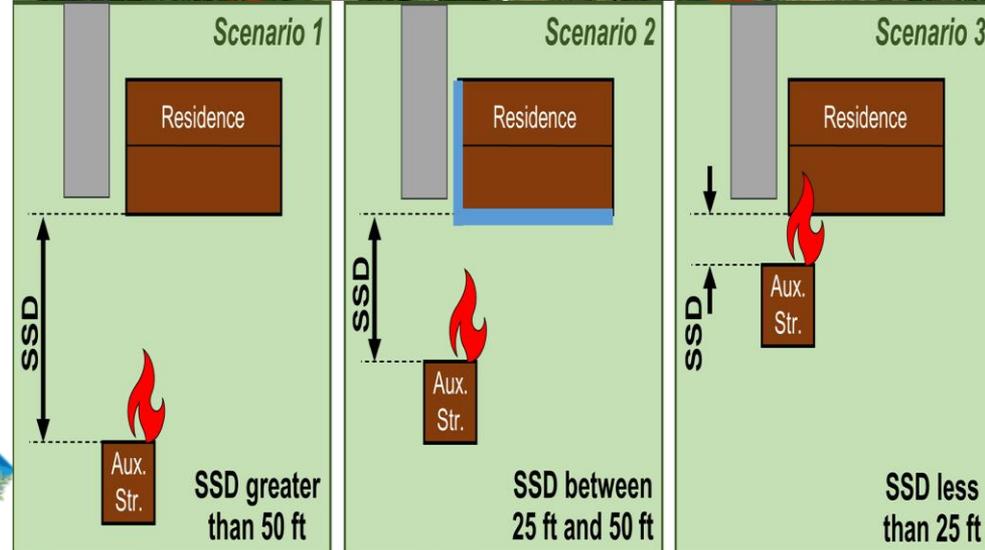
C: Parallel fences on adjacent parcels exponentially intensify fire exposure (C1, C2) which ignites Residence 3 (C3).

D: The exposure from burning Residence 3 ignites Residence 4 (D1).



Key terms

- Example: Interface / intermix
 - Subcategories of WUI (>0.2 HU/acre)
 - Used slightly differently by:
 - Feds
 - CalFire
 - Common interpretation
 - Defined in the document
 - Interface
 - Higher structure density (HU/acre)
 - Smaller SSD
 - Not usually native vegetation
 - Not urban / not high density (= > 8HU/acre)
 - Intermix
 - Lower structure density (acres/HU)
 - Greater Structure Separation Distance (SSD)
 - Usually native vegetation
 - Also not urban / not high density



Intermix



300 ft

Interface



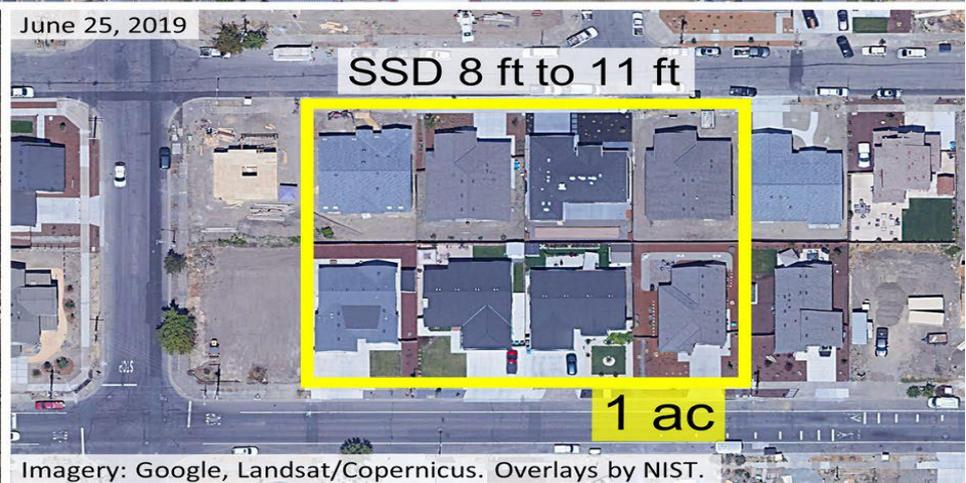
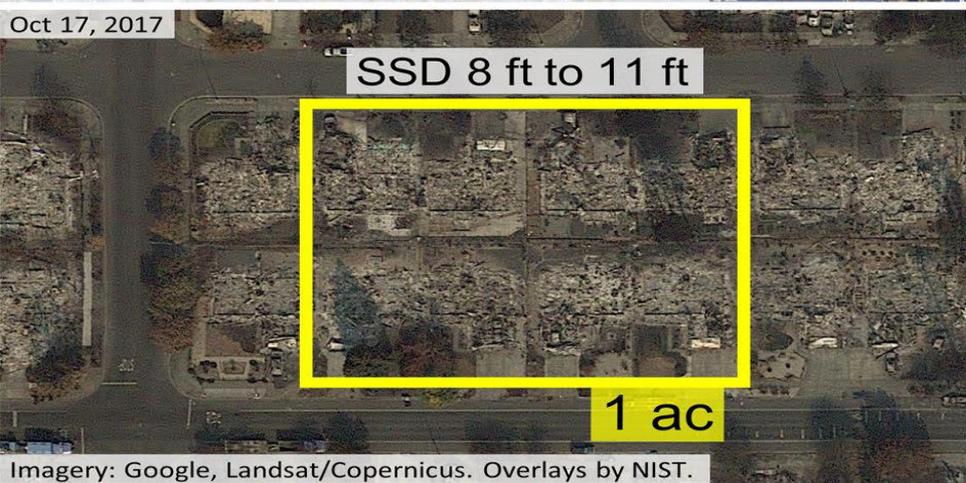


Table 3. Structure and parcel hardening effectiveness.

