

Building for Extreme Weather:
A Toolkit for Long-Term Housing

mhp
improving home & community

Table of Contents

Introduction ---- 3

How is the climate reshaping the housing market? ---- 6

Introducing Climate Resiliency ---- 7

How to conduct a climate resiliency property assessment ---- 9

Designing for Extreme Weather Threats ---- 10

1. Extreme Heat ---- 11

2. Flooding, Extreme Rainfall, & Hurricanes ---- 15

3. Tornados & High Winds ---- 19

4. Wildfires ---- 22

Resilient Design Strategies: Overall Takeaways ---- 25

Case Studies: How are these practices applied? ---- 26

Conclusion ---- 29

Resources: Ready to learn more? ---- 30

Interested in MHP's services and support? ---- 31

Sources ---- 32

MHP & Author Contacts ---- 35

Introduction

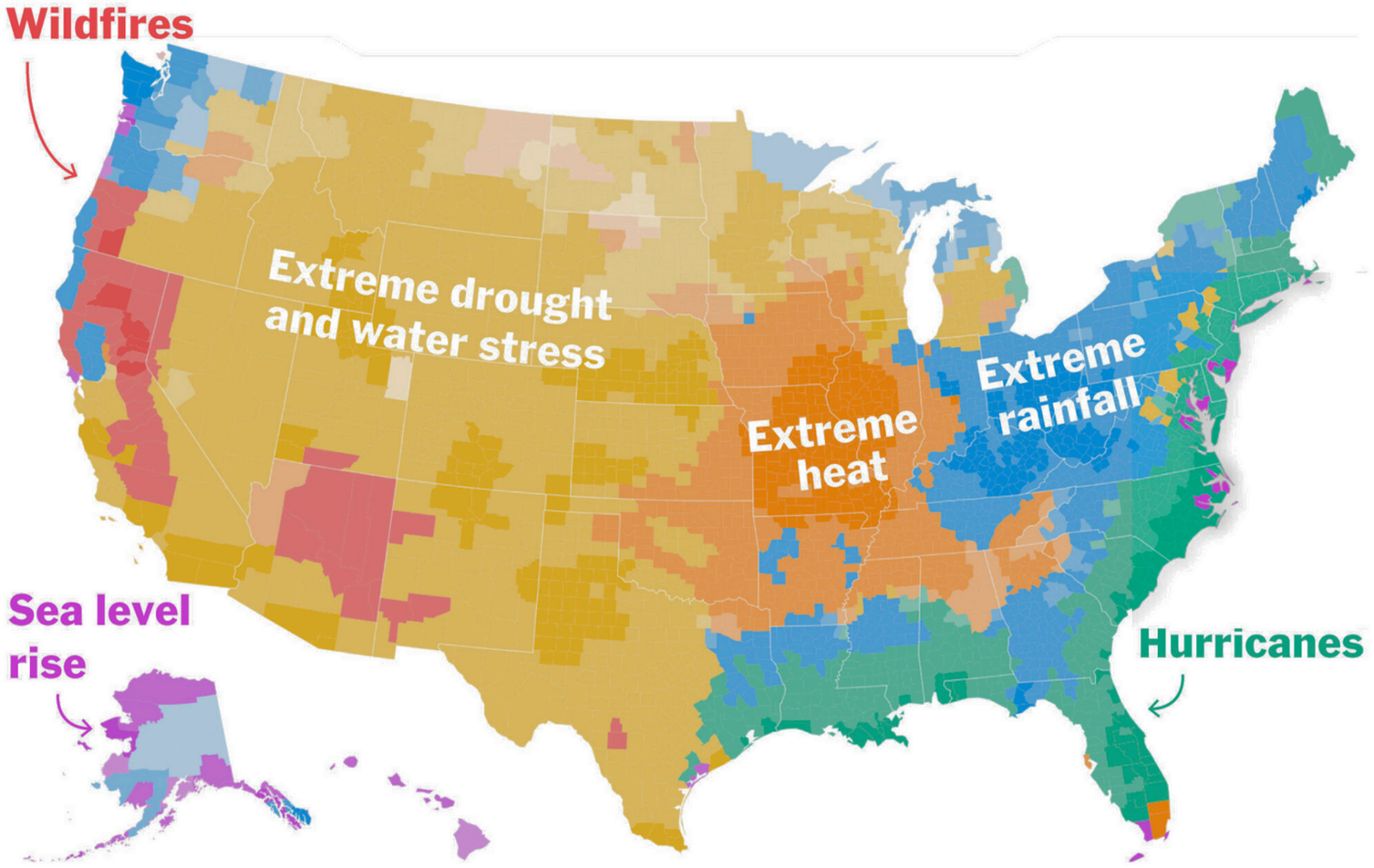
As extreme weather continues to intensify, communities across America are facing unprecedented environmental challenges. **These challenges directly impact the way we build, live, and plan for the future.**

This report presents a toolkit on how to design for an increasingly unpredictable climate. It serves as a foundational guide for developers and community members alike who are interested in understanding the core principles of building **climate resiliency**.

Through a carefully selected collection of strategies, recommendations, and real-world resources, this toolkit aims to empower users to create more sustainable, durable, and adaptable housing nationwide.

Additional resources are provided for a deeper look into climate barriers and solutions in your community. **Together, we can build a future where all communities have the tools to face climate threats.**

The growing climate challenges



Source: *New York Times, 2020*

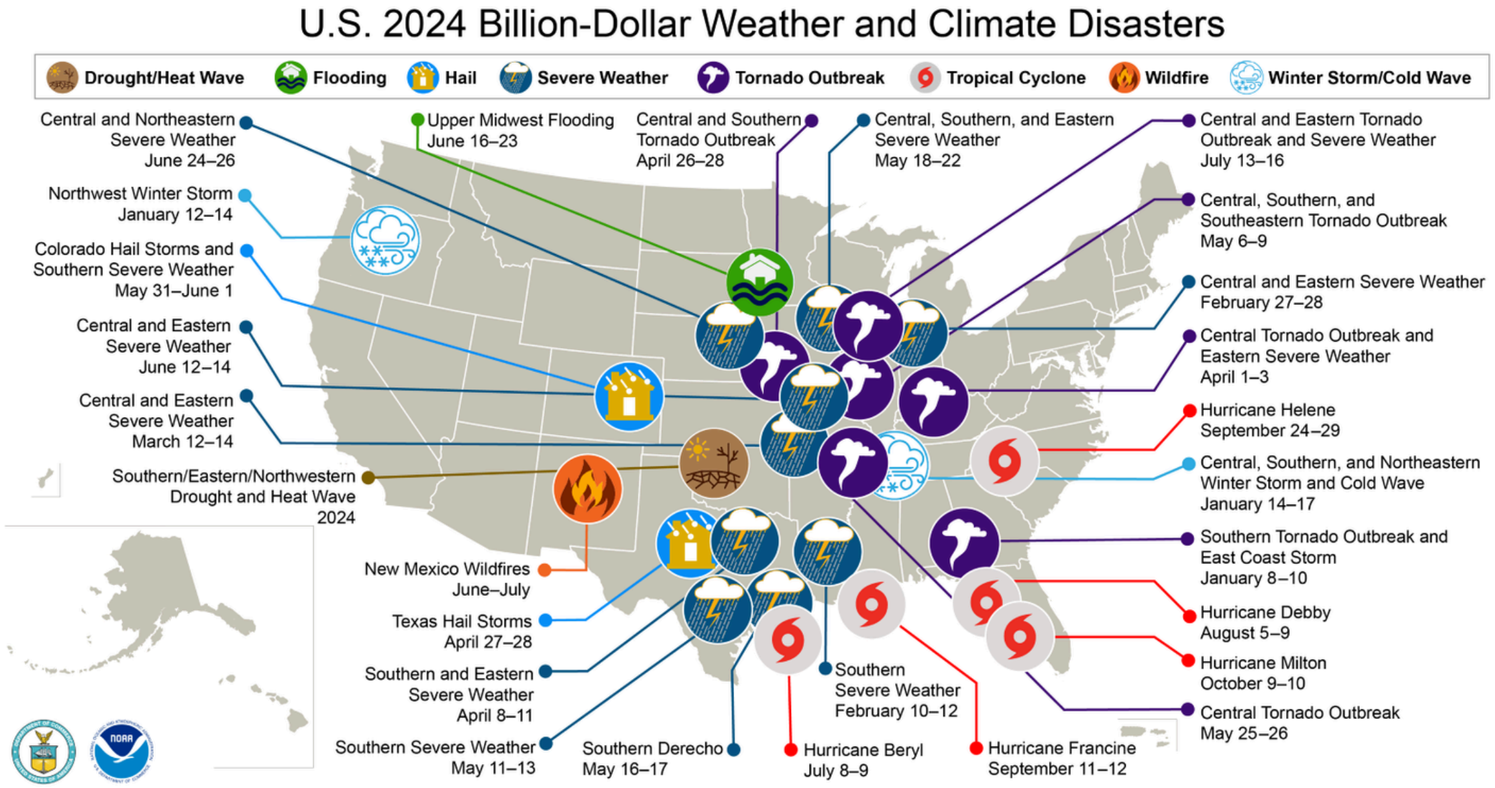
The growing unpredictability, intensity, and frequency of extreme weather events present serious threats to community infrastructure.

Extreme weather events impacting communities include:

- Drought and extreme heat
- Flooding, heavy rainfall, and hurricanes
- Tornados and high winds
- Wildfires

This map highlights the frequency and type of major weather events in the U.S. by county as of 2020.

How does the climate affect our economy?

