WAR ZONE The Tubbs Fire ripped through parts of Northern California in October. One neighborhood that was hit particularly hard was Coffey Park in Santa Rosa, where 1,500 homes were destroyed.

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Out of the Ashes

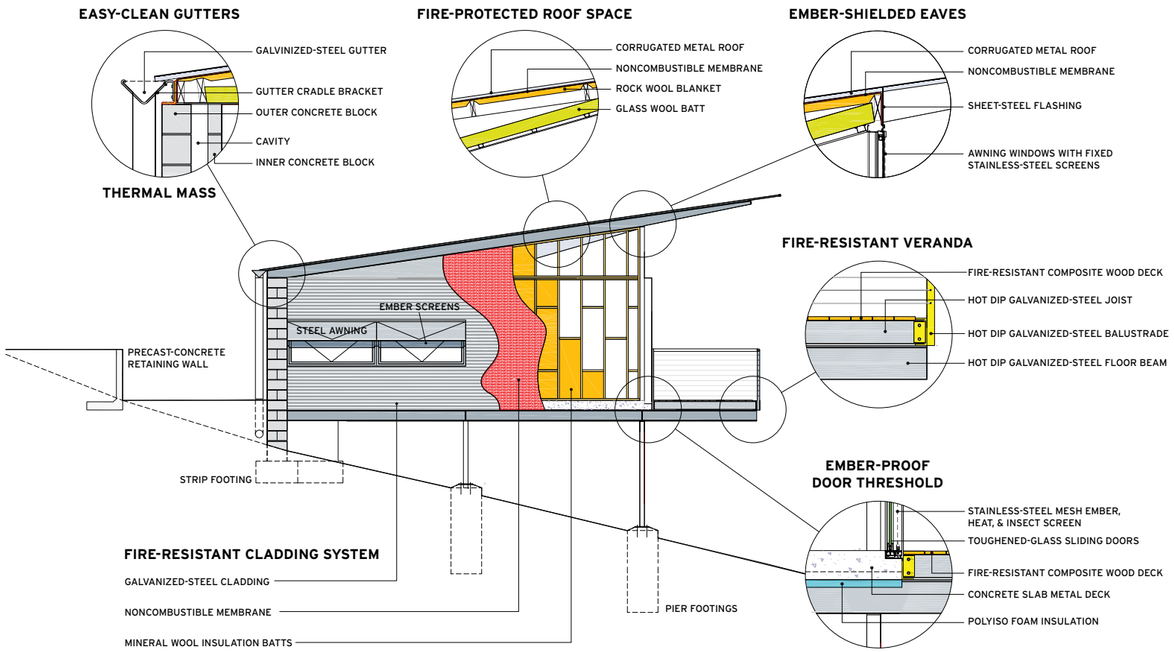
Architects rethink residential design strategies in the wake of last year's destructive California wildfires.

By Joann Gonchar, FAIA

BY NOW the stats are well known, but still horrifying: 2017 was a devastating year in terms of wildfires across the U.S. Nationwide, more than 10 million acres burned, and a record $2.9 billion was spent on trying to control and extinguish the blazes. California suffered an especially catastrophic season, with a series of wildfires tearing across the state, including the Tubbs Fire—the most destructive in its history. It ripped through the wine country north of San Francisco in October, scorching almost 37,000 acres, destroying more than 5,600 properties, and killing 22 people. A new series of fires ignited parts of Southern California in December. The largest was the Thomas Fire, which charred more than 280,000 acres in Santa Barbara and Ventura counties, destroying about 1,000 structures, and killing a civilian and a firefighter. It was tragically followed by a series of powerful mudslides that killed more than 20 people.

The factors that contribute to intense and destructive wildfires are complex and interrelated. They include land-use and zoning policies, woodland-management and fire-suppression practices, and the weather. In 2017, Mother Nature provided the "perfect ingredients" for the fires that would ravage California late in the year, explains Park Williams, a research professor at Columbia University's Lamont-Doherty Earth Observatory in Palisades, New York. Although the ample precipitation in the winter essentially ended the state's five-year drought, it also allowed grasses and other plant life to thrive. The record-breaking hot temperatures that followed meant that abundant dry and fire-prone vegetation was available to fuel the fires. And once they started, they were fanned in northern California by the Diablo winds and in the southern part of the state by the Santa Ana, which typically kick in just as rainy season starts. But the onset of the rains came later than usual, so there was no relief against the tinderbox conditions that caused the flames to spread out of control.