#	WUI Type	Probability of Structure Survivability if Neighboring Structure Ignites	Potential Fire ^a Exposure from Burning Neighboring Structure	Exposure from Other Parcel Fuels	Exposure ^b from Wildlands	Impact of Structure Ignition on Fire spread in Community	Likely Effectiveness of Partial Structure/ Parcel Hardening	Community/ Neighborhood Participation
1	HD Interface – Perimeter	Low	High	$f(\text{fuels, dist.})^c$	Variable	High	Low	Necessary
2	HD Interface – Interior	Low	High	$f(\text{fuels, dist.})^c$	Low	High	Low	Necessary
3	MD Interface – Perimeter	$f(\text{hardening})$	Moderate	$f(\text{fuels, dist.})^e$	Variable	Moderate	$f(\text{wildland fuels, parcel fuels})$	Desired
4	MD Interface – Interior	$f(\text{hardening})$	Moderate	$f(\text{fuels, dist.})^e$	Low	Moderate	$f(\text{parcel fuels})^d$	Desired
5	MD Intermix	$f(\text{hardening})$	Moderate	$f(\text{fuels, dist.})^e$	Variable	Moderate	$f(\text{wildland fuels, parcel fuels})$	Desired
6	LD Interface	$f(\text{hardening})$	Low	$f(\text{fuels, dist.})^e$	Variable	Low ^f	$f(\text{parcel fuels})$	Desired
7	LD Intermix	$f(\text{hardening})$	Low	$f(\text{fuels, dist.})^e$	Variable	Low ^f	$f(\text{parcel fuels})$	Desired

HD = high density, MD = medium density, LD = low density

$f(X)$ indicates “a function of X ” (e.g., the level of exposure from other parcel fuels is a function of the fuels and distance from the target structure)

^a flames and radiation

^b based on fire history, fuel loading, wind, and topography/aspect; wildland fuel treatments may not be at the control of the community

^c parcel-level mitigation will have limited impact if nearby upwind structures catch on fire

^d would be a function of wildland fuel treatment AND hardening of most/all perimeter structures and parcels

^e parcel-level mitigation, including wildland fuel treatment, together with home hardening, will enhance structure ignition resistance

^f ignitions due to embers from burning residential structures have been observed as far as 200 ft to 300 ft downwind



Puttin' the fence in defensible

- Hedges
 - Not really fire safe?
 - Why not?
- Fire safe zones
 - 0: 0-5 feet from house
 - Ember defense zone
 - Law in 2023
 - 1: 5-30 feet from house
 - Well spaced smaller plants
 - This is sometimes all the space we have!
 - 2: 30-100 feet from house
 - Lucky you (?)

Okay, so what DO we plant?

- There are a lot of factors to consider
 - Water use (local water districts)
 - Invasiveness (Cal IPC, ranchers, parks, water districts ...)
 - Global warming



Natives?

- Already part of an established ecosystem
 - Including mycorrhizal fungi
 - Better network building
 - Many species don't grow anywhere else
- Adapted to local conditions
 - Check your microclimate and soils
 - Normally stay hydrated with average rainfall
 - Hydrated plants are more fire resistant than drought stressed plants
 - Local fauna depend on these species



Other Mediterranean plants?

- Already adapted to our climate
 - May displace natives
 - Not always part of the local ecosystem
 - Exotic Mediterranean plants may be fine in your garden
 - Don't let them out into the WUI or beyond.
- So yes, we can grow just about anything, including
 - Japanese knotweed
 - Blue gum eucalyptus
 - Gorse
 - French broom
 - Etc.
 - So just because we can, doesn't mean we should

Which natives?

- California has myriad local microclimates
- Global warming is likely to shift these
 - Nobody knows for sure exactly how this will turn out
 - Just warming?
 - Weather pattern shifts
 - Monsoon was the weather pattern for much of California 25k years ago ...
 - Disaster for California agriculture?
 - Great news for Engelmann oaks and other relict species



The southern proxy model

- Proxies a southern city to model a shift in climate
- Marin is projected to look like San Luis Obispo area
 - Still zones 14-17
- Coastal influence thins, inland areas go to zone 7



So where does this leave us?

- Water: We need to adapt our plant palette to San Luis Obispo / Santa Maria / Santa Barbara
- Fire: Native species adapted to a future climate
 - better adapted to handle fire
 - Best bets for defensible space
- Native Plants: Focus on the conversion, finding the right plants for the right place



Is the climate model right?

- Nobody's certain
 - Models are just guesses based on best available data
 - Proofing required
 - We'll know what models were right when we get there
- There are a lot of unknowns
 - Historical precedent
 - Monsoon rain patterns?
 - Increased vulcanism?



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