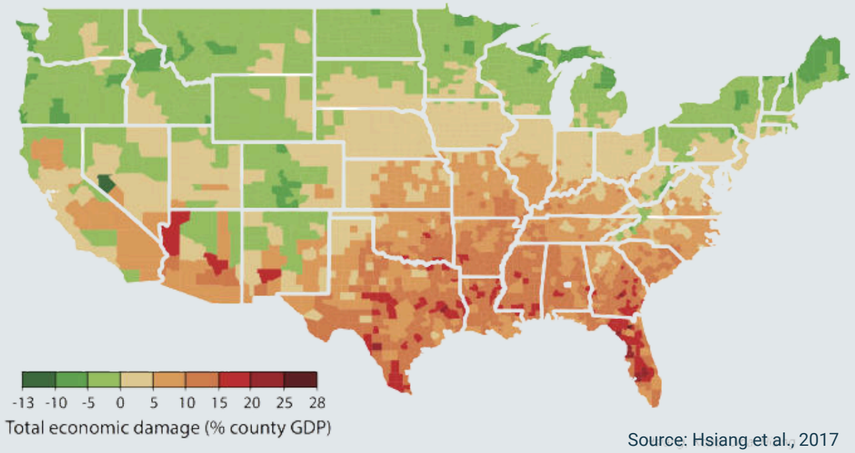


*This map denotes the approximate location for each of the **27 separate billion-dollar weather and climate disasters that impacted the United States in 2024.***

Source: *NOAA Climate.gov*

From 1990-2024, the U.S. experienced an average of **nine weather disasters per year,** which each caused over **$1 billion** in economic damages. But from 2020-2024, the average jumped to **$23 billion-dollar disasters per year,** with **27** occurring in 2024 alone.

As the climate fluctuates, so will the frequency and severity of these costly events. To prepare and protect communities, we must invest in climate-resilient housing and infrastructure that can withstand future threats.



Source: Hsiang et al., 2017

How is the climate reshaping the housing market?



of all homes are **at-risk** to climate change.



of all homes may face a **property value drop by 2055,** with **20% in the next 5 years** and an estimated **$1.47 trillion** in economic loss by 2055.

Reasons for decreasing property value:

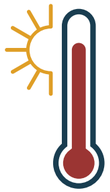
1. Increased weather damage;
2. Declining neighborhood desirability;
3. Rising rehabilitation costs (i.e. materials and transportation costs make repairs and upgrades more expensive, leaving homes outdated and ill-equipped).



increase in home insurances by 2055.



The aging housing stock is ill-equipped to withstand the growing impacts of climate change.



Chronic exposure to extreme weather triggers a domino effect of damage, cost, and instability. Examples:

1. Increased heat can lead to the cracking of concrete → water intrusion → mold.
2. Mechanical systems cannot support the weather changes → more outages → more stress on the building → increased maintenance needed and costs for updated appliances.

Rising climate threats are driving a shift in the housing market, pushing people away from high climate-risk areas and pulling demand toward stable regions, also known as displacement. This can limit local housing supply and affordability.

2018: 1.25 million Americans displaced

2022: 675,000 Americans displaced

2023: 202,000 Americans displaced

2014-2024: 9 million Americans displaced



For example, a 2018 California wildfire **displaced 50,000 people into neighboring cities,** like Chico, CA. Within a year, Chico faced a **21% increase in housing prices**, resulting in housing insecurity for the residents.



Introducing Climate Resiliency

“If we're going to build a road, is this for today's population, or is this for tomorrow's population?”

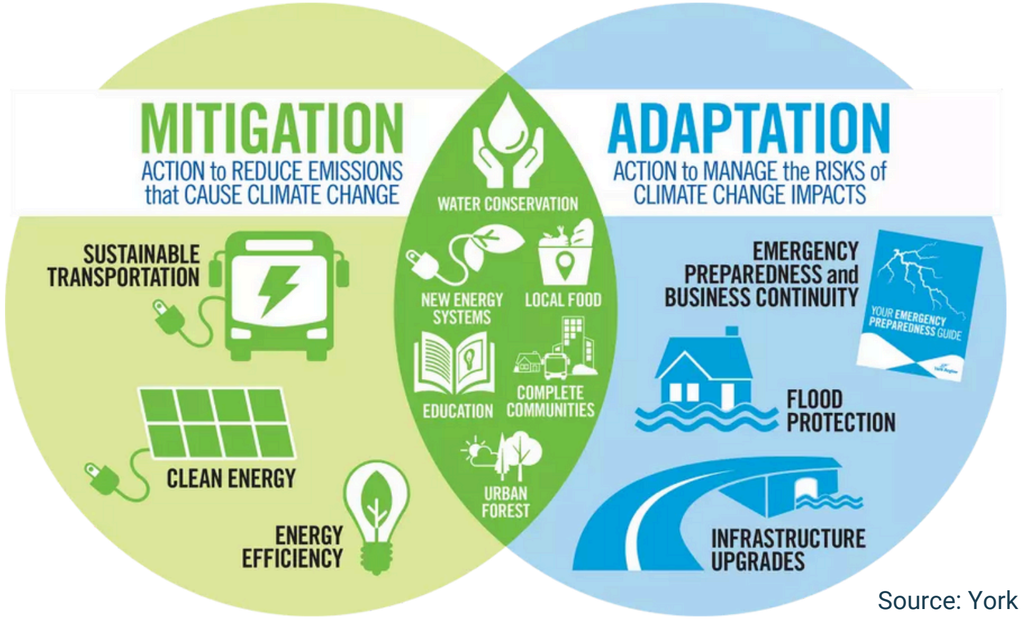
- Jesse Keenan, Climate Adaptation Expert

What is climate resiliency?

Climate resiliency is about the ability for systems to withstand, mitigate, and prepare for the impact of climate change. It is the key to fostering long-lasting, thriving communities.

In the housing world, building resiliency means building homes that will last generations. **Putting more money into the property now will mean fewer repair costs in the future.**

Designing for ever-changing climate issues means there is **no one size fits all** in problem solving. **Many of the tactics listed in this toolkit can be applied in endless variations and iterations.**



Source: York Region

Climate resilient housing comes in many forms:

Some radical...



Earthship Style Homes



Dome Style Homes, ex: UC Davis, CA



Ecovillages, ex: The Village Homes, CA

...and some that were once radical



Manufactured Homes



Eco-friendly Multifamily Housing

Before presenting climate design practices, let's first discuss how to **conduct a climate resiliency property assessment.**

To do so, we recommend you:

1. **Prepare a project scope;**
2. **Conduct a climate screening of the surrounding area;**
3. **Conduct a risk assessment:**
   a. Identify hazards: How has the area been previously affected by climate change?
   b. Define impact thresholds.
   c. Evaluate likelihood of climate impact at different thresholds
   d. Estimate consequences.
   e. Summarize risk in a measurable format
   f. Mitigate risks: What design interventions can be used to treat and plan for risks?
   g. Reevaluate risks with implemented resilient designs until risk levels are reduced to the lowest possible level.
4. **Integrate resilient design strategies into plan;**
5. **Conduct cost benefit analysis of strategies;** and
6. **Finalize strategies.**

Risk Rating Matrix

Consequence Rating	Likelihood Rating: Rare	Possible	Probable	Expected	Nearly Certain
Severe	Low	Medium	High	High	High
Moderate	Low	Low	Medium	Medium	High
Minor	Low	Low	Low	Medium	Medium

Source: City of New York

Designing for Extreme Weather Threats

To best prepare for extreme climate threats, we divided this toolkit into four weather categories. Each category will briefly present the challenges and propose design solutions. **This toolkit is only the start of what you can achieve!**

Note: Use the external hyperlinks to learn more about some techniques.

1. **Extreme Heat**
2. **Flooding, Extreme Rainfall, & Hurricanes**
3. **Tornados & High Winds**
4. **Wildfires**

1. **Understanding** Extreme Heat

Continuous extreme heat takes a slow toll on buildings. Over time, high temperatures can degrade materials, strain building systems, and reduce the lifespan of homes and infrastructure. If you are looking to retrofit your property—don't worry! There are many solutions in your budget.

One of the most critical concepts to understand is the **urban heat island effect**. As development increases, so does the presence of heat-absorbing mass like roads, rooftops, and parking structures. These materials trap heat during the day and release it at night, causing high density areas to remain significantly warmer than their rural surroundings.

The increasing heat cycle is self-reinforcing: the more people who move into a community, the more housing is needed, and the hotter a neighborhood becomes—increasing the need for strong infrastructure against rising temperatures.

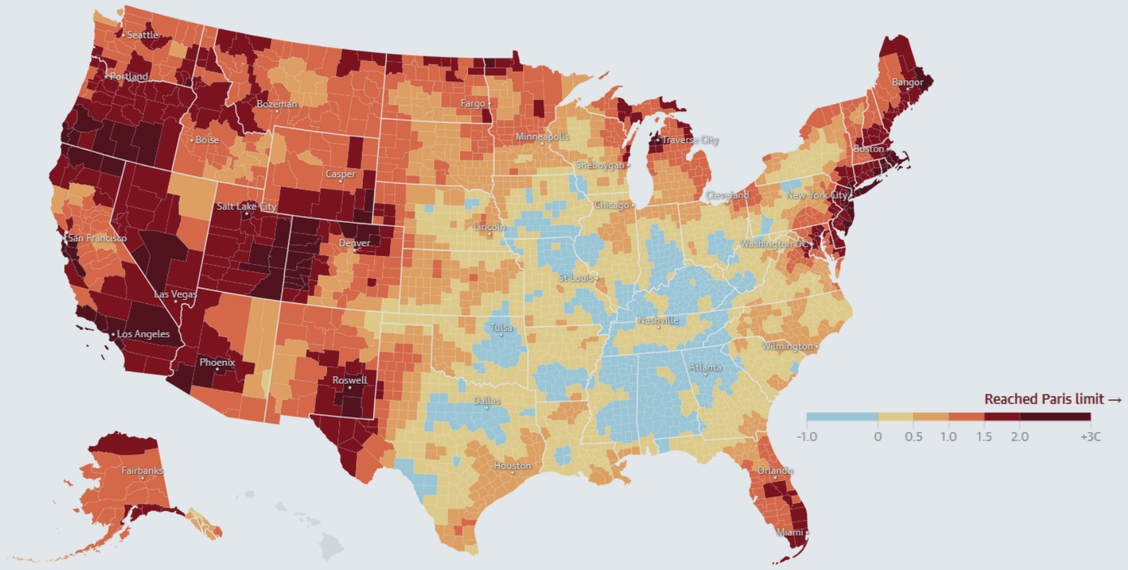
Whether you're building new or retrofitting existing structures, reducing heat absorption and improving thermal performance is key to long-term community resilience. **Design choices today can help your property withstand tomorrow's climate.**

How does extreme heat affect housing?

