Adrienne Edwards

Faculty Lecturer, Botanist,
Author and Ecologist

California State University,
Chico

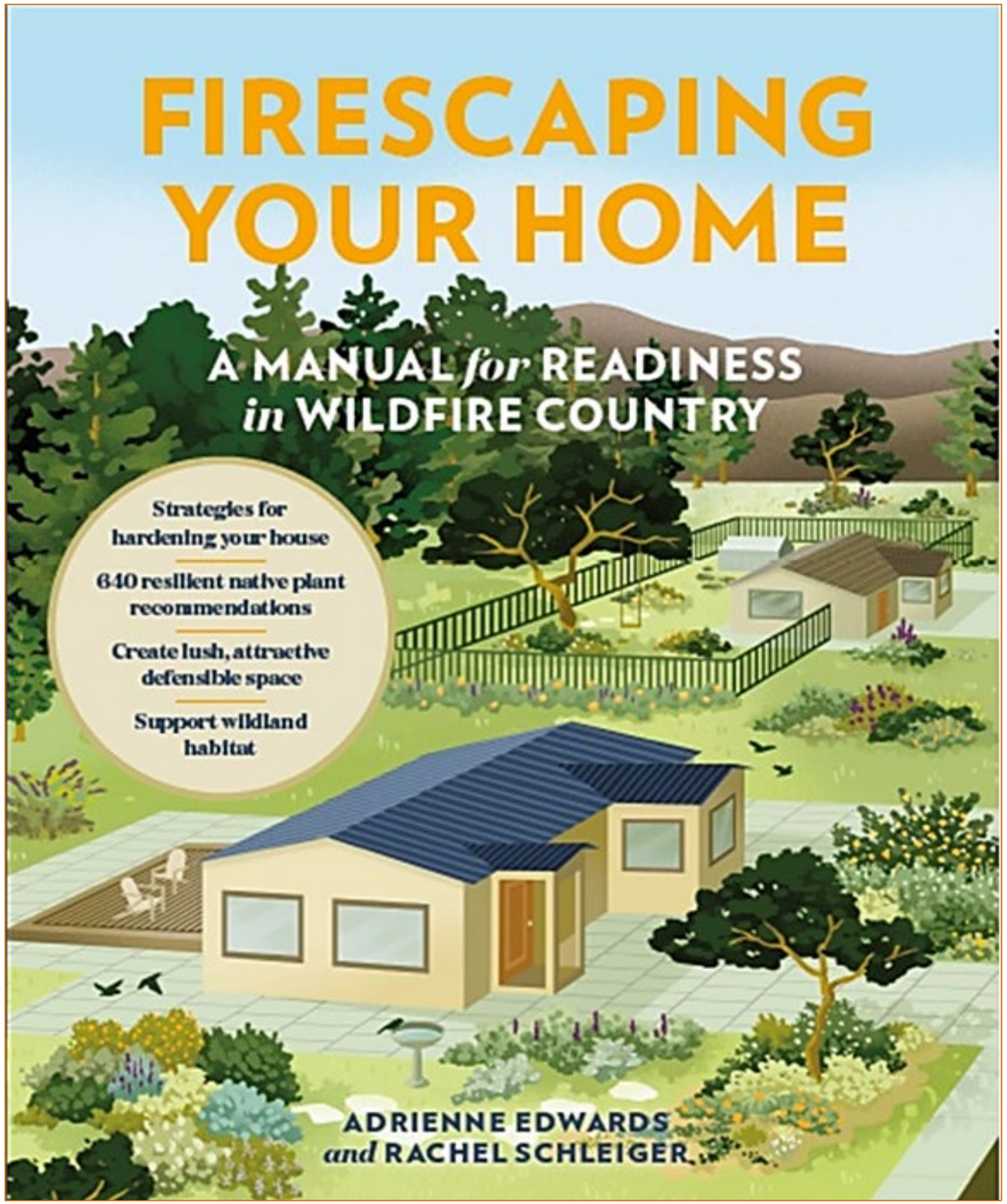
Valley Water

Landscaping Paradigms, Fire, Conservation, & Habitat

How do we live with wildfire

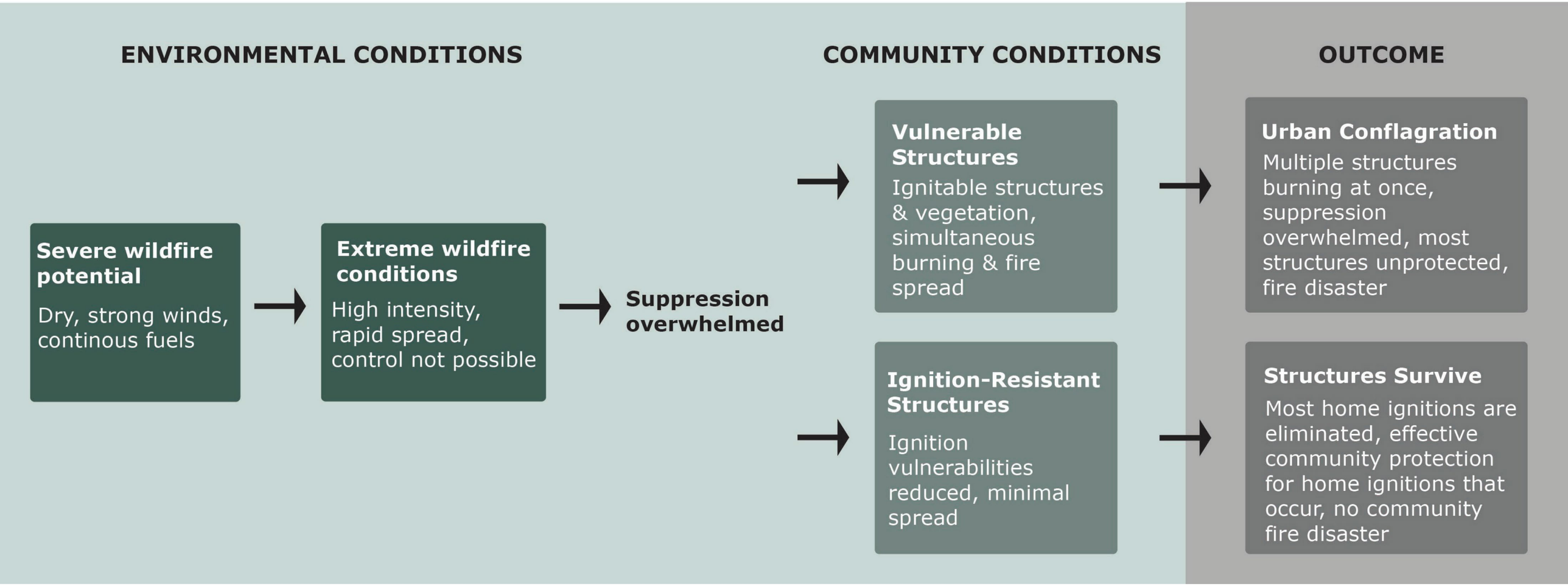
without

destroying the habitats we love?



The community fire disaster sequence

Severe & extreme wildfire conditions set the stage for disaster, but the condition of the community defines the outcome.



SOURCE: Calkin et al., 2023. Wildland-urban fire disasters aren't actually a wildfire problem.

“Wildland-urban fire disasters aren’t actually a wildfire problem.

These problem fires were defined as an issue of wildfires that involved houses.

In reality, they are urban fires initiated by wildfires.” – Calkin et al., 2023

In the built environment, we need to reframe our focus on structures and immediate surroundings, rather than just the surrounding wildlands.

This reframing is also an opportunity to think more intentionally about the purpose of landscaping with fire risk in mind:

1. **Wildlife habitat**
2. **Energy conservation**
3. **Architectural (walls, canopies, defining outdoor spaces), Engineering (reducing glare, changing windflow, soundproofing, erosion control), & Aesthetics (including all the senses!)**

Landscaping Paradigms, Wildfire, & Habitat

How do we live with wildfire without destroying the habitats we love?

Reducing Risks

- Structures & Adjacent Space First

What are the four landscaping paradigms that most affect Defensible Space?

- Foundation Plantings
- Mulches
- Fences
- Wind & Fuels

A New Paradigm: Islands & Bridges

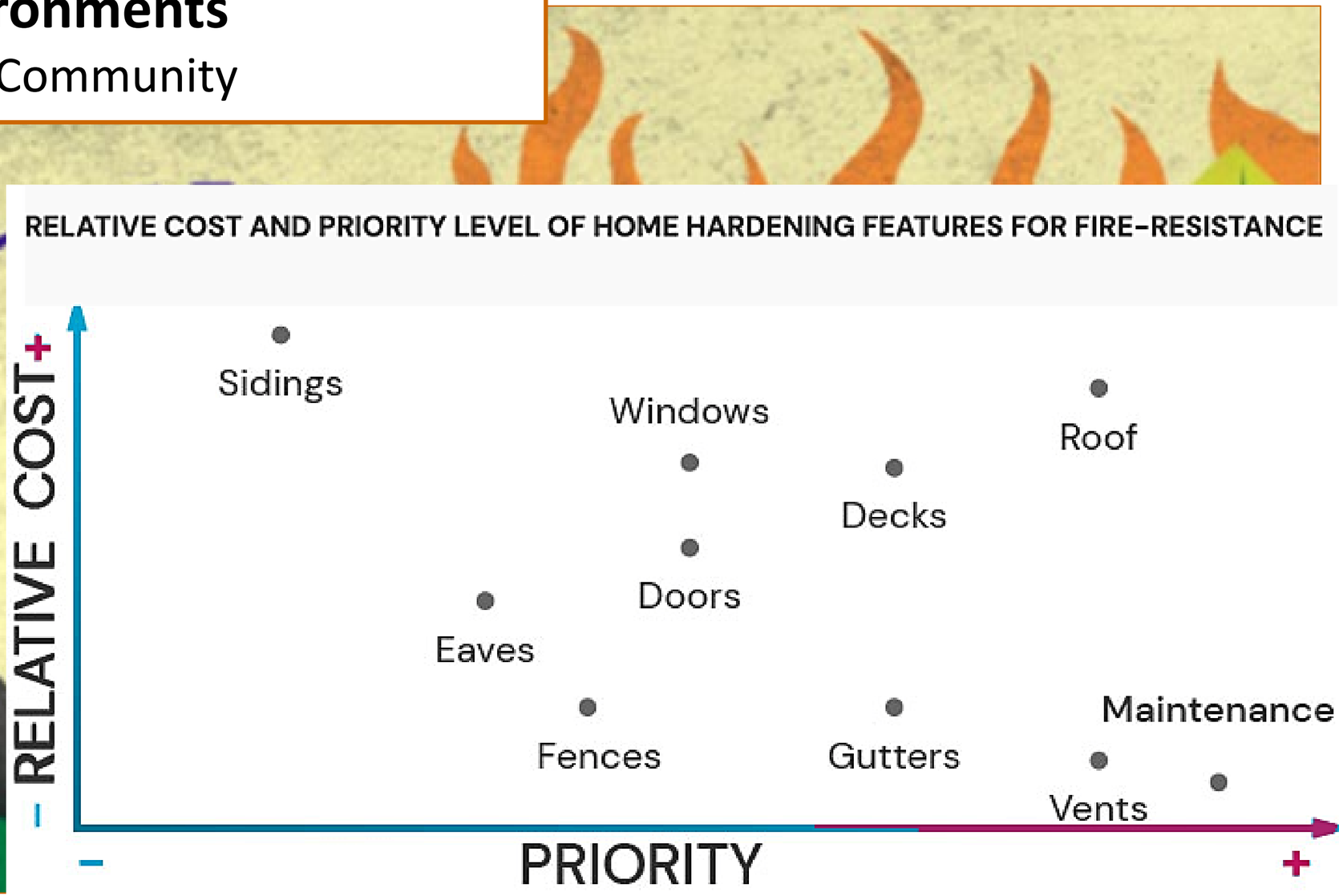
Reducing risks in built environments

1. Home 2. Landscape 3. Community

- **Non-combustible zone: 5-ft minimum**
- **Fire-safe roofing**
- **Community-level wildfire protection strategies**

$$ - California Safe Homes Act (Apr 2025)

Image: https://udrc.org/home-hardening/



Relative cost: Indicates the relative cost of upgrading the listed features to ember-resistant materials and design.

