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Community Tree Care in Wildfire-Prone Landscapes

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Trees provide benefits to home and community landscapes. For example, their shade reduces ambient air temperatures thereby decreasing energy bills. Trees also decrease stormwater runoff and soil erosion by delaying rainfall impact to the ground. They mitigate air pollution through uptake of gases like carbon dioxide and store carbon, which helps reduce the impact of climate change. In addition, they beautify yards and communities, and increase property values. These are just a few of the reasons to plant and care for trees.

However, trees can also be a significant fuel source in a wildfire, especially when in close proximity to residences and other infrastructure (Fig. 1). Tree placement, maintenance, health, and type of species are all important considerations in wildfire-prone landscapes. This publication provides information on how best to manage trees in communities prone to wildfire, with a focus on limiting trees' ability to ignite a residential structure.

Figure 1: *This image displays remains of a wildfire-damaged house (on the left) surrounded by scorched trees and is in stark contrast to an unburned neighboring house (on the right) not closely surrounded by trees. Though the complete story of this fire is not known, it is possible that tree placement was an important risk factor contributing to ignition of the house on the left.*
Credit: Virginia Department of Forestry

WILDLAND FIRE IN GEORGIA

Georgia has a long history of fires in natural landscapes, known as wildland fires. These fires, ignited by lightning and humans over millennia, shaped the environments and species where they occurred. For example, the fire-dependent longleaf pine ecosystem is home to the protected gopher tortoise, federally endangered red-cockaded woodpecker, and many other species that depend on frequent, low intensity wildland fire to maintain conditions for their survival.

A wildland fire includes both wildfires and prescribed fires. A wildfire is a wildland fire originating from an unplanned ignition, such as lightning or unauthorized and accidental human-caused fire. A prescribed fire is defined as a wildland fire originating from a planned ignition in accordance with applicable laws, policies, and regulations to meet specific objectives (Fire Management Board, 2009). Landowners in Georgia conduct prescribed fires on about a million acres a year to manage forest and agricultural lands (Mark Melvin, 2020). Prescribed fires rarely cause problems. Wildfires, on the other hand, are of the greatest concern for communities because they are less predictable.

Georgia has thousands of wildfires every year, with some years resulting in more destruction than others. The autumn of 2016 was one of the worst years in recent history. Severe drought, combined with accidental ignitions, arson, and lightning strikes, created the perfect conditions for widespread wildfires in the Appalachian region of numerous southeastern states, including Georgia. At that time, the Rock Mountain Fire in Rabun County (burned 12,962 acres),

the Rough Ridge Fire in Fannin County (burned 27,870 acres), and several other smaller wildfires in North Georgia damaged property, threatened wildlife and livestock, and created hazardous air quality and dangerous driving conditions. Though wildfires reflecting the geographic scale of Western U.S. wildfires are relatively rare in the southern region, Georgia's wildfires nevertheless threaten individual homes and communities. Wildfire risk increases as the state urbanizes, average temperatures increase, and a growing number of residents are using outdoor fire for recreational and yard maintenance purposes. Since wildland fire is a natural occurrence in the state, learning to reduce one's wildfire risk is an important action for protecting lives and investments.

FIRE BEHAVIOR & FUELS

Fire requires a combination of heat, oxygen, and fuel. A wildland fire's intensity (energy released from the fire) and severity (impact the fire has on the environment) are dependent on atmospheric conditions (weather), topography, and fuels. Weather conditions with prolonged periods of low or no precipitation, high temperatures, low humidity, and high winds provide ideal fire weather. Topography influences the speed at which fire moves, or spreads. Fire always travels faster uphill than downhill. Fuel is anything that will burn, including forest floor litter, fallen logs, pinecones, standing dead trees, live trees, mulch, landscape plants, and built structures like a house. **Any fuel will burn if dry enough**, but several characteristics of fuels can increase or decrease their likeliness to ignite and help a fire spread. These include:

- **Amount of fuel:** more available fuel means there is more fuel to burn (if dry enough to ignite)
- **Type of fuel:** small fuels (e.g., pine straw) respond quickly to changes in atmospheric moisture and can dry quickly. If they ignite, they burn quickly because there is a small amount of fuel to burn. Large fuels (e.g., a large log on the forest floor) respond slowly to changes in atmospheric moisture and so dry out or re-moisten slowly. If a forest floor log is dry enough to ignite, it will burn for a long period of time because it is a large quantity of fuel available to burn. During this time, it will create significant smoke and embers that can ignite other fuels.
- **Arrangement of fuel:** fire moves, or spreads, based on available fuels to burn. When dry fuels are close together, a fire can move more easily. When fuels are spaced apart, fire either cannot move or will move more slowly. Fuels may be arranged horizontally and a fire spreads along the ground or fuels can be arranged vertically (ladder fuels), where a fire climbs from the ground to some point above the ground (e.g., a tree canopy).
- **Fuel moisture:** the moister a fuel, the less likely it will ignite. Small fuels (e.g., pine straw) gain and lose moisture easily, whereas larger fuels gain and lose moisture slowly.

TREES ARE FUEL FOR A WILDFIRE

Trees can be a significant fuel source if atmospheric conditions support a wildfire. Trees produce leaves, twigs and branches, bark, pinecones, and fruits - all of which are fuel. Shed materials fall to the ground below the tree or on any object lying below them where fire can reach the fuel. All parts of the tree are flammable if dry enough to burn, whether they are green (live) or brown (dead). Standing dead trees (snags) provide excellent wildlife habitat but are also a large fuel source if dry enough.

Native tree species, like longleaf pine, evolved characteristics that enable them to be more resistant to the damaging effects of fire on live plant tissue. Some of these characteristics include thick bark, self-pruning branches, cone placement higher in the canopy, and foliage that protects buds. As well, some trees in non-drought conditions are naturally less flammable than other trees due to several characteristics. Table 1 lists characteristics that can increase or decrease flammability potential. **It should be noted, however, that under extreme fire-weather conditions, all plants are flammable.**

Table 1: Characteristics of high and low flammability plants (Behm et al., 2004; Doran et al., 2004).

Moisture	Low moisture	High moisture
Chemicals found in plant parts	Contains higher concentration/ presence of volatile oils, waxes, or resins	Lacks/ contains minor concentration of volatile oils, waxes, and resins
Leaves	Thin or narrow leaves	Wide, flat leaves
Plant type	Evergreen conifer species	Deciduous
Branching density and pattern of shrub or tree	Dense	Loose, open
Bark	Peeling or shredding bark	Bark not peeling or shredding
Retention of dead plant parts	Retains dead branches and/ or leaves	Sheds dead branches and/ or leaves

TREES & LADDER FUELS

Ladder fuels enable a fire to spread from the ground to some point above the ground (Fig. 2). Ladder fuels are common in residential landscapes and communities, especially in landscape beds (Fig. 3). If a wildland fire reaches the canopy of a tree, the canopy can ignite and create a canopy fire. Canopy fires burn hot and move quickly. These types of fires are considered very dangerous and so limiting ladder fuels and canopy fires is an important part of wildland fire management. As well, a burning canopy can lead to a significant number of embers that could ignite a nearby structure and/or other vegetation. Fortunately, canopy fires are rare in Georgia; however, they can occur in pine plantations.