- Accelerates wear and tear on homes, reducing projected lifespan of homes and infrastructure.
  - Heat expands and contracts building materials
- Increases cooling costs and energy demand, weakening utilities such as air conditioners.

As of June 2024, 385 US counties summers are 2.7°F (1.5°C) warmer

Map shows change in JUN-AUG's average temperature from 1895 to 2023)



Source: *Guardian*. Analysis of NOAA temperature data by Brian Brettschneider.
Note: Temperatures not available for HI.

1. **Building for** Extreme Heat: The Basics

MATERIALS



- Roofing, pavements, paint: Use **light colored, reflective materials** to reduce sun/heat absorption.
- In humid climate, use building materials with **low thermal mass, and high thermal mass** in dry climates.
- Windows: **Low E and tinted** to allow least amount of sunlight inside.

VEGETATION



- **Plant heat and drought tolerant native plants**
- Implement **bioswales** and rain gardens to capture storm/rainwater and heat.
- Add **green roofs** or walls.
- **Plant more trees** to reduce solar-pavement interaction.
- Consider retaining and **reusing stormwater** for irrigation during droughts.

LAYOUT



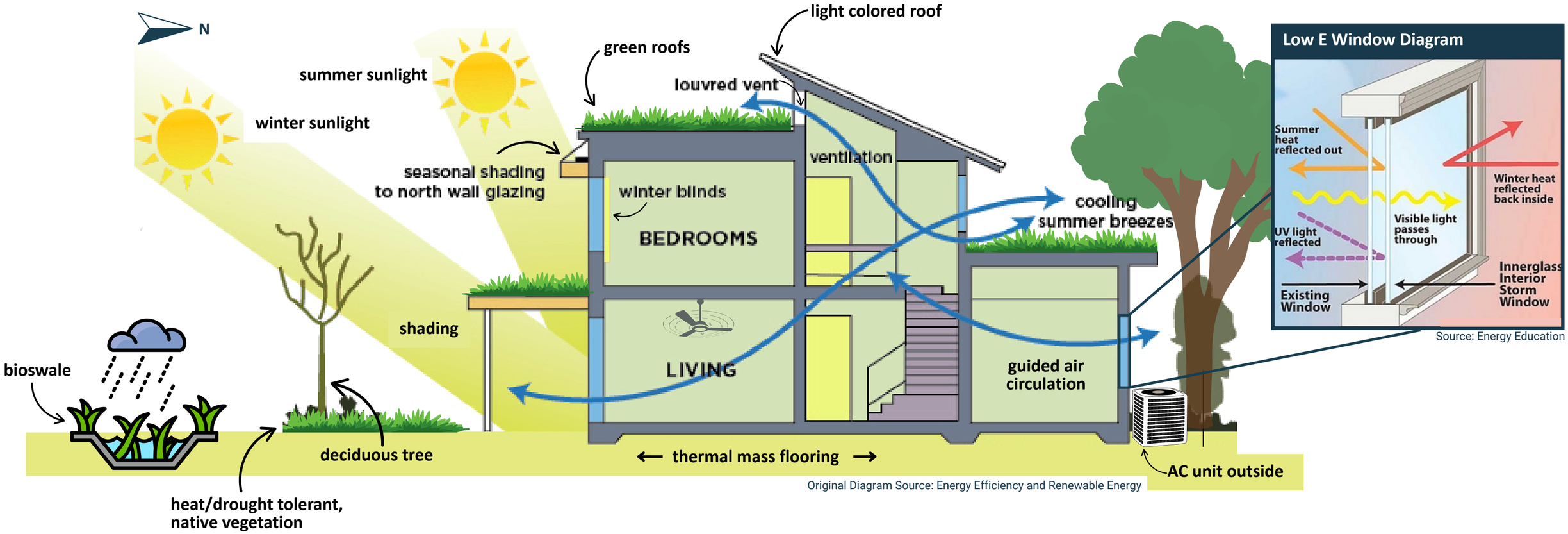
- **Use passive design practices for natural cooling** (ref. slide 14).
- **East west orientation**: face windows towards the equator.
- Create pathways for **guided circulation**, pushing hot air up and out of the house.
- Plant **deciduous trees** to provide shade in the summer by blocking sunlight when their leaves are full, and allowing sunlight in the winter.
- Add **external shading** to block sunlight.
- Place **heat generating utilities outside.**
- **Place water utilities near each other to shorten water travel times** (reduce water and water heater usage in drought).

INSULATION



- **Insulate all air conditioned spaces, including the attic.**
- **Airtight building**: check with blower door test.
- **Double-paned windows.**

1. **Building for** Extreme Heat: Diagram



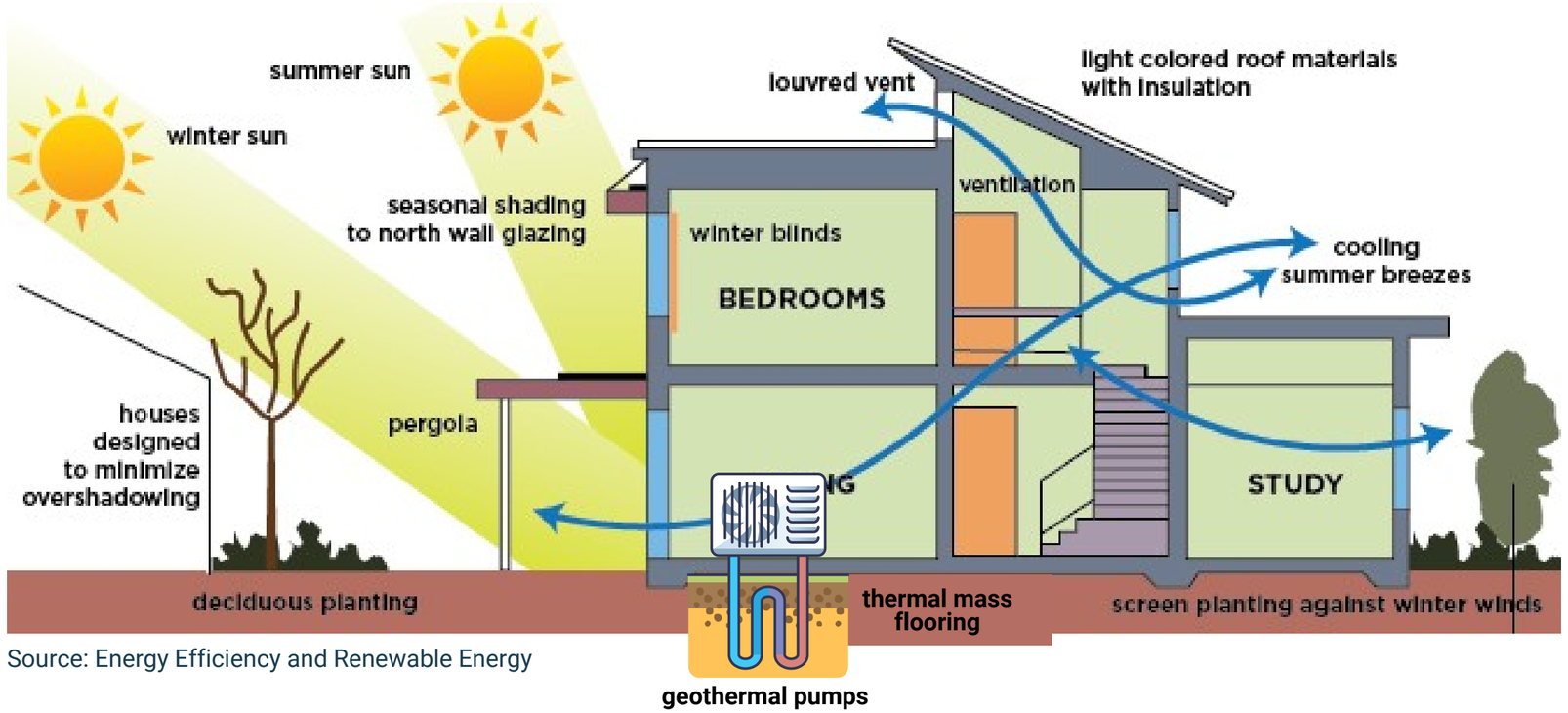
Source: Energy Education

Original Diagram Source: Energy Efficiency and Renewable Energy

1. **Building for** Extreme Heat: Passive Design

Passive Design Practices

Passive design is the practice of using natural elements—like sunlight, airflow, and shade—to reduce energy consumption through strategic layout and planning. These practices can be applied in all climates. It helps homes retain heat during colder months and stay cool during warmer ones, making them better equipped for extreme temperatures.