Priority level: Indicated the features most vulnerable to wildfires and embers. Keep in mind each situation is unique and may change your priority level.

Non-combustible Zone: convenient standard for policy & insurance.

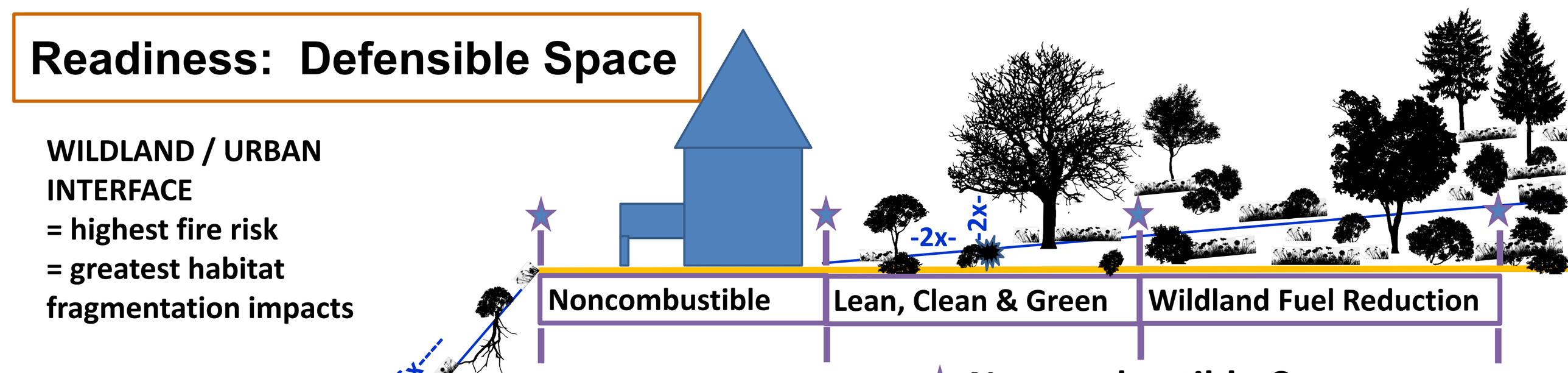
But … hydrated, non-resinous plants are more resistant to ignition than structures, & can act to capture & extinguish embers, or cool adjacent structures . . .
simply because they contain water!

California plan to ban most plants within 5 feet of homes for wildfire safety overlooks some important truths about flammability
Published: June 2, 2025 8:45am EDT

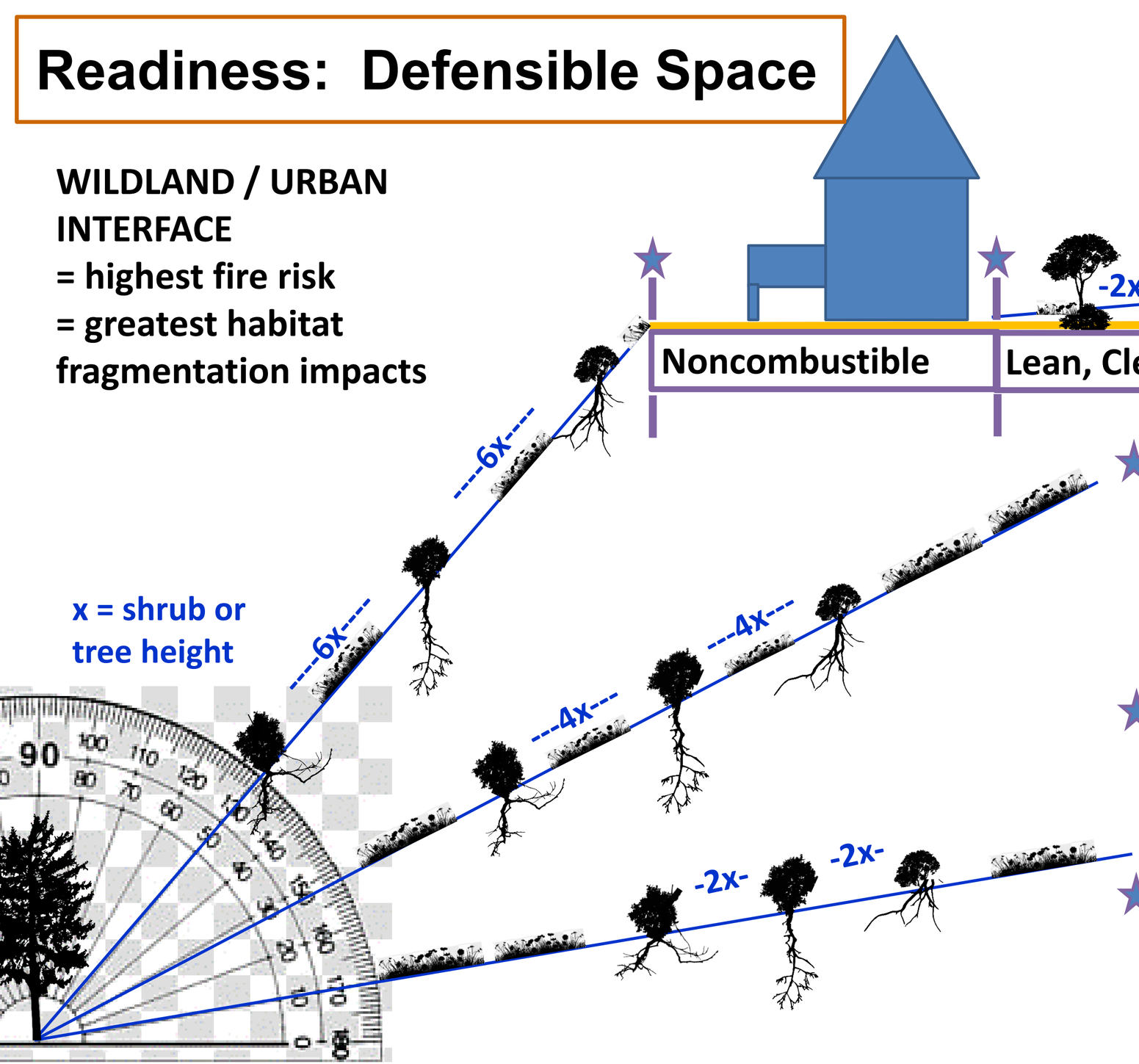
https://theconversation.com/california-plan-to-ban-most-plants-within-5-feet-of-homes-for-wildfire-safety-overlooks-some-important-truths-about-flammability-257109

Readiness: Defensible Space

WILDLAND / URBAN INTERFACE
= highest fire risk
= greatest habitat fragmentation impacts



x = shrub or tree height



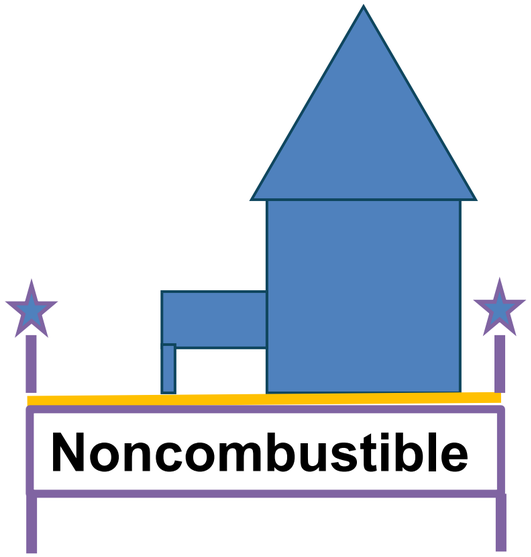
- **Noncombustible & Lean/Clean/Green zones are the most important**
- **Discontinuous fuels reduce fire hazards & still support wildlife**
- **Root architecture of different shrubs/trees stabilize slopes**

Paradigm #1:

Foundation Plantings…

Planting directly adjacent to buildings is a landscaping tradition.

“Non-combustible Zone”: Planting no longer allowed in fire-risk areas if you want insurance.



Psychologically, it is difficult for us to move away from decorating right next to our homes.

New home built in the 2018 Camp Fire footprint. Great fence, sad landscape, backwards thinking.

Foundation planting traditions stem from a desire to

- soften harsh building lines
- cover blemishes
- create a seamless link between house and garden
- add curb appeal

“What it does is set the house on a ruffle of fluffy foliage, or if the plants have been sheared the house sits on an Alice in Wonderland set of machine-like cubes, spheres, and pyramids.”

—Buscher & Carpenter, 1980

chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://archive.lib.msu.edu/tic/wetrt/article/1980mar65.pdf

We must shift away from putting plants (and other combustibles) next to our foundations—

While supporting passive solar strategies and healthy habitat.

SOURCE:
https://formla.com/resources/firesandslides/what-is-zone-0/ --Leslie A Photography

Paradigm #2:
Mulches retain moisture and suppress weeds

What's not to love about that?

"Heaven is under our feet as well as over our heads."
- Henry David Thoreau

NEVER in the Noncombustible Zone:

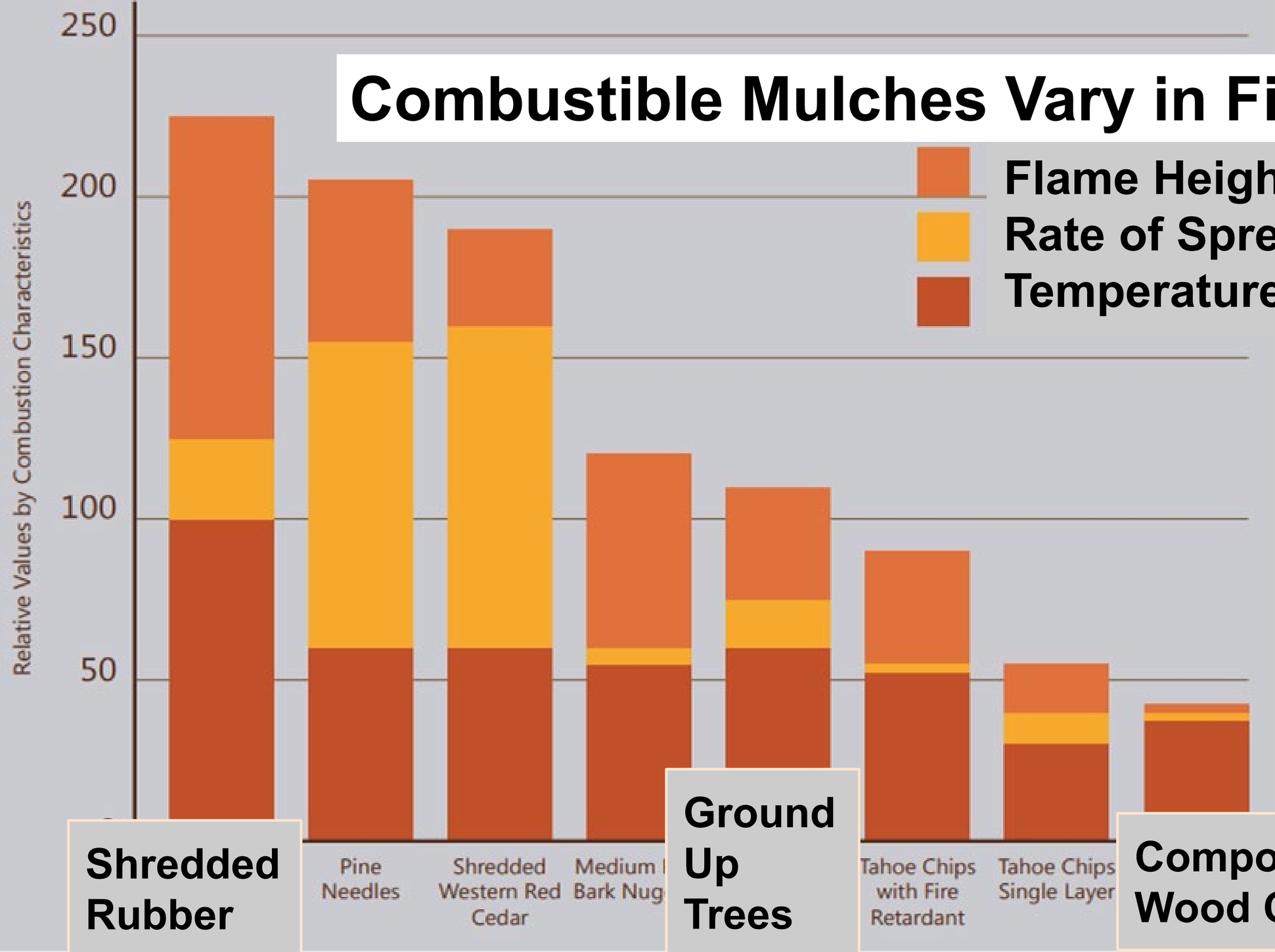
- **Organic mulches**
- **Shredded rubber mulches & landscape fabrics**
- **Astroturf** (may contain flame retardants, but also heavy metals)

Note: Organic mulches are more fire resistant if composted.

Bark mulch in noncombustible zone can cause structure ignition.

https://news.wgcu.org/2023-10-20/with-wildfires-growing-california-writes-new-rules-on-where-to-plant-shrubs

Combustible Mulches Vary in Fire Risk



Shredded Rubber

Ground Up Trees

Composted Wood Chips

Measured at four inches above the bed.

Composted wood with fungi can hold more water.

Fire Safe Marin

https://firesafemarin.org/wp-content/uploads/Mulch-Study.pdf

Non-composted mulches more prone to transition from smoldering to flaming at critical wind speeds, which varied by mulch type.

Larger mulch particle sizes more prone to ignition (more available air spaces).

--Lin et al, 2025. Susceptibility to ignition of landscaping mulches exposed to firebrand piles or radiation https://doi.org/10.1016/j.firesaf.2025.104388

https://www.thespruce.com/rock-garden-ideas-8620748

Mulches and Wildlife:

> 70% of native bee species nest in the ground, digging tunnels in bare soil or between plants.

Many butterfly and moth species use soil & organic matter to overwinter.

Weed barriers & heavy mulch BLOCK insects from accessing soil habitat, and starve soil of organic matter.

Consider incorporating a leaf swale to keep biomass on site but isolated.

"Your leaf litter can be home to a rich assortment of native plants while it is fertilizing, mulching, and watering your land."
— Douglas W. Tallamy

Non-combustible Mulch Options:

Bare soil = habitat, can grow spring ephemerals, low maintenance!

Gravel with no weed barrier = habitat if thin patches

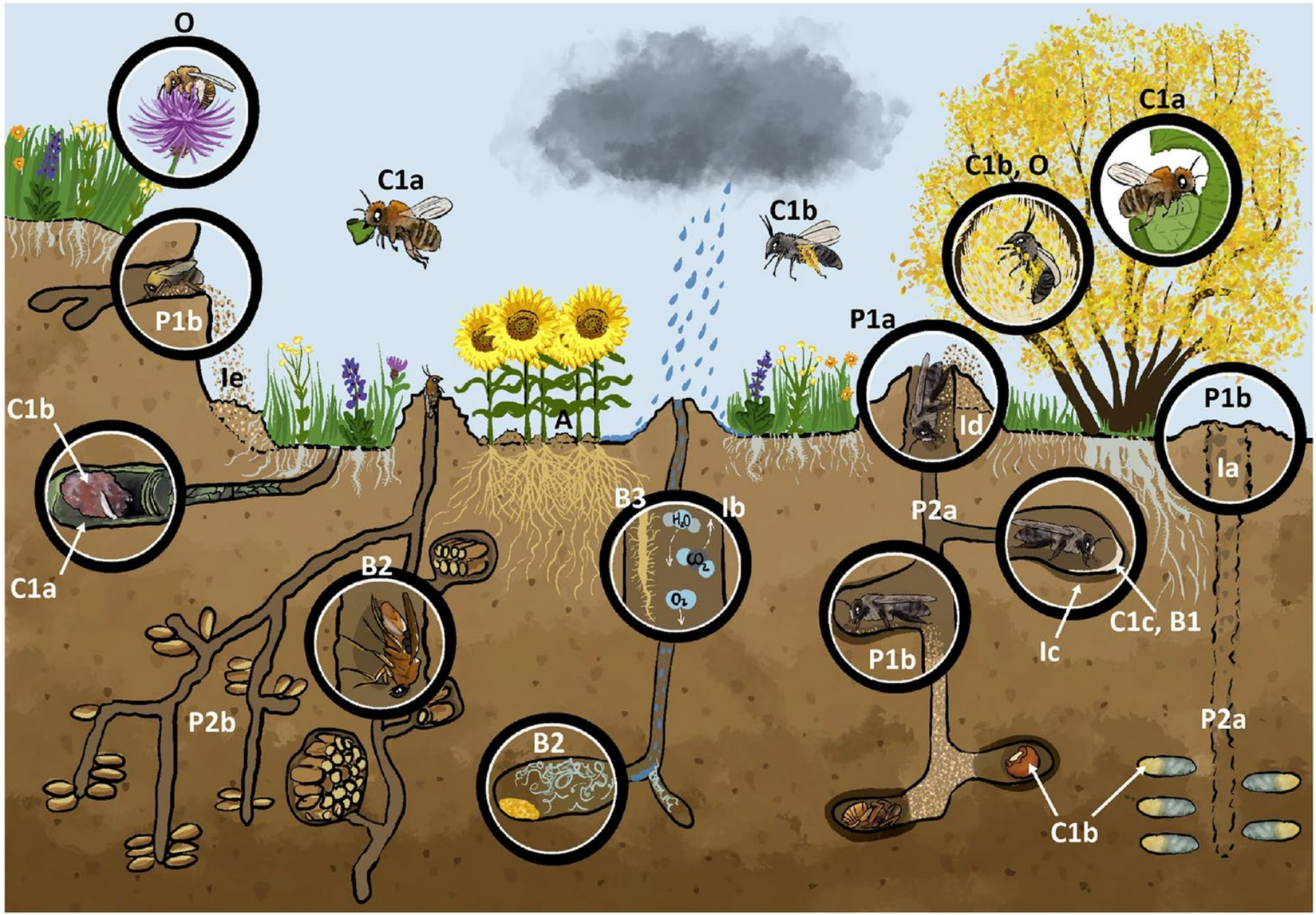
Pavers with spaces between = habitat especially along edges

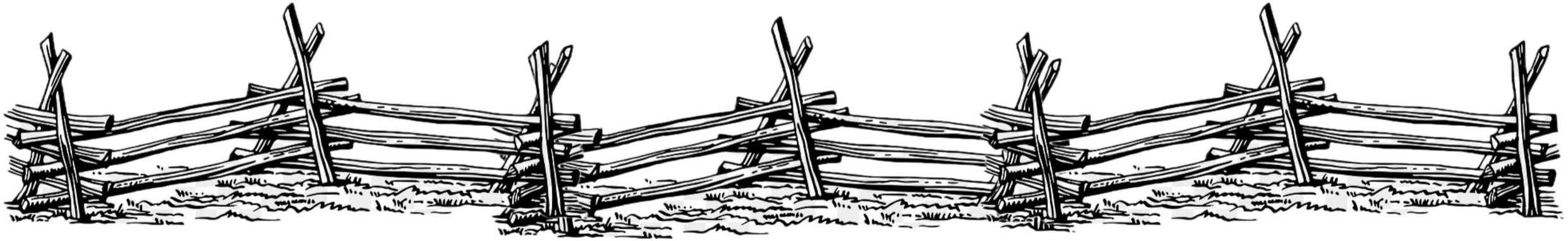
Decomposed granite (DG) = no habitat, most carbon intensive

Consider targeting irrigation in summer to control weeds

Ground-nesting bees positively affect physical (P), chemical (C) and biological (B) properties of soil.

Tschanz et al., 2025.
Beyond pollination – The neglected contribution of ground-nesting bees to soil functions, https://doi.org/10.1016/j.baae.2025.02.003





Paradigm #3:
Fences

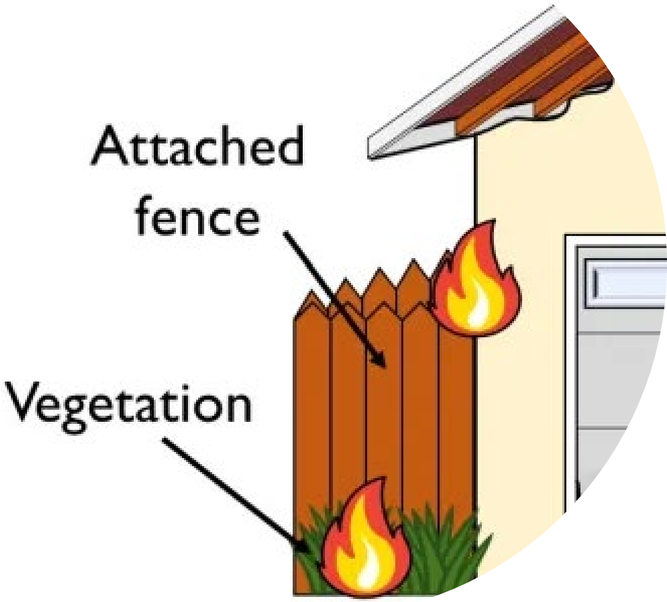
Why and when do we need fences?

"Fences make good neighbors."
–Mending Wall, Robert Frost

Why and when do we need fences?