While scientists caution that no individual weather event or single disastrous season can be attributed to climate change, experts do see the imprint of global warming on wildfire activity. An investigation by Williams and John Abatzoglou, an associate professor in the Department of Geography at the University of



KARRI FIRE HOUSE'S FIRE-RESISTANT STRATEGIES

Idaho, shows that human-induced climate change nearly doubled the area affected by forest fires in the American West over the past three decades. Their study, published in the *Proceedings of the National Academy of Sciences*, analyzed satellite data according to eight different metrics, concluding that anthropogenic climate change was responsible for an additional 16,000 square miles of forest fire area between 1984 and 2015.

Many California architects now believe that catastrophic wildfires may well represent the new normal. Last season's blazes "weren't an anomaly; they are a sign of what's to come," says Brandon Jorgensen, a Napa-based designer. He has assembled a group of Bay Area practitioners to propose solutions for building in fire-prone areas. In addition to organizing an exhibit slated for next fall in Napa, the team plans to examine the state's Wildland-Urban Interface (WUI) regulations—guidelines intended to protect life and property where wildfire risk is high—and then recommend changes to code officials.

Some of the region's architects are focused on rebuilding as quickly as possible. Julia Donoho, chair of the AIA Redwood Empire's

IMAGES: © ANDREW HALSALL (BOTTOM); IAN WEIR (TOP AND OPPOSITE)

TREEHOUSE The Karri Fire House is built to the second-highest of six levels of resilience specified by Australian code. Its entry facade (opposite) is largely masonry, but the eastern elevation (above) opens to views of the surrounding eucalyptus forest.

Firestorm Committee and an attorney as well as an architect, is advocating a "whole neighborhood" reconstruction effort that would coordinate contractors and homeowners in certain areas in an attempt to rebuild en masse and expedite reconstruction. She says that 10 builders are interested in such an approach for Coffey Park—an especially hard-hit development in Santa Rosa. A group-reconstruction process is moving forward in another Santa Rosa development, the Mark West Estates, where one contractor is building about 80 houses.

As the rebuilding effort gets off the ground, other architects are putting forward ideas to bring life to devastated neighborhoods. For instance, Byron Kuth and Elizabeth Ranieri, principals of the San Francisco firm Kuth Ranieri, propose small popup shelters that could be distributed throughout a neighborhood and offer shade, cell phone charging powered by rooftop photovoltaic panels (PVs), and a place where homeowners could meet with their contractor or architect. They are also proponents of easing restrictions on accessory dwelling units—often referred to derisively as mother-in-law apartments. Such structures, which many jurisdictions have frowned upon because they increase density, could allow homeowners to rebuild in phases, serving first as their short-term housing before being turned into a home office or a rental apartment.

As design teams start to develop long-term solutions, they will need to consider vegetation along with structure. "Almost every bit of landscape acts as a fuel," warns Stephanie Landregan, the former chief landscape architect of the Mountains Recreation & Conservation Authority, an agency dedicated to the preservation of open space and parkland in and around Los Angeles. Among her recommended strategies are a defensible space around buildings, use of water-retaining plants such as succulents, and avoidance of branches that overhang the roof.

But before building or planting anything in a fire-ravaged landscape, project teams will have to prepare the land, including stabilizing sites and grading. These operations can help prevent catastrophic events like the mudslides that occurred in the immediate aftermath of the Thomas Fire. The procedures can provide important safeguards against more insidious erosion and runoff collecting in storm drains and polluting rivers and streams. In California, the Army Corps of Engineers has removed much of the scorched debris and ash, which contain heavy metals and other toxins. However, runoff from exposed slopes denuded of vegetation, and the sediment it carries with it, still poses a threat to aquatic ecosystems, according to Jessica Pollitz, a project manager in the Petaluma office of civil consultants Sherwood Design Engineers. (Her firm is working on several post-fire residential projects in the north Bay Area, including one with Kuth Ranieri). In some cases the charred soil can become hydrophobic, further hindering infiltration and exacerbating the problem, she points out.