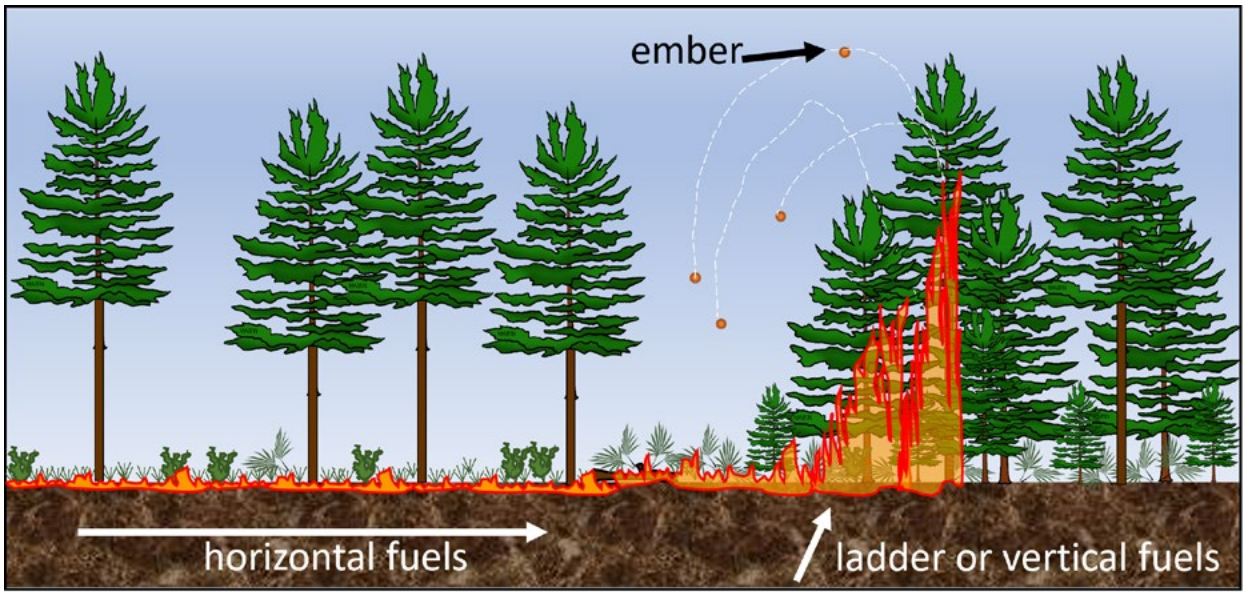

Figure 2: *Graphic display of how wildland fire spreads based on available fuels. As seen, fire may spread along the ground via horizontal fuels or a fire may spread vertically via vertical fuels.* Credit: Holly Campbell

Figure 3: *Ladder fuels consist of closely spaced vegetation of varying heights that may enable a wildland fire to climb from the ground to the canopy of a tree. In the community landscape, ladder fuels are commonly found in landscape beds as pictured in this image.* Credit: Holly Campbell

HOW STRUCTURES IGNITE

Structures include residences (e.g., single family home, condominium, apartment) and their attachments (e.g., deck, arbor, patio), storage sheds, shops, detached garages, barns, businesses, churches, vacation homes, and community buildings. Structural ignition from wildfire occurs from direct flame contact, embers, and/ or radiant heat (Fig. 4). Direct flame contact (a process known as conduction) occurs when flames come in direct contact with a part of the structure, leading to ignition of the structure. Embers from a wildfire are lifted into the atmo¬sphere by heat generated from a fire (a process called convection). Embers can travel over a mile and ignite a new fire where they land. If a wildfire ember lands in dry leaves on a residential roof or in a gutter, the ember can ignite the leaves and potentially ignite the structure. **Embers are the primary way homes ignite during a wildfire.** Lastly, radiant heat ignition occurs when the heat from a nearby fire dries out and raises the temperature of the structure's building material enough for it to ignite.