- Influence how we experience our surroundings
- Manage personal and social boundaries, pets, and affect social relationships.
- Often installed with little consideration for how they affect us, or our environments.

https://bigjerrysfencing.com/fences-and-neighbors-what-should-you-do/

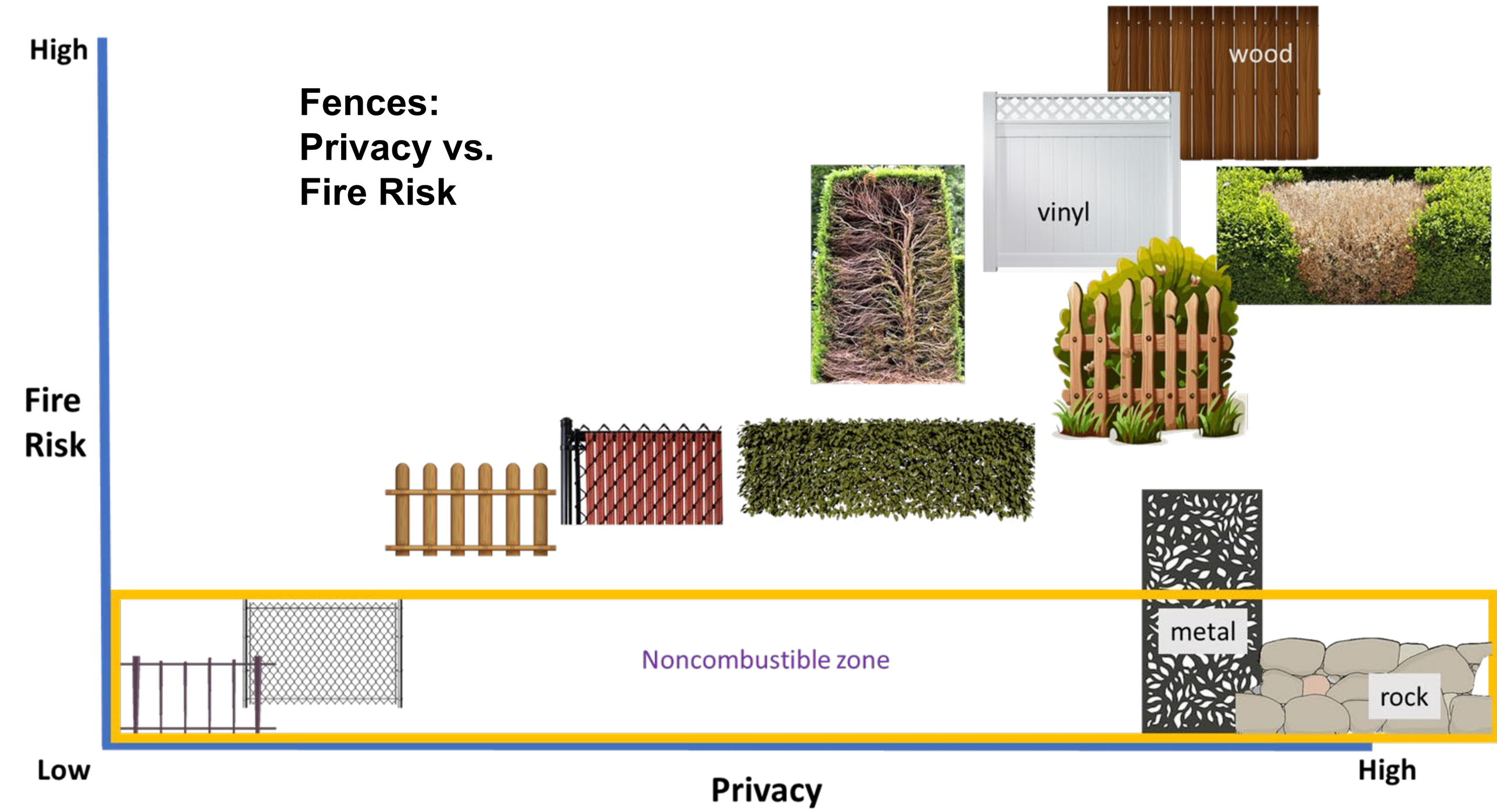


Fences, like landscaping, should consider needs, habitat, and fire safety.

Fences, like landscaping, should consider your privacy/security needs, community, and fire safety.

Maybe we’re going a little overboard?

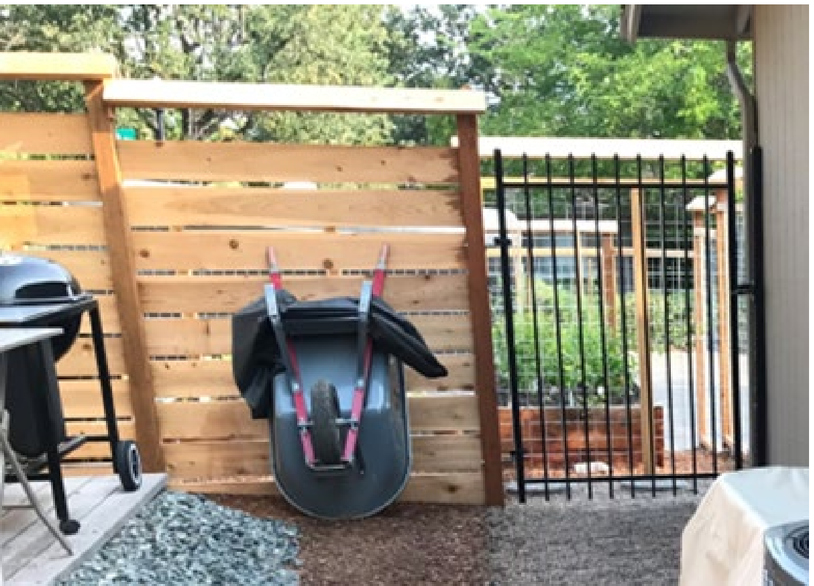
Fences: Privacy vs. Fire Risk

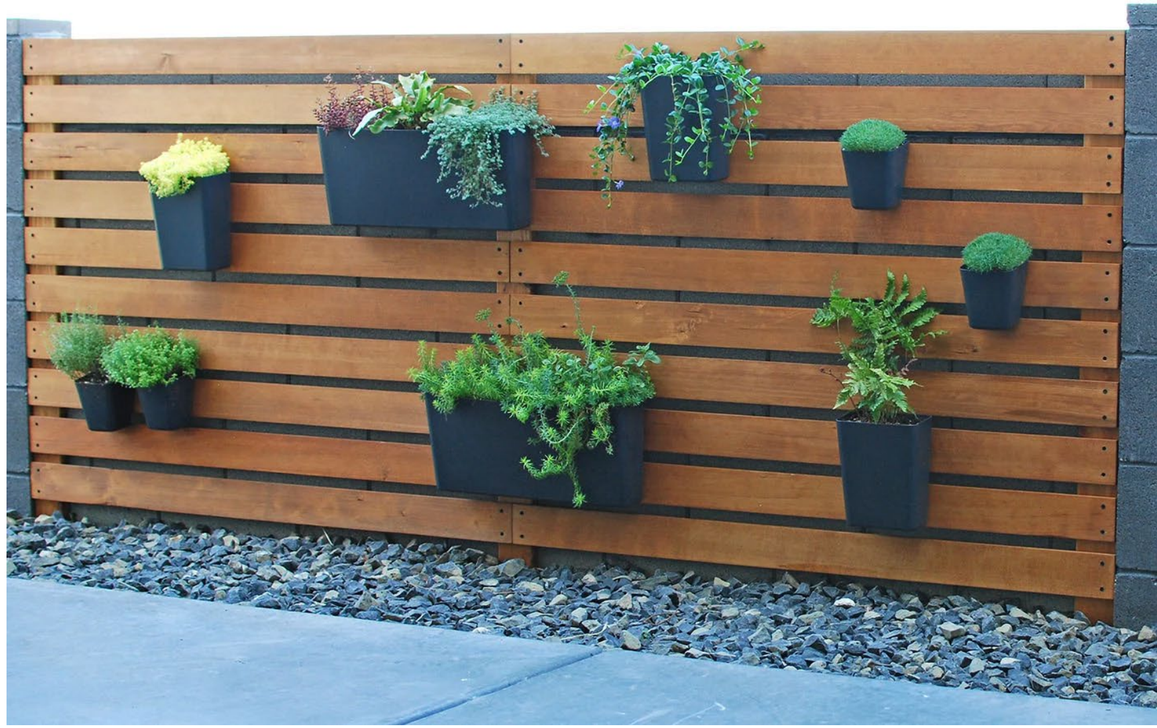





Corrugated metal roofing material + wood/metal framing

Metal for fencing or wood/metal combo (Corten, Sleekfence, etc.)





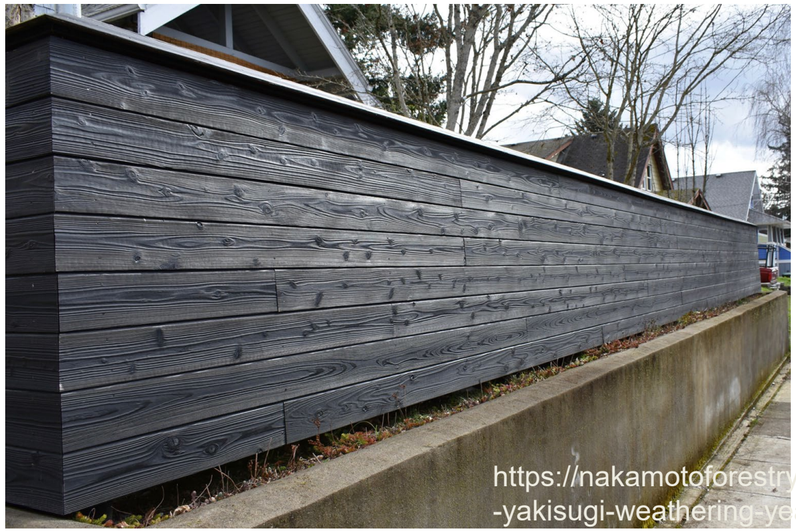
Living fences, combo rock & earth berms - lean & green

(Plastics & vinyl fencing melt & combust!)

Modified Wood Fence Example → Charing technique, Yakisugi (Shou Sugi Ban):

- Fire resistant: harder to ignite, sheds fewer embers
- Water resistant
- Resistant to insects and rot

Why? Charring burns off celluloses but leaves behind lignins, which require a higher ignition temperature.



Wood with high tannin content can also have lower flammability; when charred, tannins form more fire-resistant graphene.

Defensive Space & Fences:

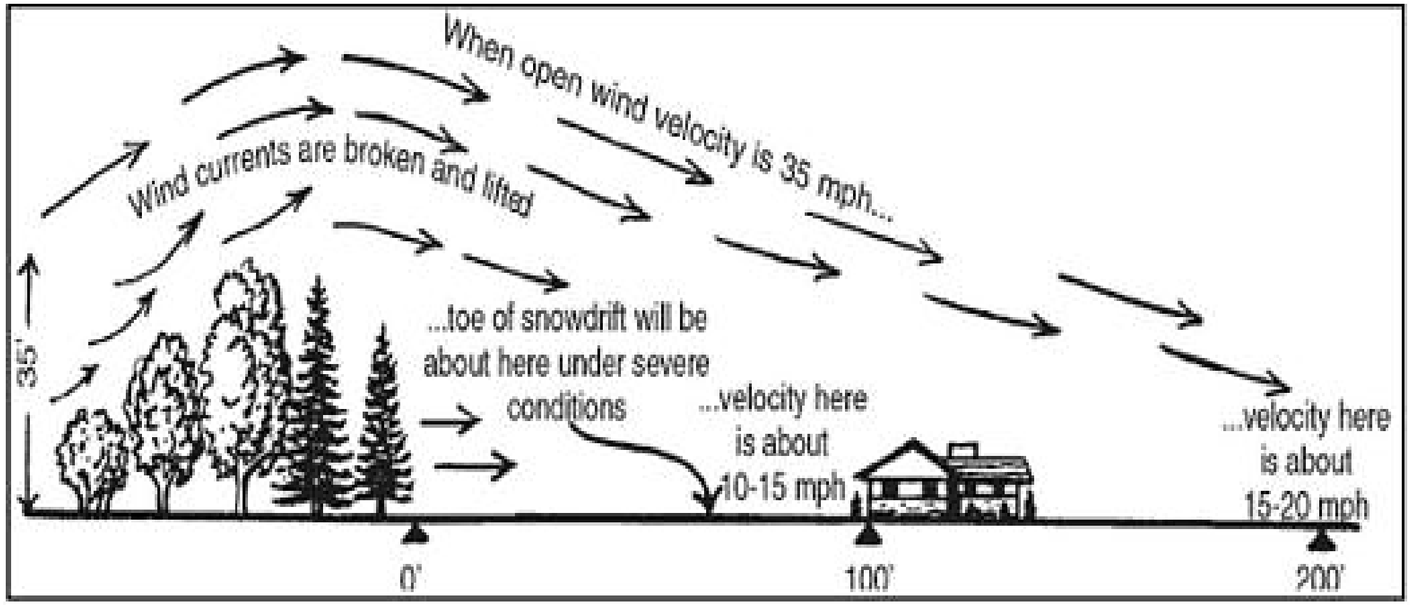
Noncombustible zone:

- None, rock, or metal

Lean, Clean, & Green:

- Balance privacy/security versus combustibility/habitat → consider breaking up horizontal fuels
- Rock walls & living fences create habitat
- All must be managed for debris during fire season

What's wrong with this picture?