Architects involved in the recovery effort and looking for fire-resistant precedents can be found elsewhere, not just in California, or the United States. One designer who created his practice around wildfire design is Ian

RUGGED REFUGE A house atop a promontory in Montecito, California, has garage-style doors that can be rolled down to protect its glazed facades. The swimming pool water can be used for firefighting if necessary.

Weir, an architect and landscape architect based in Brisbane, Australia. He advises that anyone building in areas prone to wildfires (or bushfires, as they are known there) prioritize fire-resilient construction strategies over site clearing and management of surrounding vegetation. It isn't practical to assume that such landscape maintenance activities will be performed in perpetuity, he says.

An illustration of this principle is the Karri Fire House, completed in 2014 within a mature eucalyptus forest outside the town of Denmark in western Australia. The bar-shaped, three-bedroom residence for a firefighter and his family, designed in collaboration with Queensland-based architect Kylie Feher, has one masonry wall but is otherwise supported by a shop-fabricated steel frame that cantilevers over the steeply sloping site. Galvanized cladding, intended to reflect the radiant heat of a bushfire, covers the roof and three facades. Underneath is a noncombustible fabric membrane similar to that used in firefighting apparel.

Many of the house's features perform double, even triple duty, helping conserve energy and improve comfort, in addition to maximizing fire resistance. For instance, the masonry wall—which incorporates a fireproof cavity—along with the suspended concrete floor, provides thermal mass to help modulate indoor temperature. Metal screens can be rolled down over the east-facing facade, which consists of sliding glass doors. These can be used on a daily basis to shield the interior from heat gain and glare from the intense afternoon sun, as well as keep out insects while letting the breezes in. They can also be lowered during periods of fire risk to protect the glazing, since glass tends to be the part of a building most vulnerable to fire.

Similar strategies are evident in a 3,100-square-foot, three-bedroom California residence built a decade ago on a promontory high above Montecito. Designed by architect Tom Kundig, principal of Seattle-based Olson Kundig, the muscular building is in tune with its rugged, high fire-risk setting. Built for a retired couple and now owned by a family whose primary residence is on the East Coast, it has a steel structure, weathering steel cladding, an overhanging steel roof and operable, perforated rolling coil garage-style doors. The latter perform much the same way as the screens in the Australian house, protecting the expansive windows that offer stellar bay views. With the aid of a submersible pump, the pool water could be used for firefighting if necessary.

The house survived last December's wildfires and the ensuing mudslides unscathed (the fire came within a quarter of a mile of the property). But Kundig is careful not to oversell its capabilities: "It is virtually impossible to design a fire-proof house" or, at least, one you would want to live in, he says. "Our guiding principle was not to provide fuel for the fire."

Much the same philosophy seems to be behind a house that Palo Alto–based Field Architecture is working on near Healdsburg, in Sonoma County. Although the site did not burn, wildfire resistance has now "been taken on as an explicit objective for all our projects in areas where fire is part of the cycle," says firm principal Jess Field. Conceived as a series of pavilions, the scheme creates defensible space around the collection of structures with a noncombustible paved area. To prevent embers from accumulating, the individual volumes have a metal skin that folds, wrapping their roofs and wall planes to meet a masonry base. The design also eliminates openings that could permit embers to pen-