Source: Energy Efficiency and Renewable Energy

ADDITIONAL PASSIVE ELEMENTS (not incl. slide 14)

Sunlight and Heating/Cooling:

1. Face windows towards the equator to allow the sun to warm the building during the winter.

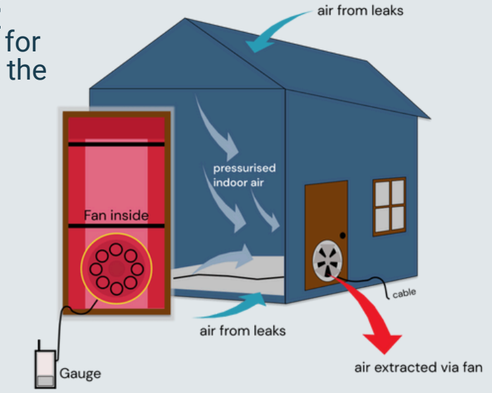
2. Create **seasonal shading methods** so that the summer sun cannot enter in.

3. Install **geothermal pumps** to allow for the natural cooling and heating of the house through heat and water temperatures.

Insulation:

1.Insulate thoroughly and seal all spaces to keep the home airtight. This helps prevent unwanted heat loss in winter and heat gain in summer.

To test airtightness, use the blower door test. This will check for air leaks throughout the house.



Source: Scott Home Services

2. **Understanding** Flooding, Extreme Rainfall, & Hurricanes

Increased flooding and rainfall will continue to devastate and weaken communities. What were once considered "100-year storms" now occur every five years—or even more frequently—bringing torrential downpours and overwhelming infrastructure. As raging floodwaters become a regular threat, it is essential to understand the evolving risks and build resilience.

Flood prone areas require great updates and planning for their developments. **This can be costly, but it is crucial to ensuring a long lifespan for the community.** What is spent today will avoid high damage costs in the future.

This section offers guidance for navigating and preparing for the intensifying impacts of hurricanes, extreme rainfall, and flooding in a changing climate.

How do extreme rainfall and flooding affect housing?

1. Internal molding.
2. Water damage to infrastructure from chronic flooding.
3. Hurricanes can wipe out communities, completely destroying infrastructure, leaving areas with long lasting devastating effects.

Considerations with rising sea levels:

1. How will coasts will be impacted?
2. Current floodplain risk: will the property join the floodplain?
3. What permanent barriers are needed in the community or on the development?

Important abbreviations/terminology:

1. **BFE:** Base flood elevation is the expected height water will reach in a base flood. There is a 1% chance of this occurring each year.
2. **DFE:** Design flood elevation is the highest flood elevation a building can protect against.
3. **FEMA:** Federal Emergency Management Agency is an organization that aids communities with disaster relief.
4. **Permeable:** Allows water to enter or absorb into the material or element.
5. **Floodplain:** Generally flat, low-level areas near rivers, lakes, and streams that are prone to flooding during storms.



2. **Building for** Flooding, Extreme Rainfall, & Hurricanes: The Basics

MATERIALS



- **Avoid materials that are mold prone and absorb water** like pink insulation, untreated wood, and drywall.
- **Use water resistant materials** as found in the FEMA list of material analysis (pg. 9-13).

VEGETATION



- Plant **native, water-tolerant plants** that **reduce flooding** and **combat soil erosion**.
- Implement **bioswales** and **rain gardens** to capture stormwater.

INSULATION



- **Use spray foam insulation to help seal cracks.**
- **Use dry or waterproof techniques.** (ref. slide 18)
- **Use dryable wall insulation** technique (ref. slide 17). This technique uses **no internal insulation** to allow wall/floor to dry quicker after water exposure (reduces the chance of mold).

LAYOUT



- **Use dry or waterproof technique.** (ref. slide 18)
- **Elevate/raise house above DFE.**
- **Determine foundation type**: stilts and open vs. closed. (ref. slide 17)
- **Place electrical appliances and outlets above projected flood lines.**
- **Design layout so water will be less likely to flow** into electrical appliances.
- **Install flood gates** to keep water out.

STORMWATER MANAGEMENT

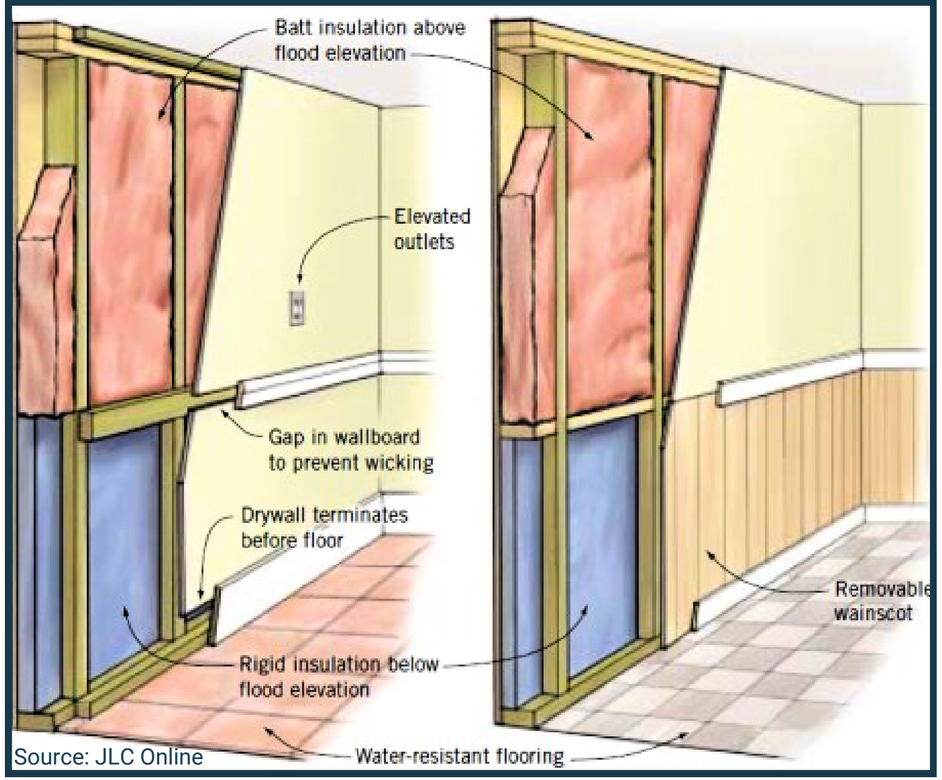


- **Piping**: Consider **proper draining** that can support the amount of projected flooding/ determine how/where stormwater will drain to (inside and outside); install **backwater values** to lessen house water infiltration from pipes and **sump pumps** to take water out of spaces.
- Consider retaining and **reusing stormwater** for irrigation.
- Consider **land grading** to keep water away from the property.
- Consider **permeable pavers** to provide natural drainage.

2. **Building for** Flooding, Extreme Rainfall, & Hurricanes: Diagrams

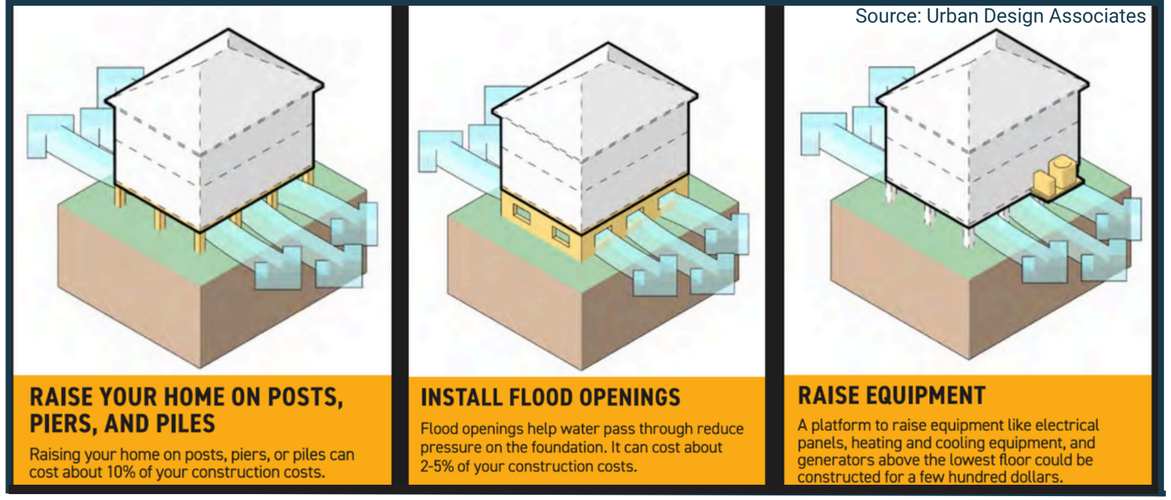
Below are diagrams that correspond and illustrate the bullet points on the previous slide (ref. slide 16).