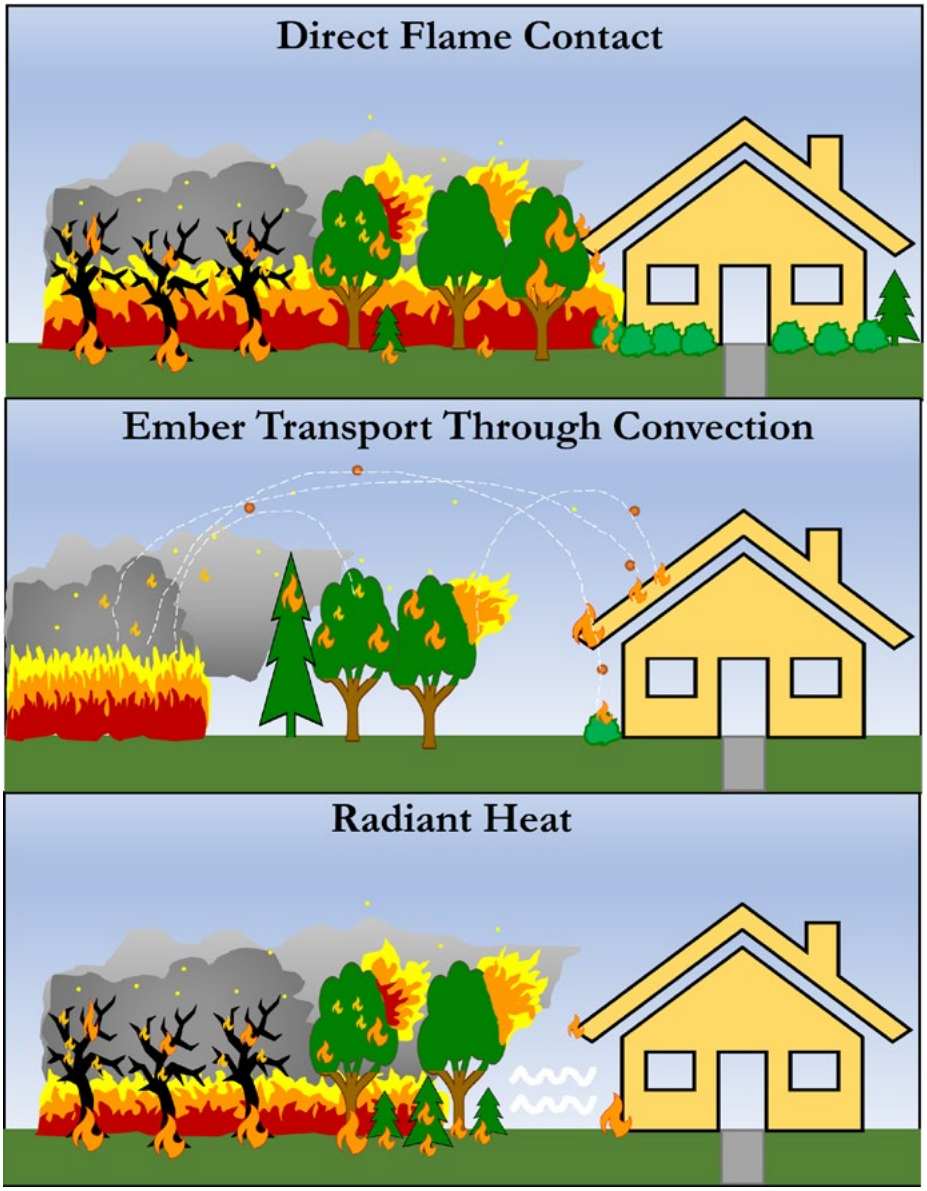

Figure 4: *Examples of structural ignition via direct flame contact, embers, or radiant heat.*
Credit: Holly Campbell

WILDFIRE RISK MITIGATION ACTIVITY FOR COMMUNITY TREES

Tree Placement to Reduce Wildfire Ignition Risk to Structures

The National Fire Protection Association (NFPA), in collaboration with several partners, developed the Firewise USA program to help communities and residents lower their wildfire risk. Firewise landscaping, otherwise known as fire-resistant landscaping or firescaping, is a type of landscape design and maintenance that reduces the risk of structural ignition from wildfire by modifying the fuels surrounding the structure, including the trees. Learn more about specific recommendations at the Firewise USA website (See Additional Resources). Firewise USA has specific recommendations for tree placement around the home, including (Fig. 5):

- **No trees placed or grown in the area 0 – 5 feet from the structure or any attachments on the structure** (e.g., deck). This is the most vulnerable location of the structure to ignition, so eliminating fuels in this area is strongly encouraged.
- **The dripline of a tree should be no closer than 10 feet from the structure.** The tree will shed debris on the roof, deck, or in close proximity to the structure, increasing ignition potential.
- **Trees and/or groups of trees grown in area 5 - 30 feet out from the structure should be spaced 18 feet apart** (18 feet between driplines of the trees)**; trees and/or groups of trees grown in area 30 - 60 feet out from the structure should be spaced 12 feet apart; trees and/or groups of trees grown in area 60 - 100 feet out from the structure should be spaced 6 feet apart.** The 5 -30 foot zone around the structure is still a high risk area for structural ignition. Widely spacing large fuel sources like trees helps minimize the amount of fuel in close proximity to the structure. Trees further from the structure can be spaced closer since the fuel hazard is a function of distance to structure and distance to additional fuel sources.
- **The lower branches of trees should be 10 feet above or away from other vegetation.** This is recommended to prevent ladder fuels since underlying or nearby vegetation will typically have flame lengths less than 10 feet, thus reducing the risk of a canopy fire.
- **Trees on slopes should be spaced further apart.** This is recommended since fire moves faster uphill. As the fire quickly spreads uphill, its flames lean uphill, thus requiring more space between fuels to prevent them from igniting one another.