PHOTOGRAPHY: © NIKOLAS KOENIG

HEALDSBURG HOUSE FIRE-RESISTANT STRATEGIES

1 SITE PLANNING
Structures are stied away from the natural convective draw of ravines and concave landforms.

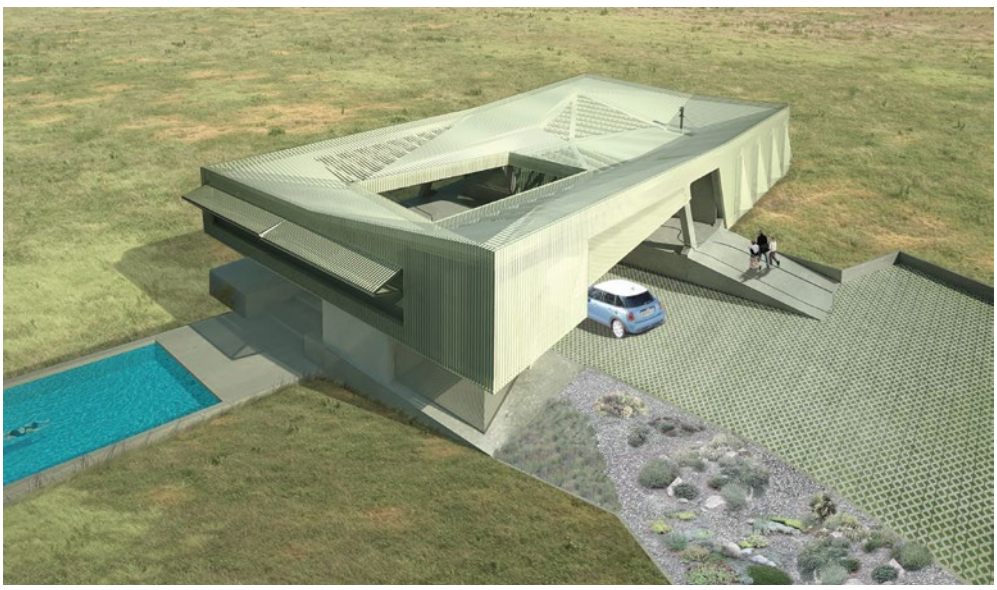
2 LANDSCAPE INTERFACE
Defensible space is preserved with a noncombustible border at the base of structures.

3 BASE
Noncombustible materials at the intersection of ground and wall planes prevent debris accumulation.

4 RESISTANT ASSEMBLY
Vented soffits and unsealed mechanical spaces are eliminated to prevent ember intrusion.

5 GEOMETRY
Noncombustible siding over heat-resistive insulation continuously wraps the walls and roofs.

6 ENVELOPE DETAILING
Assemblies are detailed to form a tight envelope with minimal collection zones.



RESILIENT RESIDENCE Kuth Ranieri has developed a theoretical case study house to illustrate the relationship between fire resistance and environmental performance. The concrete-and-steel-framed building, clad in corrugated metal, includes renewable energy, graywater recycling, rainwater storage, and natural ventilation, among other features.

etrate the exterior envelope such as vented soffits and unsealed mechanical spaces. Field says that architects working in similar vulnerable settings must accept fire protection as a critical project criterion, "just as we design for other environmental conditions, including earthquakes, wind, and solar orientation."

Field, Weir, and all the other architects interviewed for this article concur that such design objectives as environmental performance and fire resistance are inextricably linked. To illustrate this concept for potential clients, Kuth and Ranieri have developed a theoretical four-bedroom case study house that integrates green strategies with wildfire preparedness. It incorporates passive systems, such as natural ventilation and thermal mass, with energy-generating PV panels, and battery backup, to provide stable power after a disaster. It also includes rainwater storage and graywater recycling to help conserve potable water while providing a secondary source—along with the swimming pool—for firefighting. They hope it makes the point that the reconstruction effort is "an opportunity not to just rebuild, but to rebuild smarter, more resilient, and ecologically attuned structures." This goal will become only increasingly urgent as California—and the planet—becomes hotter, drier, and more prone to catching fire. ■

Continuing Education

To earn one AIA learning unit (LU), including one hour of health, safety, and welfare (HSW) credit, read "Out of the Ashes," review the supplemental material found at architecturalrecord.com, and complete the quiz at continuingeducation.bnpmedia.com or by using the Architectural Record CE Center app available in the iTunes Store. Upon passing the test, you will receive a certificate of completion, and your credit will be automatically reported to the AIA. Additional information regarding credit-reporting and continuing-education requirements can be found at continuingeducation.bnpmedia.com.

Learning Objectives

1 Outline the factors that contribute to catastrophic wildfires.

2 Explain the relationship of wildfire activity and climate change.

3 Describe landscape and construction strategies that can enhance a building's fire-resistance.

4 Discuss the overlap between fire-resistant design strategies and those that save water and energy and enhance occupant comfort.

AIA/CES Course #K1804A