How to prepare drainable, dryable walls for flooding:



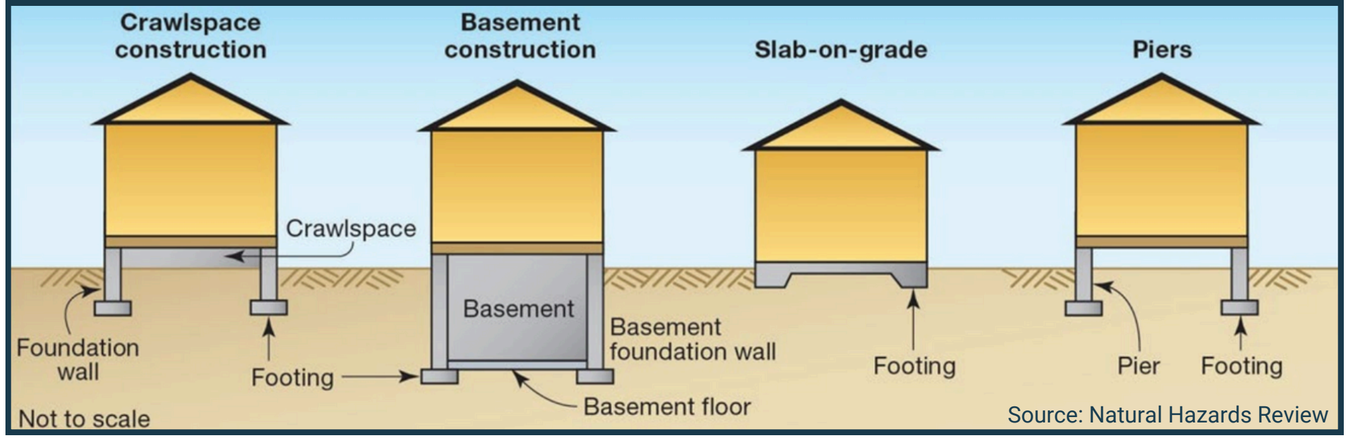
Source: JLC Online

How to properly prepare home foundation for flooding:



Source: Urban Design Associates

More foundation variations for flooding:

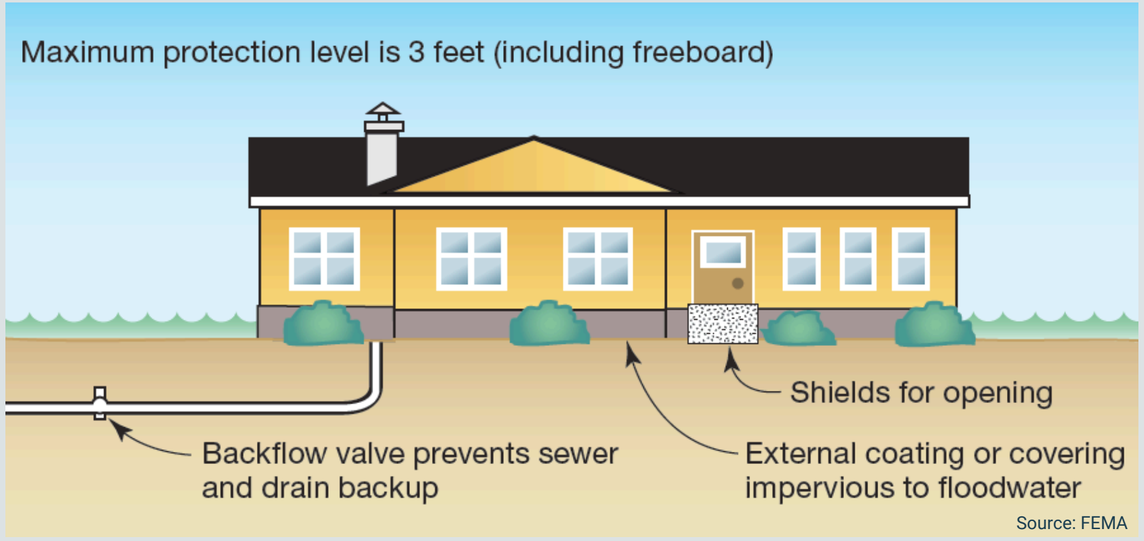


Source: Natural Hazards Review

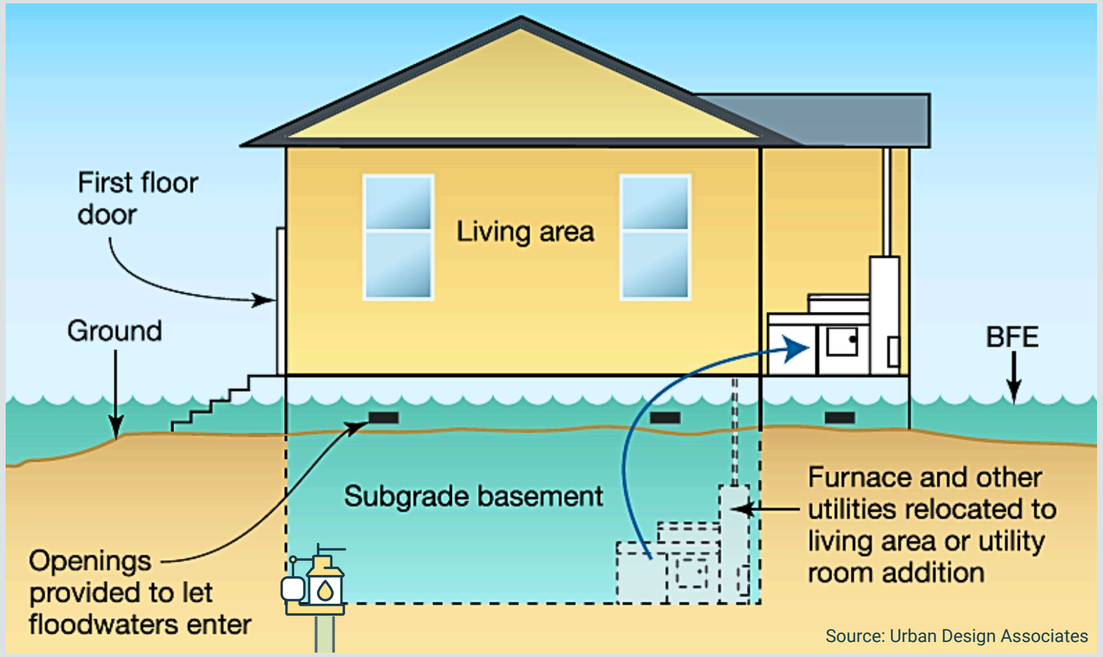
2. **Building for** Flooding, Extreme Rainfall, & Hurricanes: Methods

Dry Floodproofing vs. Wet Floodproofing

Dry floodproofing restricts water from entering the building. This technique focuses on **watertight, easily dryable, impermeable building materials,** and elements. **Flood gates** are also utilized to prevent water from entering the space. However, this method is not recommended with a basement or BFE above 3ft. T**o learn more, refer to this FEMA guide.**



Wet floodproofing purposefully allows water to enter into the house. To do so, **add openings** to the foundation to let water fill the basement. **The space where the water will fill must be prepared for prolonged flooding and water damage** (i.e. no electrical and waterproof materials). **To learn more, refer to this FEMA guide.**



3. Understanding Tornados & High Winds

In 2024, the U.S. experienced 1,810 tornadoes—the highest annual count in nearly two decades. Understanding how you can build wind-resistant homes can mitigate devastating effects.

Building strong, durable housing requires attention to detail and a commitment to exceed safety standards. Every fastener and connection matters when resisting wind uplift. Investing in reinforced materials and careful construction now can prevent major losses later.

This section offers essential strategies to help homeowners, builders, and planners prepare for and adapt to these escalating threats. **By applying resilient design solutions, we can better protect homes and the people in them against the growing force of high winds and tornadoes in a changing climate.**

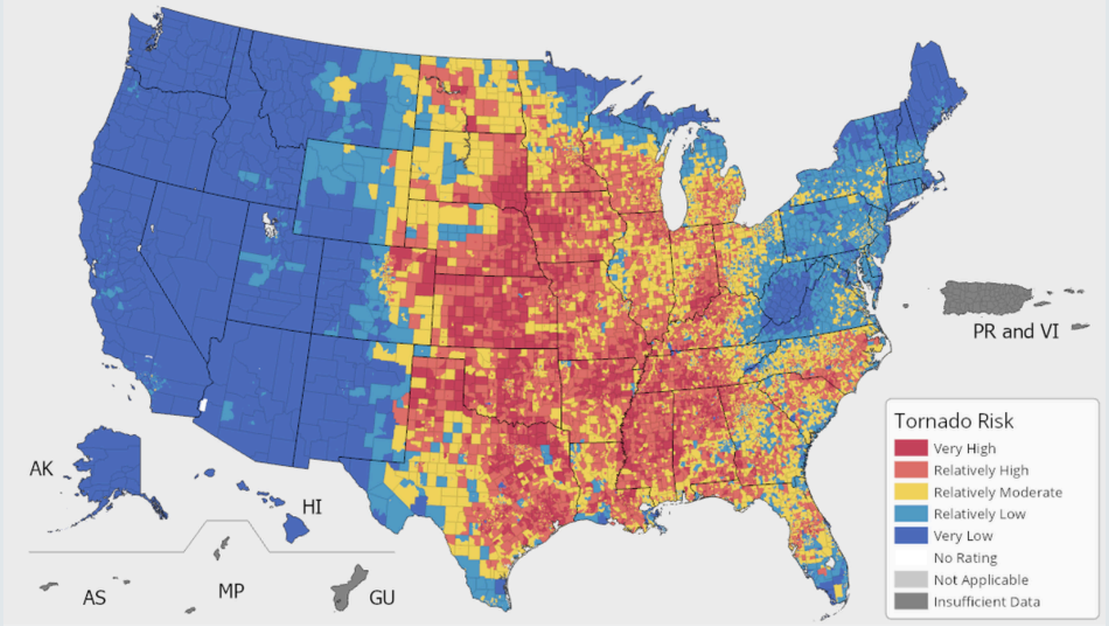
How do extreme winds affect housing?

- Extreme wind can create **serious property damage**: rip roofs off; uproot vegetation like trees; crack walls; break windows; and more.
- Winds can **lift debris**, threatening properties and resident safety.
- **Cracking infrastructure** can also allow **water to enter** into the house, creating further damage.

Use this tool to determine the maximum basic windspeed and projected wind speeds: https://ascehazardtool.org/. To use this tool:

1. Enter your desired location.
2. Determine which risk # your property is/will be - Houses are typically II, higher density are III.
3. Click “wind” for load type, and click “view results.”
4. When viewing results, click summary to review expected windspeeds.

Tornado Risk Index as of March 2025 by Census Tracts (communities)



Source: FEMA.