Paradigm #4:

Fuels dictate fire behavior on our landscapes

What about wind?

Wind is the primary factor influencing fire spread.

Wind Apps/Websites for Overall Wind Patterns

Wind is the primary factor influencing wildland fire spread*.

- **Windfinder (preparation)**
- **Windy (preparation)**
- **Watch Duty (during a fire)**

***The number of homes destroyed by wildfires has doubled over the past 30 years, and most of them were in grasslands and shrublands, not near forests.**
– Radeloff et al., 2023. DOI: 10.1126/science.ade9223

Knowing prevailing winds is as important as taking solar exposure into account.

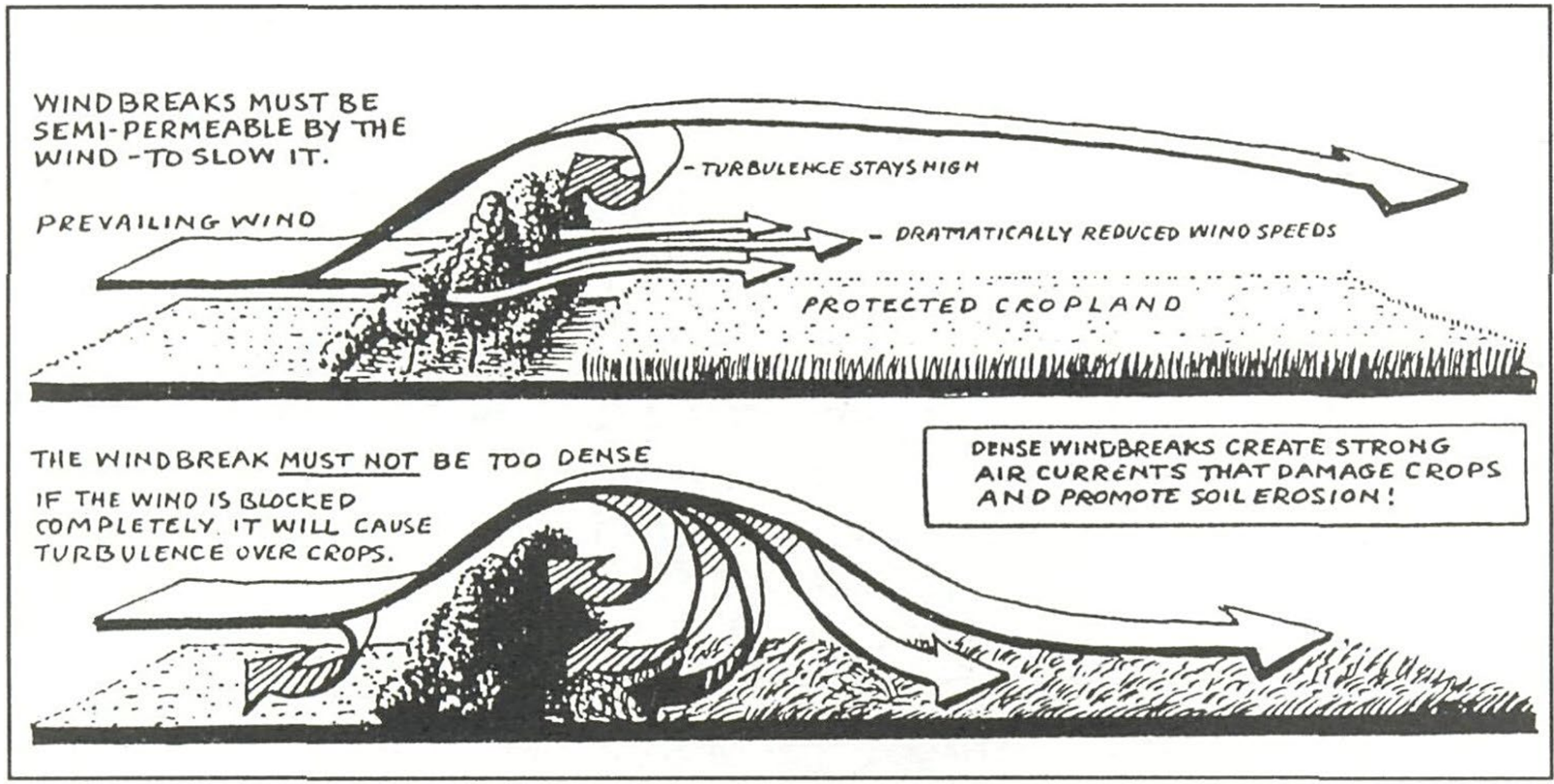
Besides shade, trees and shrubs can change wind patterns and serve as “fire shelterbelts” that may decrease ignition potential or give more time to evacuate.

Windward wind speeds are reduced 2-5x windbreak height.
Leeward wind speeds are reduced up to 30x the height of the windbreak.

A tree and shrub shelterbelt with 40-60 percent density provides the greatest area of downwind protection, while minimizing wind turbulence.

Denser windbreaks protect a smaller area, but with greater wind speed reduction (and increased eddy formation).

Solid walls cause turbulence that can simply stir embers and debris together into an ignition free-for-all.



Remove all the trees & shrubs around our homes?

No! Here are some questions to consider regarding plant health and wind movement/abatement.

What kind of trees?	No conifers, no resinous junipers & eucalyptus, no palms	Oaks are great!
What is the condition of each tree?	Limbed up at least 6-10 feet; lean, clean, & green!	Healthy = Greater fire resistance
Are there ladder fuels adjacent?	No fire-season vegetation connecting to the trees	Consider 2-3x spacing vertically and horizontally
How do winds flow around tree?	Direction? Intensity? Influence?	Trees & shrubs can reduce wind intensities

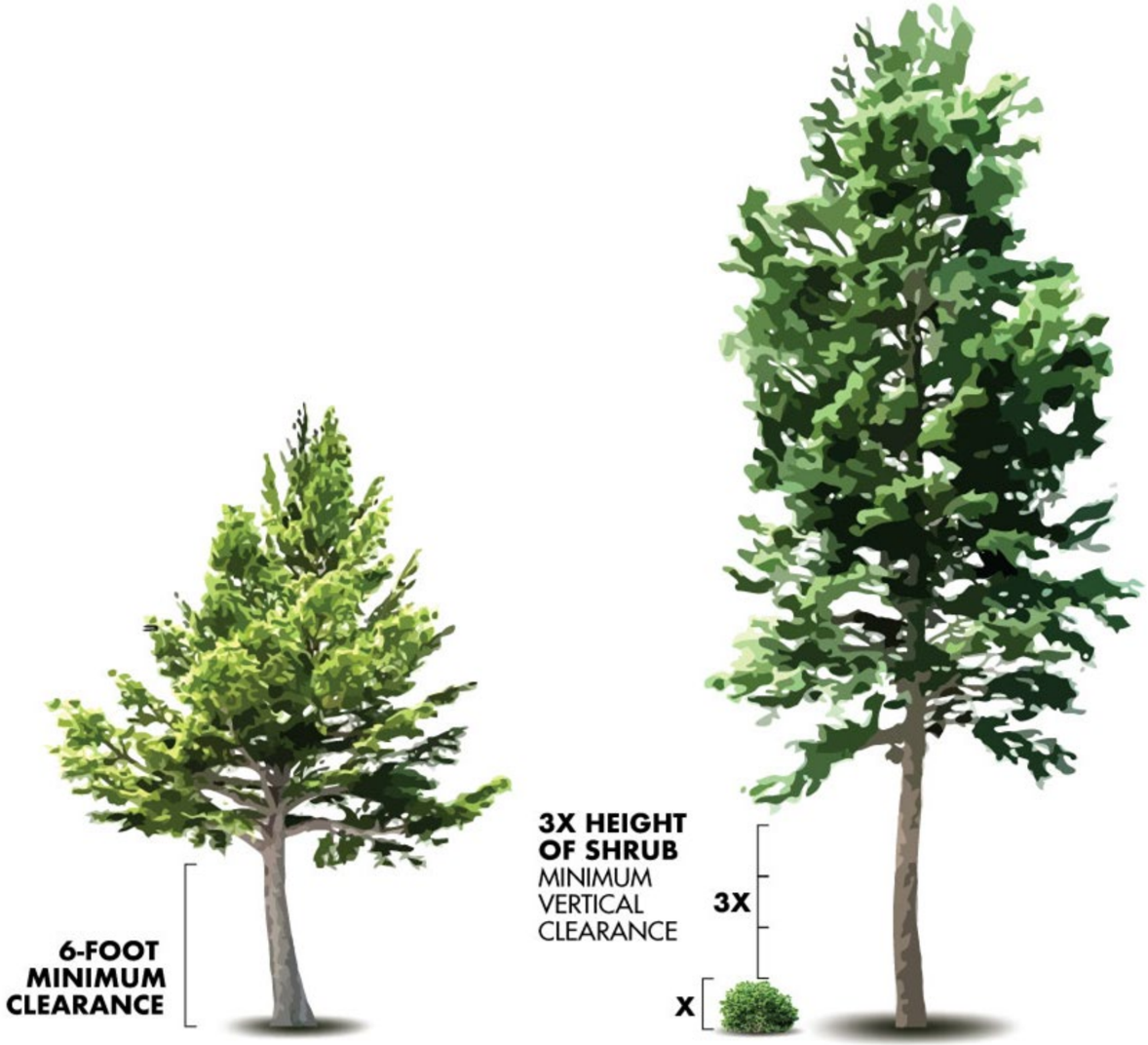
SPACING: follow horizontal and vertical guidelines to deprive fire of fuel

THINNING: cut out dead materials and thin for good air flow

Keep in mind that dead snags & logs can provide habitat too, isolated & away from structures.

https://www.youtube.com/watch?v=mpkCs7KJBFc

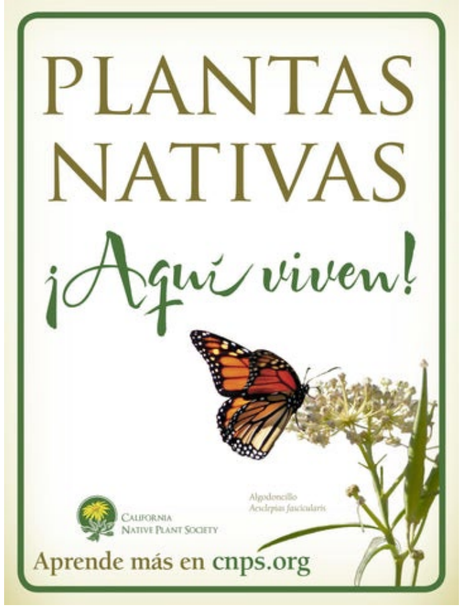
Negative space is just as important in landscaping as in art!