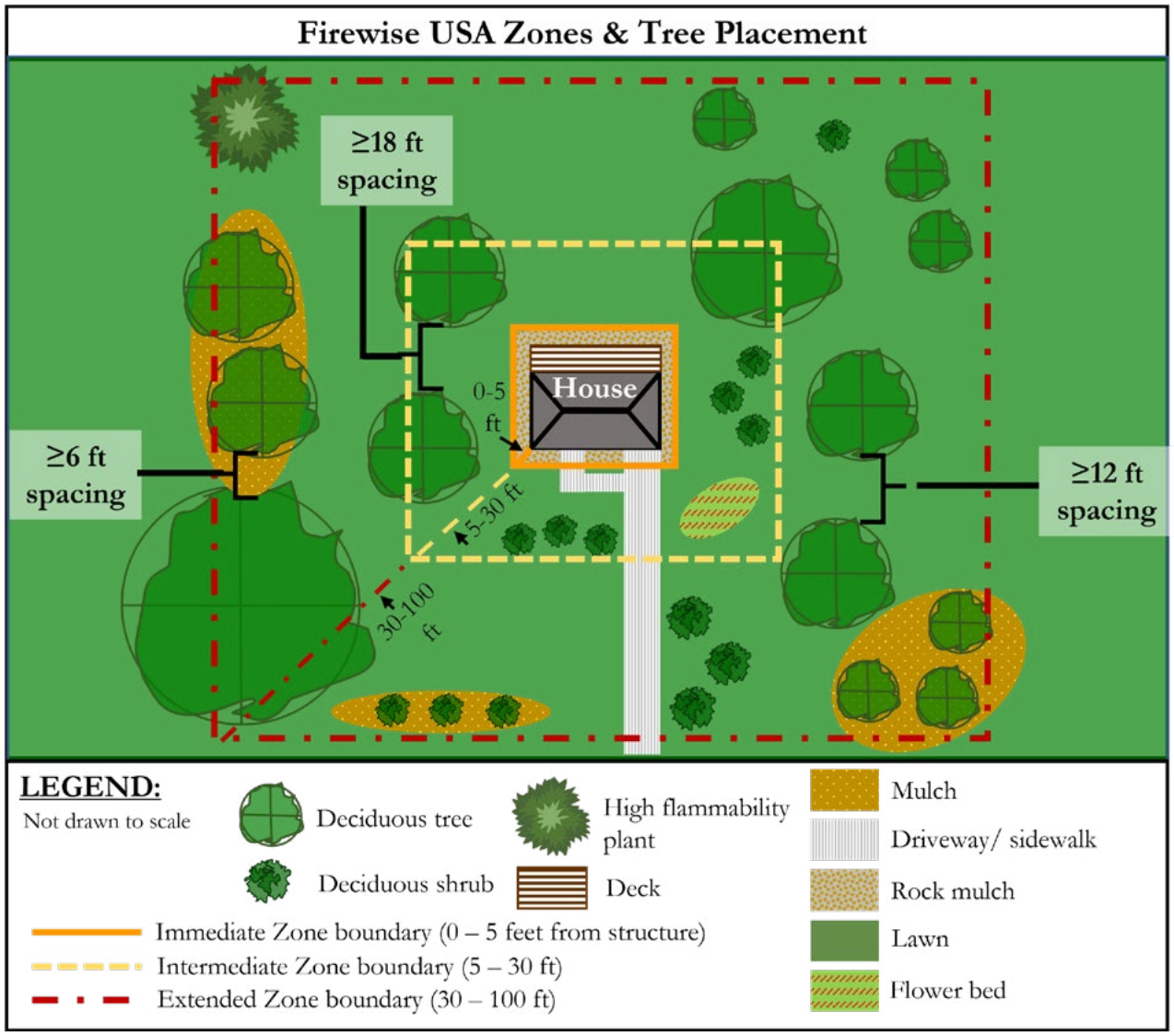

Figure 5: *Firewise USA Zones and tree placement (spacing). Spacing guidelines provided by Firewise USA and graphic provided by author.*

Tree Maintenance to Maintain Wildfire Risk Reduction

Managing a lower flammability landscape entails maintaining spacing of trees per Firewise USA recommendations on a seasonal and annual basis (see section above).