3. Building for Tornados & High Winds: The Basics

MATERIALS



- Overall, the builder should prioritize using **wind-resistant and strong materials that can withstand impact from debris.**
- Based off of the windspeed found from the tool on slide 19, determine which **roofing material** fits best (ref. slide 21).
  - **Metal roofing** is most wind resistant with high impact resistance, low likelihood of allowing water into house, and high sturdiness.
- Determine structural **wall types:**
  - **Avoid lighter materials like wood** framing that can lift more easily.
  - **Use heavier and durable materials like concrete.**
    - for a more sustainable and secure option, use woodcrete or hempcrete **Insulating Concrete Forms** (ICFs). Although costlier, this method will reinforce the concrete and better protect your home.

LAYOUT



- Design a layout that will **reduce wind load** to the structure:
  - **Orient building with the wind patterns**
  - Use **aerodynamic building shapes** such as dome and octagonal can brace the wind better.
- Establish a **strong foundation** by using concrete and fastening the framing to foundation.

VEGETATION



- Use **plants with strong rooting and less leaves** (to catch less wind).
- **Routinely clear your yard of debris**, check your **trees' health**, and **prune your plants** to lessen the chance of debris lifting during a windstorm.

INSULATION

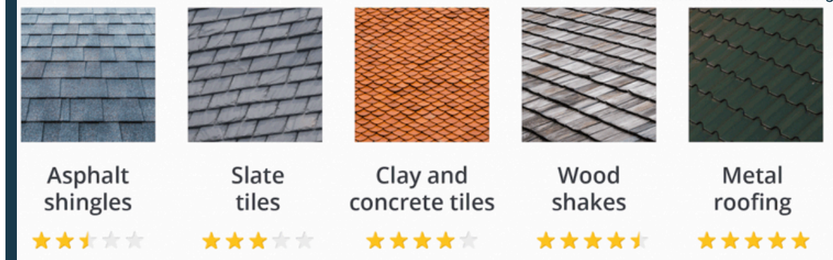


- Use **spray foam insulation** for added strength, wind uplift resistance, and water resistance.

3. Building for Tornados & High Winds: Diagram

Roofing materials grading for high winds:

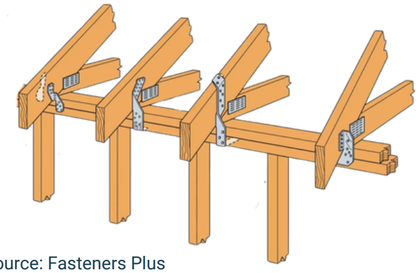
Source: Home Run Financing



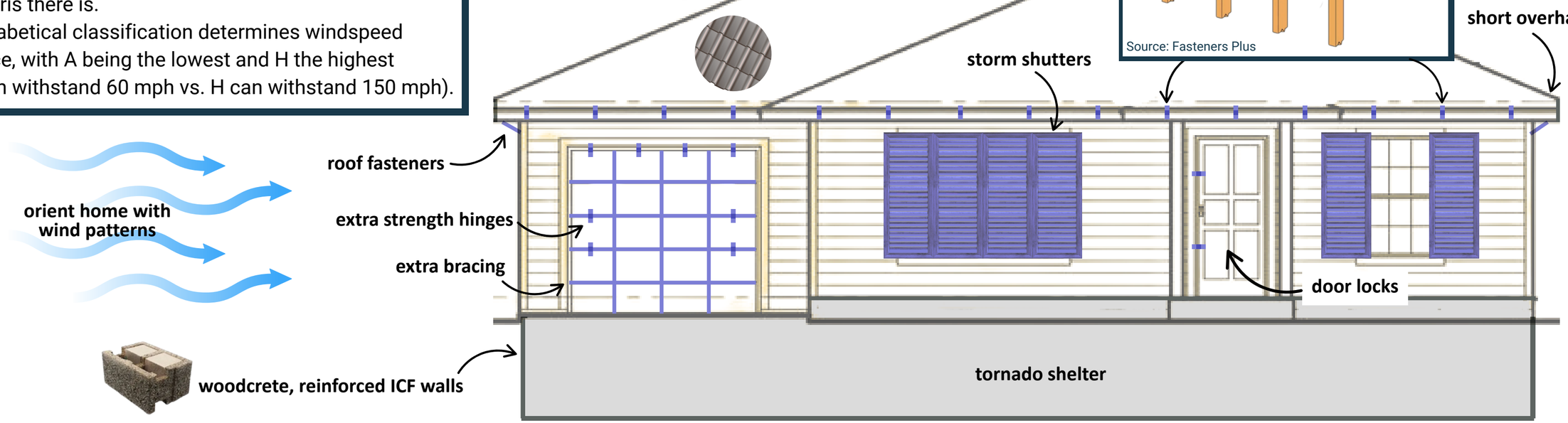
Note: Shingles have their own wind classifications, which can raise their grading:

- The higher the class number, the more impact resistance from debris there is.
- The alphabetical classification determines windspeed resistance, with A being the lowest and H the highest (ex: A can withstand 60 mph vs. H can withstand 150 mph).

Fasten the roof to the wall beams:



Source: Fasteners Plus



4. **Understanding** Wildfires

Wildfires are becoming more destructive and difficult to put out due to **dryer climates**. From 1999 to 2020, scientists saw a **246% increase in housing loss from wildfires.** High winds, prolonged drought, and record-breaking heat waves have increased the wildfire risk to forests, grasslands, and suburban neighborhoods.

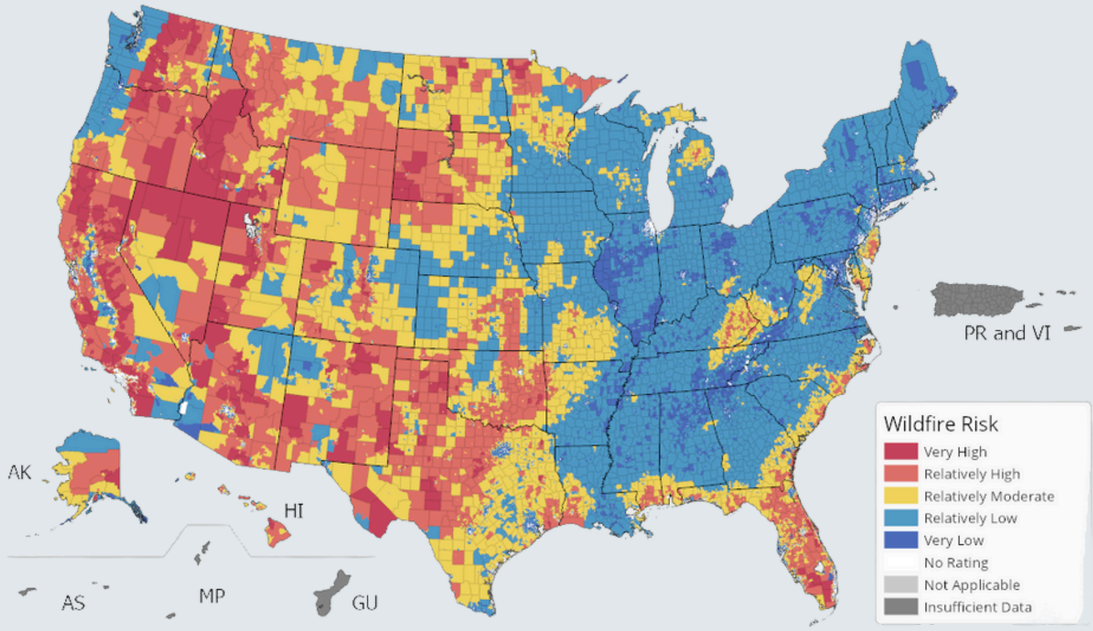
The housing impacts are devastating. Entire communities are reduced to ash, with homes lost not only to flames but to smoke carried miles away by wind. **Traditional construction methods and materials often fail under wildfires and intense air pollution, leaving residents vulnerable to both property loss and displacement.**

This section provides actionable strategies for strengthening wildfire resilience in housing infrastructure. From **fire-resistant building design to defensible space planning**, it equips stakeholders with the tools needed to prepare for and withstand the increasingly aggressive wildfires.

How do wildfires affect housing?

1. Smoke from fires increases air pollution with smoke from fires.
2. Flying embers from nearby fires can land on houses and start fires.
3. Quick, devastating, and unexpected destruction from fires.
4. Can destroy surrounding property or community.

Wildfire Risk Index as of March 2025 by Census Tract (communities)



Source: *FEMA*.

4. **Building for** Wildfires

MATERIALS



- Build with **fire-resistant materials** (i.e. concrete, metal, brick, stone, tempered glass) **for all exposed exterior surfaces to block contact from flying ember.**
  - Use **Class A roofing** for the highest fire protection, or **apply fire-retardant coatings** to upgrade lower-rated materials.
  - Use tempered or double-pane glass for windows to reduce the risk of shattering from intense heat.
  - Use fire-rated or steel doors to keep smoke and fire from entering the home.
- **Avoid using wood for any exterior elements.**

INSULATION



- Use **flame retardant spray foam** to seal any cracks, making the home safe from smoke and flying embers.
- With a higher budget, consider **noncombustible materials such as mineral wool, cellular glass, or closed-cell insulation.**
- **Avoid flammable materials, such as pink insulation.**

LAYOUT



- **Create buffer zones, or a defensible space,** around your property to help prevent wildfire spread to your home (ref. slide 24).
- **All exterior vents must be screened with wire mesh or hardware cloth, with openings no larger than 1/8 inch** to make sure smoke or embers cannot enter.
- If the property allows, design your **driveway large enough for a firetruck to turn around.**
- **Add a sprinkler system to the roof** to put out fires around the house.

VEGETATION



- Plant **drought tolerant and fire resistant plants** (plants with high water retention).
- **Routinely clear your yard, roof, and gutters of combustible debris/brush**.
- Routinely **check your trees' health, and prune your plants to reduce fire fuel**.
- **Avoid planting vegetation close together** (ex. rows of shrubs).
- Use **non combustible ground coverage** (i.e. rocks, gravel).
- Keep **trees at least 10ft from the building**.