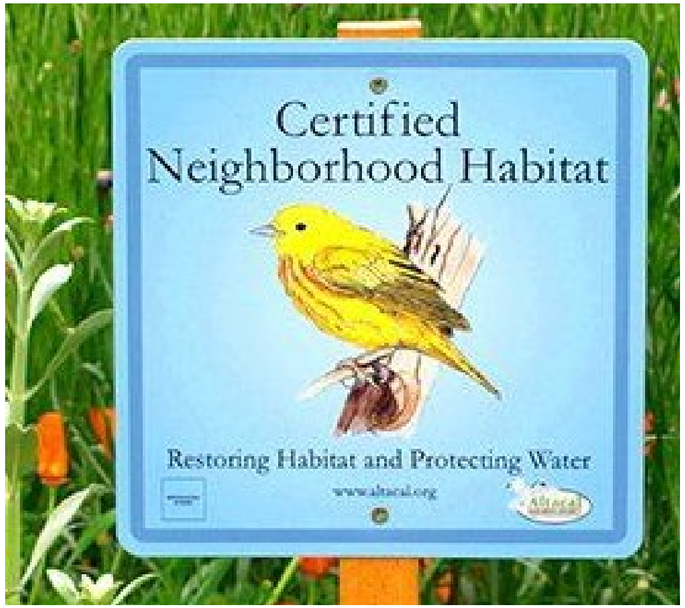


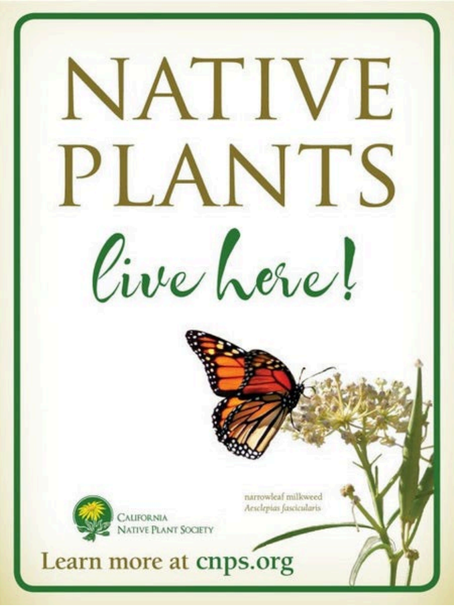
FireSafe Marin

This oak canopy slowed down winds and captured embers, perhaps saving this wood frame house from a 2017 wildfire in Sonoma Co.

This oak canopy slowed down winds and captured embers, during the 2018 Camp Fire, but the understory was clean!







A New Paradigm: Islands & Bridges

Are we helping or hurting our wildlife neighbors?

We fragment the wildlands that we love:

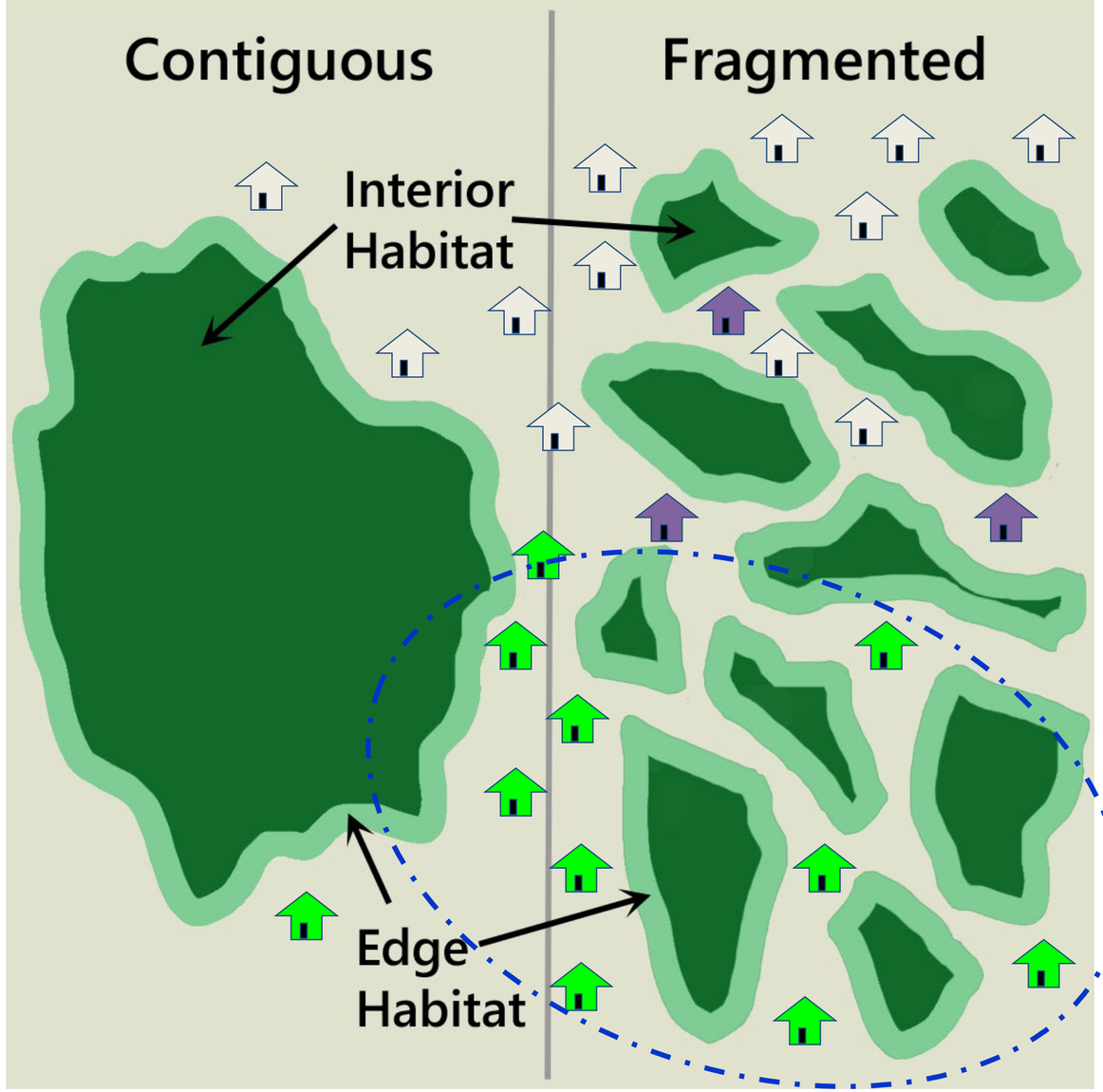
Habitat fragmentation is the #1 driver of biodiversity loss.

Creating habitat islands & bridges in our yards can mitigate biodiversity loss.

Habitat Fragmentation occurs when large, contiguous habitats get divided into smaller, isolated patches.

How can we mitigate for habitat fragmentation?

- Pollinator “desert”, highly irrigated, no resources
- Pollinator “poison desert”, pesticide use
- Pollinator oasis, no pesticides



Our “Built Environment” could provide stepping stones for wildlife… rather than inhospitable corridors

What kind of habitat does this provide?

Pollinator desert, highly irrigated

Pollinator desert, pesticide use

Pollinator friendly habitat

Commonly available nursery plants may contain systemic pesticides like neonicotinoids that sicken or kill pollinators.

Roundup disrupts pollinator physiology, development, & behavior.

Excess fertilizer makes plants less drought tolerant.

Why do we need to provide habitat?

~75% reduction in insect biomass since 1970 in some protected areas

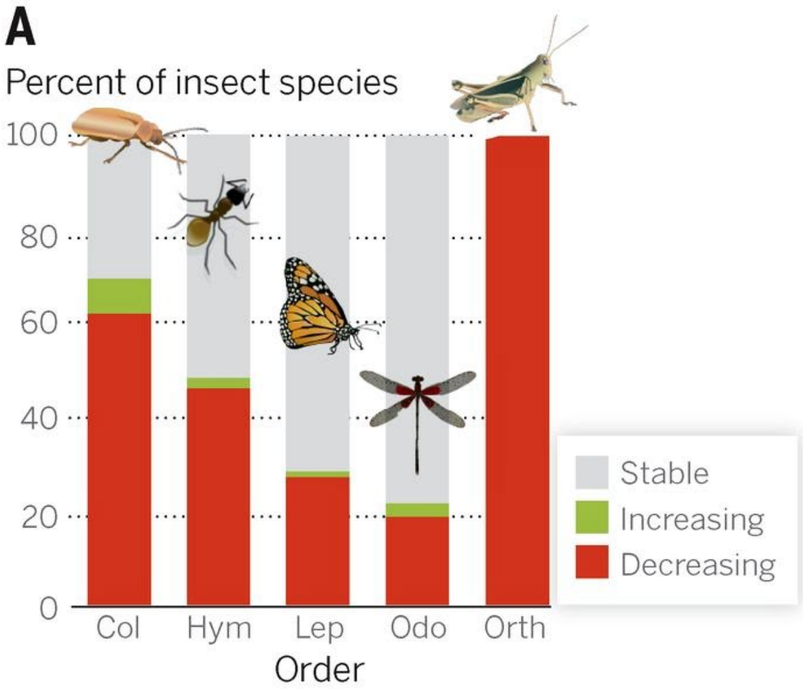
(Dirzo et al., 2014)

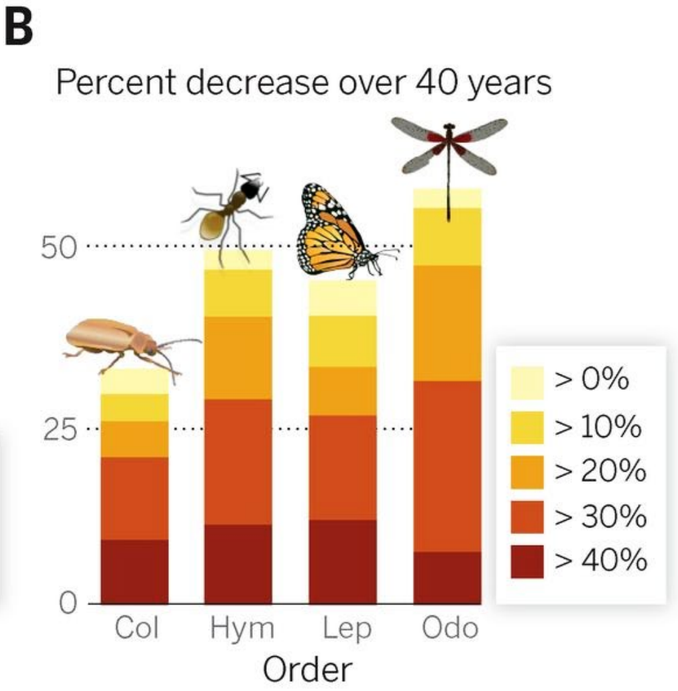
Biggest insect declines in developed areas