Tree leaves and other tree debris should be removed from roofs, gutters, decks. Debris should also be removed from the 0 – 5 foot area around the home, and from around flammable landscape structures like fences and play structures.

Certified Arborists, landscape architects, and other professionals can play an important role in modifying a landscape to make it more wildfire resilient, thus lowering the risk of structural ignition. Typical tree maintenance tasks by a tree care professional may include pruning (e.g., canopy raising, thinning, and reduction pruning) or tree removal. Tree care professionals can also serve an important role as educators and advocates of tree management and retention in wildfire-prone communities per the recommendations above. A fire-resistant landscape need not be void of trees, but actions taken to minimize risk are recommended.

Other Considerations

Though any tree can ignite under certain atmospheric conditions (e.g., prolonged drought), the selection and/ or placement of lower flammability tree species is recommended to lower the risk of structural ignition. If a community chooses to plant a higher flammability tree, minimizing the horizontal and vertical fuels around the tree and locating it as far from the structure as possible (at least greater than 30 feet) is recommended. See the table above or visit the Additional Resources section for more recommendations on lower flammability tree species.

IS YOUR COMMUNITY OR HOME AT RISK TO WILDFIRE?

Some Georgia communities and residents are at an in¬creased risk to wildfire based on where they are located. Higher wildfire risk areas are areas where human infrastructure is adjacent to or intermingles with undeveloped natural areas, or wildlands (Fig. 6). Structures in these higher risk areas are more at risk to wild¬fire because wildfires ignited in adjacent wildlands have a shorter distance to travel and potentially ignite nearby structures compared to structures not ad¬jacent to wildlands. According to the 2020 U.S. Census and other reports, Georgia has one of the fastest growing populations and contains a high percentage of communities in higher wildfire risk areas (Martinuzzi et al., 2015; U.S. Census Bureau, 2021).

There are a few ways you can learn about your communities' wildfire history and whether your residence lies in the WUI.

- Inquire with your local fire department or Georgia Forestry Commission County Forester: https://gatrees.org/about/county-contacts/
- Identify your WUI risk on the Southern Group of State Forest¬ers Southern Wildfire Risk Assessment Portal (SouthWRAP): www.southernwildfirerisk.com/
- Identify your wildfire risk on the USDA Forest Service Wildfire Risk to Communities webpage: https://wildfirerisk.org/

Figure 6: ***Higher wildfire risk communities occur immediately adjacent to wildlands (a) or are intermingled with wildlands (b).*** Credit: Georgia Forestry Commission

CONCLUSION:

By following a few simple guidelines as described in this article, communities can significantly decrease the likelihood of substantial destructive impacts from wildfires and community members and tree care professionals can play an important role.

REFERENCES

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Melvin, M.A. 2020. 2020 National Prescribed Fire Use Report. Technical Bulletin 04-20. Coalition of Prescribed Fire Councils, Inc. and National Association of State Foresters. 9 p.

U.S. Census Bureau. 2021. Name of data or report. Retrieved from [https://www.census.gov/quickfacts/GA].

ADDITIONAL RESOURCES

Firescaping: Wildfire-Resistant Landscaping in Georgia by Holly Campbell. 2020. Warnell Outreach Publication WSF-NR-20-96A: https://bugwoodcloud.org/resource/files/18516.pdf

Firescaping Online Training for communities: https://open.ugaurbanag.com

Fire-Resistant Landscaping in North Carolina by Kays et al. 2020. https://content.ces.ncsu.edu/fire-resistant-landscaping-in-north-carolina

International Society of Arboriculture (ISA) Southern Chapter Southern Wildfire Risk Reduction Qualification (WRRQ): https://www.isasouthern.org/wildfire-risk-reduction-qualification-wrrq

Prescribed Fire Training for communities: https://ifas-cesrxfire.catalog.instructure.com/courses/89854/enrollment/new