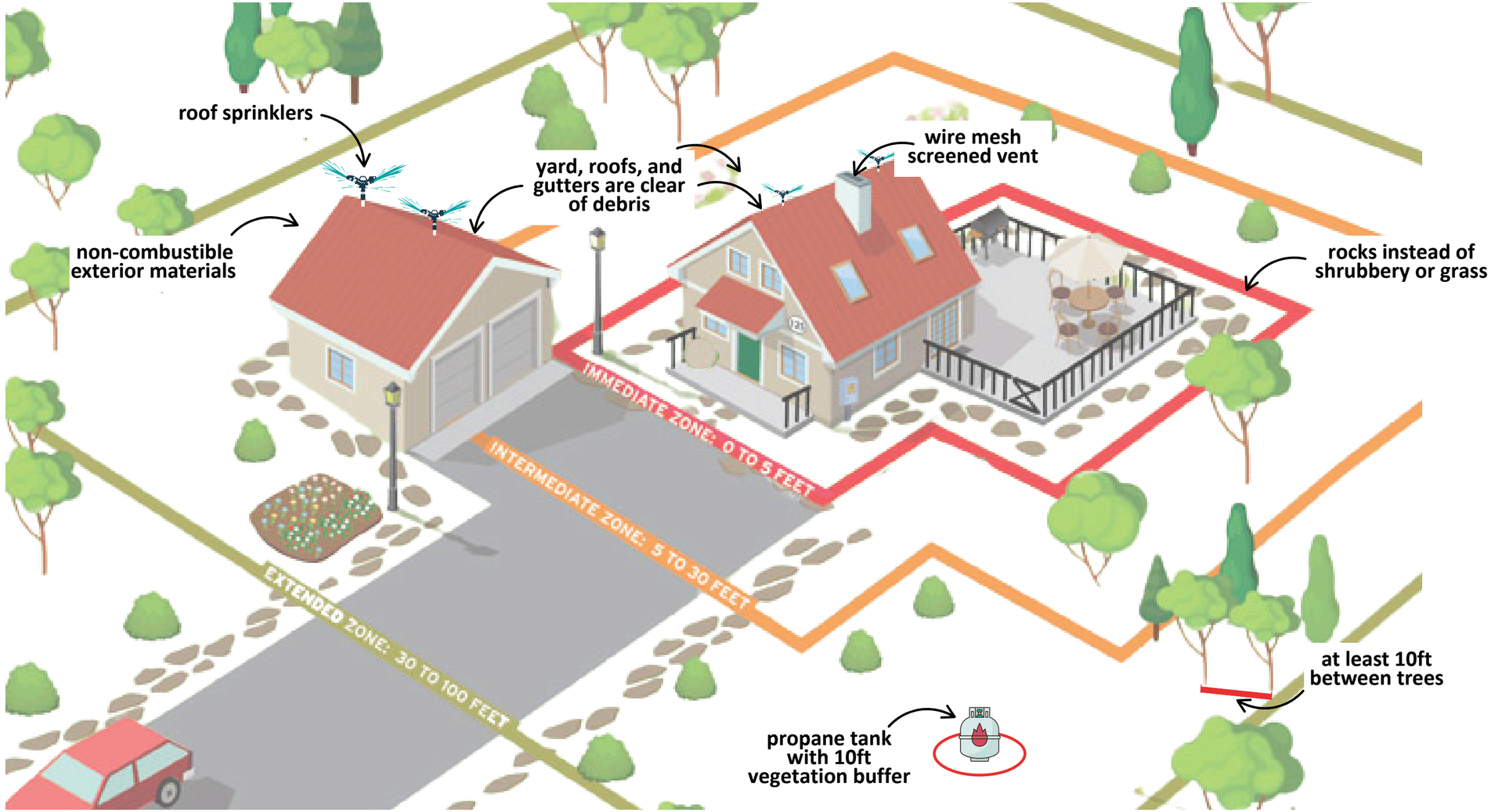
4. **Building for** Wildfires: Defensible Space Diagram

Defensible space is a buffer zone between your home and surrounding vegetation or structures that helps slow or stop the spread of wildfires, allowing more time for firefighters to arrive and residents to evacuate.

Immediate Zone (Zone 0):
- 0-5ft from the home
- Zero combustibles allowed

Intermediate Zone (Zone 1):
- 5-30ft from the home
- Upkept and limited combustibles allowed

Extended Zone (Zone 2):
- 30-100ft from the home
- Combustibles allowed with 10ft buffers



Original diagram source: USDA Forest Service

Resilient Design Strategies: Overall Takeaways

MATERIALS



- Choose materials that are **equipped to withstand and mitigate/absorb the negative climate effects**.
- Prioritize materials that are **not from a depleted resource**.
- **Opt for the more effective, although expensive materials to reduce future repairs**.

INSULATION



- Use **spray foam to block unwanted climate effects from entering inside the home** (ensure airtightness).
- Use the **blower door test** to check for air leaks in windows, foundation, etc.

LAYOUT



- **Passive design** and strategic, efficient layout can lessen need for other costly resilient practices.
- Depending on the climate, **choose an adequate elevation and foundation type**.

VEGETATION



- Choose **native plants** that are equipped to **withstand and mitigate/absorb the negative climate effects**.
- **Maintain vegetation and debris** for climates with high winds and wildfires**.**
- **Minimize original land disruption** as much as possible (i.e. aim to keep soil and trees)**.**



Case studies:
How are these practices applied?

Spring Lake, *California*

Location: Woodland, California
Developer: Mutual Housing California
Units: 98 affordable multifamily units
Climate: Extreme heat and drought
Notable Achievement: First federally-recognized net-zero energy affordable housing complex in the U.S.

Spring Lake bridges quality, climate resilient housing to low-income individuals. Administered in two phases, this complex achieved positive-net energy housing.



Source: Zero Energy-Ready Home

Key Sustainable Features

Energy Efficiency Measures

- Solar panels
- Net-Zero Energy Design: Phase 2 achieved positive net energy (produced 14% more energy than it consumed).
- ENERGY STAR Appliances in all units.
- Thick fiberglass insulation in walls and attics to reduce heating/ cooling needs.
- Raised heel trusses
- Tight-fitting windows
- Ducts placed in conditioned spaces (not attics), preventing ~20% energy loss. Color-coded energy monitor meters to help residents monitor usage.

Water Conservation

- Low-flow fixtures installed across all units to reduce daily water consumption.
- Strategic layout to reduce water travel from heater.

Sustainable Construction

- 71% of construction waste was recycled.
- Sustainably sourced wood used for framing.
- Low-energy lighting fixtures used.
- Durable materials selected to reduce long-term maintenance and material waste.

Community and Resident Empowerment

- Green Education:
  - Energy meters with color-coded usage indicators.
  - Optional resident-led Green Leaders Team for peer education.
  - Workshops on budgeting, health, and sustainability.

Lower Sioux Indian Community's Hempcrete, *Minnesota*

Location and Developer: Lower Sioux Indian Community, MN
Units: 10 affordable homes (with plans for future expansion and funding support from MHP).
Climate: Cold winters, hot summers, and high humidity.
Notable Achievements: 2nd hempcrete duplex in the world; 1st multifamily hempcrete home in the US.

The Lower Sioux Indian Community is pioneering sustainable housing solutions by constructing homes using hempcrete—a carbon-negative material made from hemp stalks, lime, and water. This initiative addresses the Tribe's housing shortage and promotes environmental stewardship.



Source: Lower Sioux Indian Community

Key Sustainable Features

- Effective insulation: helps maintain consistent indoor temperatures, reducing heating and cooling needs.
- Hempcrete's breathability reduces indoor humidity and the risk of mold, contributing to healthier living environments.
- Hempcrete is naturally water- and fire- resistant.
- Local Materials: Utilizing locally grown hemp reduces transportation emissions and supports regional agriculture.
- Recyclable Components: Hempcrete is fully recyclable, contributing to a circular economy.
- Durable Design: The homes are built to withstand Minnesota's harsh climate, ensuring longevity and reducing maintenance needs.

Community and Resident Empowerment

- Job Creation: The project has generated employment opportunities in hemp farming, processing, and construction, fostering economic growth within the community.
- Training Programs: Local residents receive training in sustainable building practices, equipping them with valuable skills for future projects.

Conclusion

Climate resilience is not just about adapting to change-- it's about planning for the unpredictable. **By integrating the strategies outlined in this toolkit, communities and builders can create resilient living spaces, which not only withstand but thrive amid the challenges posed by a changing climate. Investing in such measures today will safeguard communities and reduce long-term costs associated with climate-related damages.**

Looking ahead, the next breakthrough in climate resilient design could emerge from any community. *You* might be the next to pioneer a solution that transforms the way we build and live. **Together, we can build a future where all housing is climate resilient.**

“I hope there comes a time when we don’t have to talk about sustainable design and we can just call it good design.” *—Gould and Hosey (2007)*

Resources: Ready to learn more?