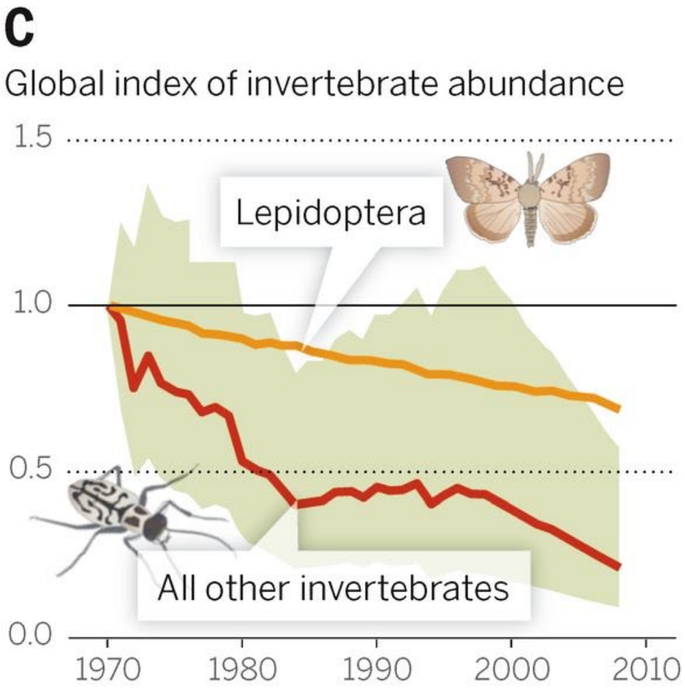
(Wagner et al., 2021)

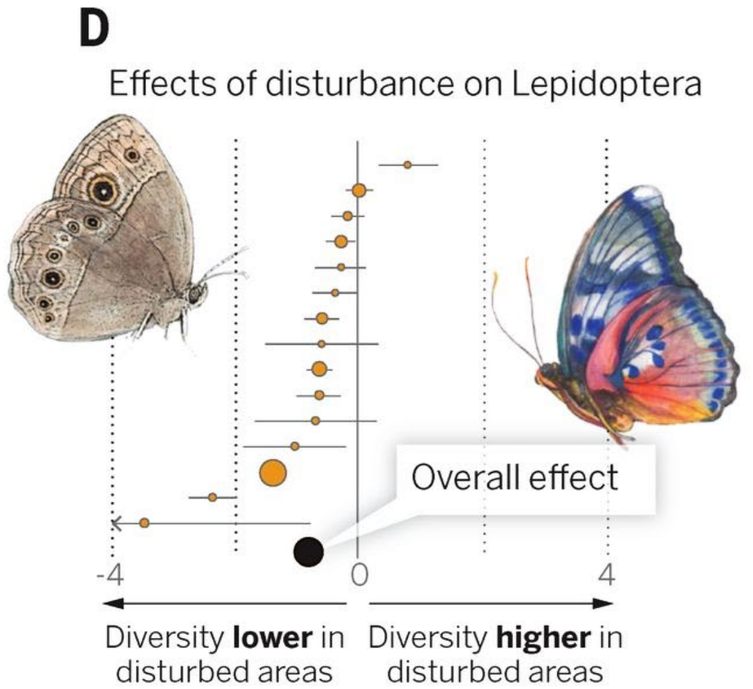
Disproportionate declines of formerly abundant species underlie insect loss

(van Klink et al., 2023)





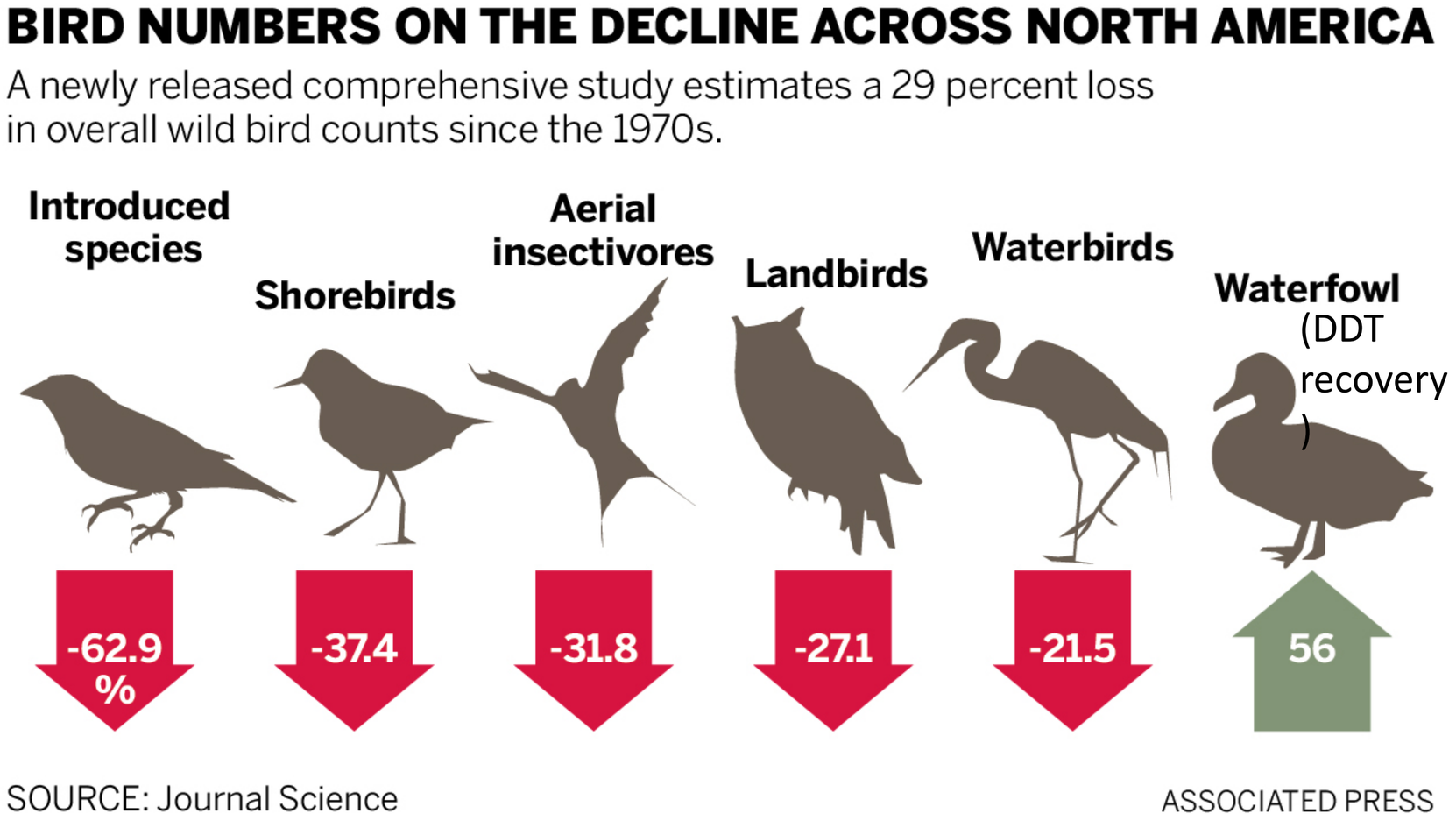




Why do we need to provide habitat?

~75% reduction in most bird populations since 1970

(Rosenberg et al., 2019)

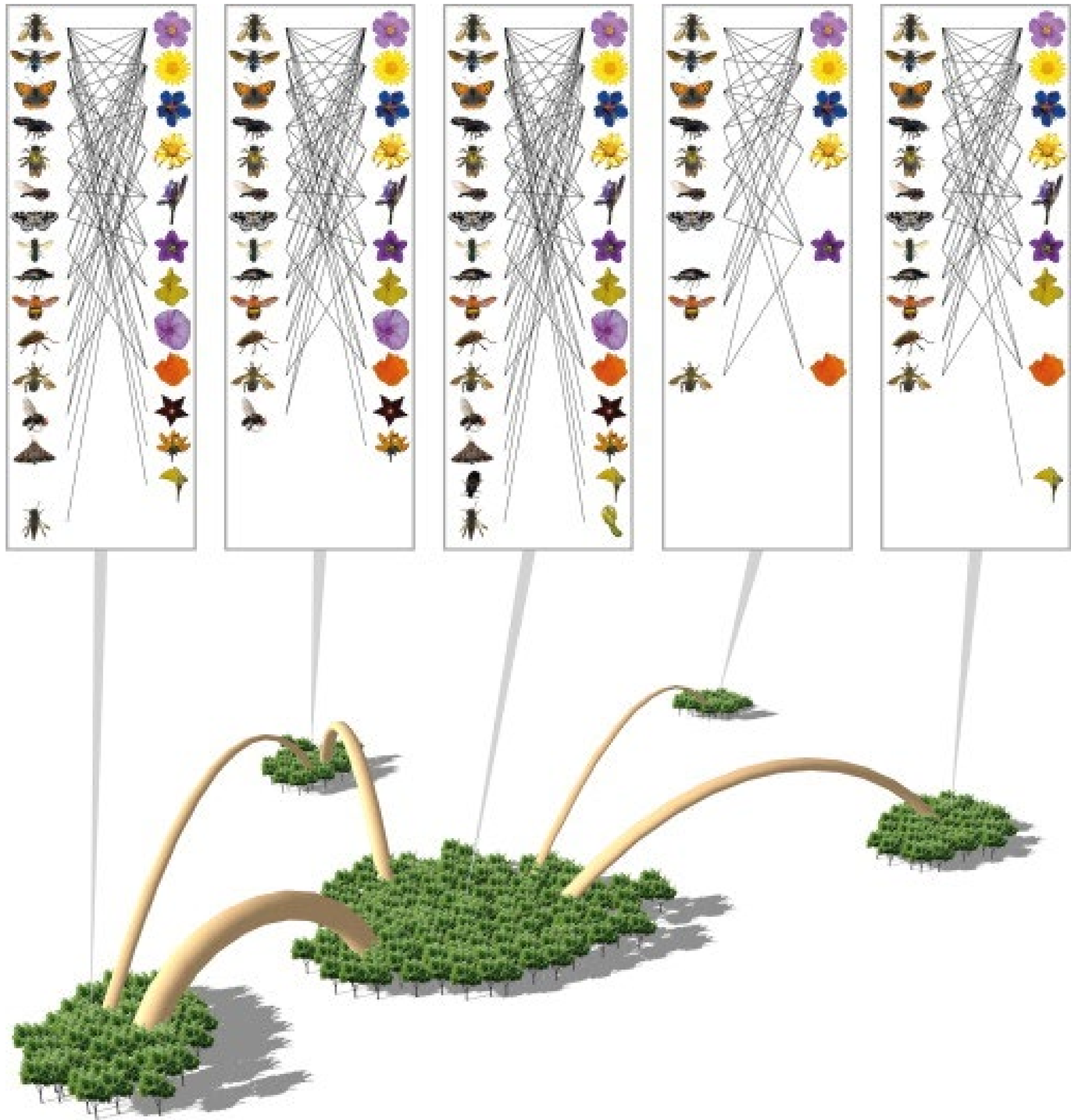


Why do we need to provide habitat?

Extinction of species interactions

Fragmentation reduces number & diversity of interactions

(Hagen et al., 2021; Valiente-Banuet et al., 2019)



Habitat island plantings:

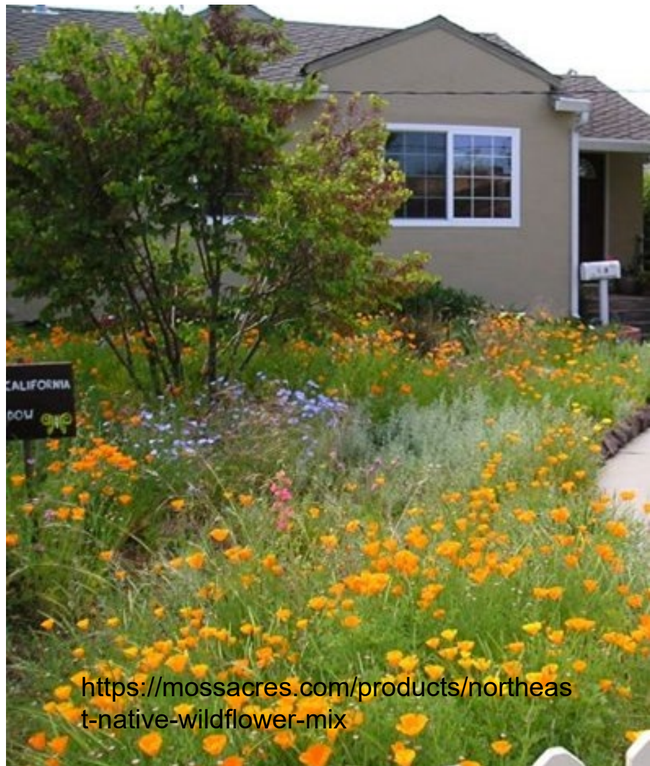
Can capture embers, slow winds, and break up fuels

Can be seasonal, or mature & fire resistant

https://www.postindependent.com/news/local/fire-wise-landscaping-protect-your-home-this-wildfire-season-by-creating-defensible-space/

https://www.quora.com/Can-Redwood-trees-grow-anywhere-except-for-where-theyre-growing-right-now

https://www.thecooldown.com/green-home/natural-lawn-reddit-user-no-grass-wildflowers/



https://mossacres.com/products/northeast-native-wildflower-mix

- **PLANT SELECTION: No plant is fireproof, but some increase fire risks**
  - **Fast-growing, non-native plants are common in big-box nurseries**
  - **Many treated with pesticides that can persist in plants for years (ex: neonicotinoids, & even Roundup in dead tissues)**

EXAMPLES: Highly Flammable – and poor habitat!

Mexican feather grass
Stipa* (syn. *Nasella*) *tenuissima

carpet junipers
***Juniperus communis* & other hybrids**

Palm trees (California, date, etc.)
Washingtonia filifera, Phoenix dactylifera, etc.)

Italian cypress or any conifer
Cupressus sempervirens

Images: Wikipedia, A.Edwards, Las Vegas Review-Journal, BrighterBlooms

Oleander: Promoted by some as fire resistant

Oleander is drought tolerant & can hold moisture in leaves when young but can also be quite flammable!

- **Toxic to humans, livestock, & many insects**
- **Host of pests like glassy winged sharpshooter, which can spread diseases to agriculture crops**
- **Accumulates dead leaves and stems**
- **Flammable oils and resins**

➢ PLANT SELECTION: No plant is fireproof

- Fire resistant plants are difficult to ignite
- Fire retardant plants can catch burning embers without catching fire (at least for a while)

Fire Resistant / Retardant Natives

California lilac
***Ceanothus* sp.**

Limbed up, with no fuels beneath

qual bush
Atriplex lentiformis

Maintained, high salt content in leaves reduces ignitability

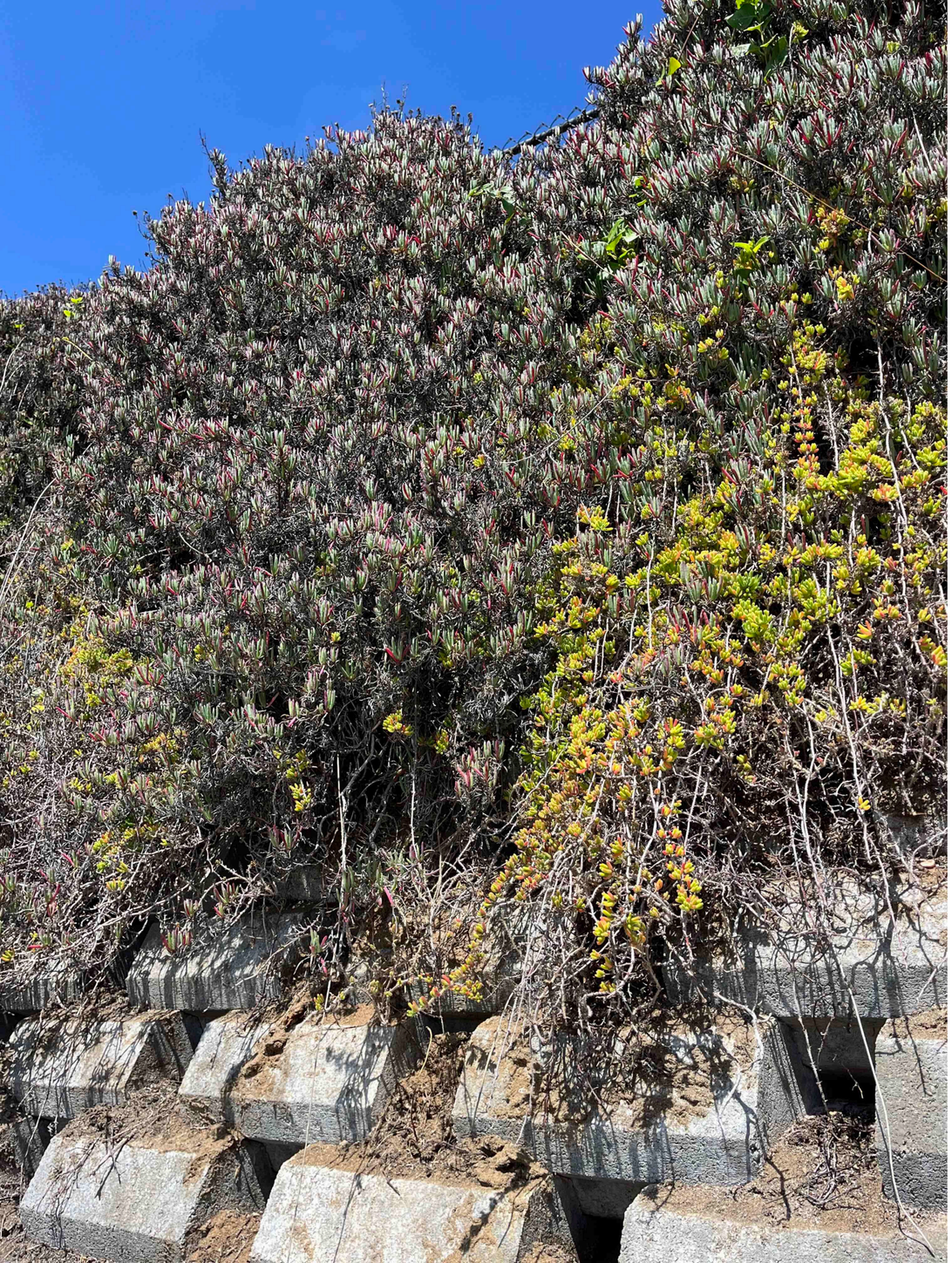
broadleaf stonecrop
Sedum spathulifolium

Succulents, but clear of dead tissues

Native spring bulbs, poppies
Douglas iris
Iris douglasiana

Merely clear out dead tissues prior to fire season

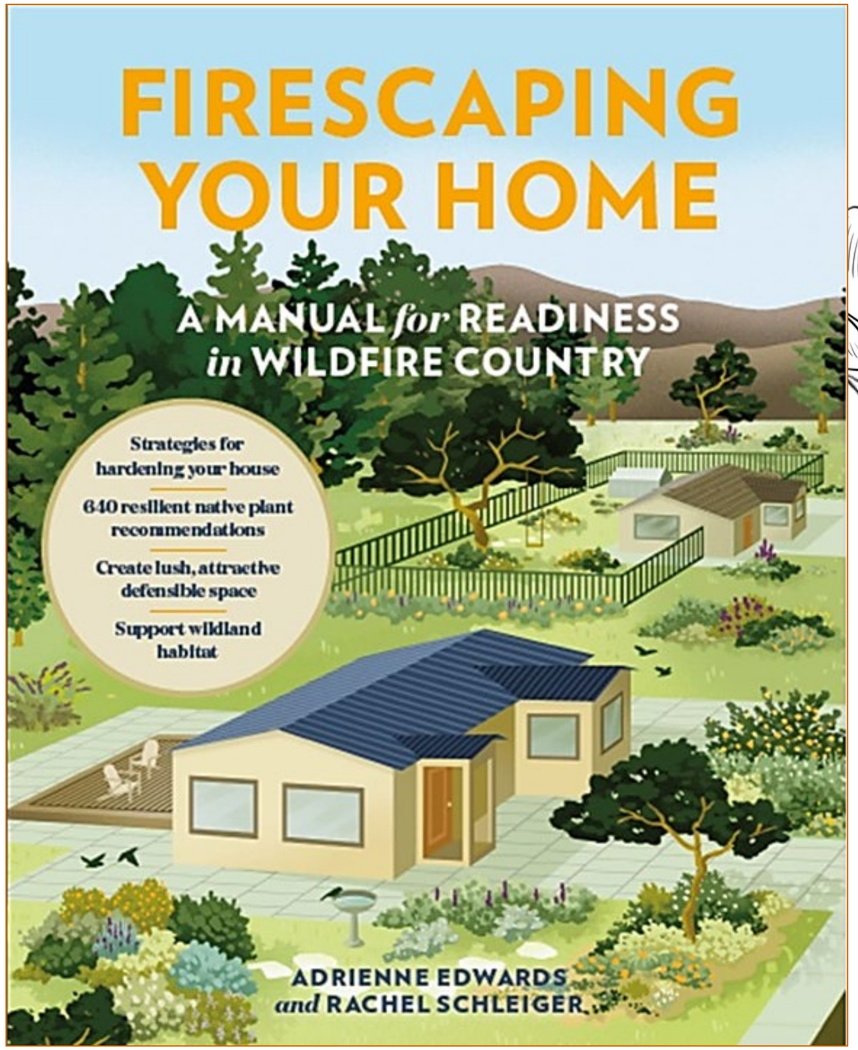
Images: CNPS East Bay, California Flora Nursery, CNPS Calscape, Franco Folini



Invasive iceplant (*Carpobrotus edulis*) used for erosion control; outcompetes natives)

Succulents must be lean, clean & green.

Thank You!


FIRESCAPING YOUR HOME
A MANUAL for READINESS in WILDFIRE COUNTRY
Strategies for hardening your house
640 resilient native plant recommendations
Create lush, attractive defensible space
Support wildland habitat
ADRIENNE EDWARDS and RACHEL SCHLEIGER

“One of the most important garden characteristics associated with house loss is the presence of fuel close to the house.”

Radiant heat from burning plants or fuels can shatter windows.
Overhanging branches can clog gutters with fuel and drop burning leaves on the roof.
Flammable taxa can spread flames and generate heat.
Less flammable taxa can reduce radiant heat and potentially extinguish embers.

Highest Risk: Non-combustible Zone

- Connectivity between flammable ground material and shrubs
- Watering status of plants
- Tree cover and the proportion of flammable trees (e.g. Eucalyptus)
- Propane tanks with adjacent plants
- Flammable material under decks
- Wood fences

Highest Risk: Lean Clean & Green Zone

- Watering status of plants
- Presence of fuel under trees (esp. trees with peeling bark)
- Tree cover and proportion of flammable trees and shrubs

Now let’s examine some of our prevailing landscape habits that increase fire risk and/or decrease healthy habitat.

Ondei et al., 2025. An expert system to quantify wildfire hazards in gardens and create effective defensible space. https://doi.org/10.1016/j.ijdrr.2025.105424

We acknowledge that wildfire can be a source of deep trauma for families and communities.

We also recognize the role of "good fire” -- controlled and cultural burns -- as ecological and traditional practices that sustain healthy, resilient ecosystems.

We honor all experiences, sorrows, and joys related to fire.

--Rachel & Adrienne