GENERAL

- **HUD's community resilience toolkit:** https://www.hudexchange.info/resource/5981/community-resilience-toolkit/
- **Risk map:** https://hazards.fema.gov/nri/map
- **Green Banks as a funding option**: https://coalitionforgreencapital.com/what-is-a-green-bank/
- **Department of Energy's Zero Energy Ready home program**: https://www.energy.gov/eere/buildings/zero-energy-ready-home-program
  - List of winners of this program: https://www.energy.gov/eere/buildings/doe-zerh-housing-innovation-awards
- **Heat, sea level rise, economic damage tool :**
  - https://projects.propublica.org/climate-migration/
- **Climate Vulnerability Map:** https://map.climatevulnerabilityindex.org/map/cvi_overall/usa?mapBoundaries=TractandmapFilter=0andreportBoundaries=Tract&geoContext=State
- **Office of Energy Efficiency and Renewable Energy's Energy Basics Training Tool:** https://bsesc.energy.gov/energy-basics
- **NYC's Climate Resiliency Design Guidelines:** https://climate.cityofnewyork.us/initiatives/climate-resiliency-design-guidelines/



FLOODING

- **Flood resistant materials FEMA guide:** https://www.fema.gov/sites/default/files/2020-07/fema_tb_2_flood_damage-resistant_materials_requirements.pdf
- **Flooding SWLA Guide**: https://www.visitlakecharles.org/just-imagine-swla/projects/resilient-housing/



WIND

- **Understanding classifications and how to read ASCE mapping for wind speeds**: https://www.engineeringexpress.com/wiki/asce-risk-categories-explained/



WILDFIRES

- **Community Planning Assistance for Wildfire resources:** https://cpaw.headwaterseconomics.org/resources/
- **How to create a defensible space:** https://www.safetyactioncenter.pge.com/articles/23-learn-create-defensible-space-home



EXTREME HEAT

- **Heat projection tool:**
  - https://impactlab.org/map/#usmeas=absolute&usyear=1986-2005&gyear=1986-2005

Interested in MHP's services and support?
We Provide FREE Resources & Expertise to Strengthen Rural & Native Communities

We'll turn your housing goals into action!



WHAT WE DO:

MHP delivers the **resources, knowledge, and hands-on guidance** you need to achieve your housing and community development goals—**at no cost.**

- **Achieve housing and community development solutions**
- **Strengthen your organization** with tools for long-term success
- **Engage local voices** to guide your work
- **Secure funding** through grants and programs
- **Build partnerships and grow collaborations**





WHO'S ELIGIBLE?

- Community-Based Nonprofits
- Local Governments
- Native Nations
- Projects in eligible rural areas

Scan Here!

APPLY NOW!

Visit **mhponline.org/RFTA** or email **RFTA@mhponline.org**

Sources:

"7 Facts About Wildfires {And What We're Doing to Help}." One Tree Planted, Oct. 2017, https://onetreeplanted.org/blogs/stories/7-facts-about-wildfires.

"Billion-Dollar Weather and Climate Disasters." NOAA National Centers for Environmental Information (NCEI), https://www.ncei.noaa.gov/access/billions/.

Brumer-Smith, L. "5 Sustainable Home Design Trends." U.S. News & World Report, Jan. 2024, https://realestate.usnews.com/real-estate/articles/sustainable-home-designs-that-are-trending-in-2024.

"Climate Resiliency Design Guidelines." Mayor's Office of Climate & Environment, City of New York, https://climate.cityofnewyork.us/initiatives/climate-resiliency-design-guidelines/.
Donev, J.M.K.C., et al. Energy Education, 2024, https://energyeducation.ca. Accessed 2024.

"Facts + Statistics: Wildfires." Insurance Information Institute, https://www.iii.org/fact-statistic/facts-statistics-wildfires. Accessed 2021.

"Federal Role in State and Local Building Codes and Standards." Federal Emergency Management Agency, https://www.fema.gov/sites/default/files/documents/fema_federal-role-state-local-building-codes-standards.pdf. Accessed Apr. 2025.

"GREAT BUILDING CODES REPORT: Protecting Communities and Saving Money: The Case for Adopting Building Codes." Federal Emergency Management Agency, Nov. 2020, https://www.fema.gov/sites/default/files/2020-11/fema_building-codes-save_brochure.pdf.

Graham, M.S. "Selecting Shingles for Wind Resistance." Professional Roofing, Aug. 2007, https://www.professionalroofing.net/Articles/Selecting-shingles-for-wind-resistance--08-01-2007/1120.

"Greening Strategies." York Region, https://www.york.ca/york-region/plans-reports-and-strategies/greening-strategy. Accessed 2024.

Happy Writers. "Building Homes That Can Withstand Wind." A and H Insurance, Sept. 2024, http://aandhinsurance.com/home-withstand-wind/.

"Heat Island." Environmental Protection Agency, https://www.epa.gov/heatislands/heat-island-cooling-strategies. Accessed 2021.

Higuera, Philip E., et al. "Shifting Social-Ecological Fire Regimes Explain Increasing Structure Loss from Western Wildfires." PNAS Nexus, Mar. 2023, https://academic.oup.com/pnasnexus/article/2/3/pgad005/7017542.

Hsiang, Solomon et al. Estimating economic damage from climate change in the United States.Science356,1362-1369 (2017). DOI:10.1126/science.aal4369.

Sources:

"Home Run Financing." Home Run Financing, https://www.homerunfinancing.com/2021/06/08/best-type-of-roof-for-hurricanes-high-winds/. Accessed 2024.

"Learning Center." Colony Roofers, Apr. 2024, https://colonyroofers.com/learningcenter/securing-roof-high-wind.

McLaurin Law. "Protect Your Home from High Winds: 7 Essential Tips." McLaurin Law, 2024, https://mdlawtex.com/blog/protect-your-home-from-high-winds-7-essential-tips/.

Milman, Oliver. "How Climate Risks Are Driving Up Insurance Premiums Around the US – Visualized." The Guardian, Dec. 2024, https://www.theguardian.com/environment/2024/dec/05/climate-crisis-insurance-premiums.

"Visualized: The Parts of the US Where Summer Heat Has Risen the Most." The Guardian, June 2024, https://www.theguardian.com/environment/article/2024/jun/27/us-summer-extreme-heat-map.

Milne, M. "Designing Your Home to Survive Wildfires." Research Professor of Architecture, UCLA, https://energy-design-tools.sbse.org/FIRES.html. Accessed 2024.

Morrison, R. "How Are the Climate Crisis and the Housing Crisis Related?" Earth.org, Aug. 2023, https://earth.org/how-are-the-climate-crisis-and-the-housing-crisis-related/.

"Mutual Housing at Spring Lake: A Zero Net Energy Community for Farmworker Families." Mutual Housing, https://www.climatereadiness.info/wp-content/uploads/2016/10/Mutual-Housing-at-Spring-Lake.pdf.

"NASA: What Is Climate Change?" NASA, https://science.nasa.gov/climate-change/what-is-climate-change/. Accessed 2024.

"Net Zero Homes: Everything You Need to Know." West Coast Green, https://www.westcoastgreen.com/net-zero-homes/#site-header. Accessed 2024.

Olick, Diana. "U.S. Housing Market Could Lose Nearly $1.5 Trillion in Value Due to Rising Costs of Climate Change." CNBC, Feb. 2025, https://www.cnbc.com/2025/02/19/us-housing-market-could-take-1point5-trillion-hit-due-to-climate-change.html.

"Passive and Low-Energy Cooling." Energy Efficiency and Renewable Energy, Sept. 2022, https://basc.pnnl.gov/resource-guides/passive-and-low-energy-cooling.

Poon, Linda. "Where America's Climate Migrants Will Go As Sea Level Rises." Bloomberg City Lab, 2020, https://www.bloomberg.com/news/articles/2020-02-03/mapping-migration-in-the-face-of-climate-change.

"Plumbing: The Basics of Core Plumbing Layout." Office of Energy Efficiency and Renewable Energy: Building Science Education, https://bsesc.energy.gov/energy-basics/basics-core-plumbing-layout. Accessed 2024.

Sources:

Rankin, Andrew. “Climate Can Affect Housing Costs, Communities.” Center for Climate and Energy Solutions, Apr. 2021, https://www.c2es.org/2021/04/climate-can-affect-housing-costs-communities/.

“Sea Level.” NASA: Global Climate Change, 2021, https://climate.nasa.gov/vital-signs/sea-level/.

“Sewer Lateral Inspection Program (SLIP): Backwater Valves.” City of Santa Barbara, https://santabarbaraca.gov/government/departments/public-works/water-resources/sewer-lateral-inspection-program-slip/backwater. Accessed 2024.

Sisson, Patrick. “Climate Change Is Killing Buildings in Slow Motion.” Bloomberg, Oct. 2024, https://www.bloomberg.com/news/features/2024-10-21/how-climate-change-exacts-a-hidden-toll-on-buildings.

Somvichian-Clausen, Alex. “Extreme Heat and Climate Conditions Are Hitting the Planet Decades Earlier Than Expected.” The Hill, https://thehill.com/changing-america/sustainability/climate-change/496872-potentially-fatal-combinations-of-heat-and. Accessed 2021.

“Tornados: Risk Index.” Federal Emergency Management Agency, https://hazards.fema.gov/nri/tornado.

“USDA: Decrease Wildfire Risks by Choosing the Right Plants.” USDA, Nov. 2014, https://www.usda.gov/about-usda/news/blog/decrease-wildfire-risks-choosing-right-plants.

WaterSprout. “Mutual Housing at Spring Lake.” WaterSprout, https://watersprout.org/portfolio/spring-lake-woodland/.

“Wildfire-Resilient Buildings: Builders Hold the Key to Combating This Growing Threat.” JLC Online, Apr. 2022, https://www.jlconline.com/projects/disaster-resistant-building/wildfire-resilient-buildings_o.

“World Habitat Awards: Mutual Housing at Spring Lake.” World Habitat Awards, 2017, https://world-habitat.org/world-habitat-awards/winners-and-finalists/mutual-housing-at-spring-lake/.

Zwahlen, M. “Woodland, California: Affordable Housing for Agricultural Workers Builds Community Leaders.” U.S. Department of Housing and Urban Development, https://www.huduser.gov/portal/casestudies/study-110921.html.

Thank you!

If you have any questions, please contact
Olivia Hurley, Community Development Associate:
olivia.hurley@mhponline.org

mhp
improving home & community



mhponline.org I @followmhp | LinkedIn
MHP is an equal opportunity provider.
©2024 Minnesota Housing Partnership