

Minimizing Wildfire Risk

—A forest landowner's guide



'Had we properly managed our forests, the devastation caused would not have been nearly as severe as it has been, and it's a crying shame. The point is that we can prevent fire by good sound practice.'

—President George W. Bush, 2002

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Many people are unaware that wildfire poses a threat to their forestland. While it may not be your daily concern, these North Carolina statistics from 2001 may change your mind:

- More than 8,100 homes and other structures valued at \$563 million were threatened by wildfire.
- More than 560 homes or other structures worth more than \$5.4 million were damaged or destroyed by wildfire.
- More than 760 vehicles valued at \$3.6 million were lost to wildfire.
- More than 24,500 acres of forest were damaged or destroyed by wildfire.

Wildland firefighters are typically able to protect 99 percent of threatened homes and structures, but that protection comes at a cost and a risk of life and limb. As more people reside among the trees, the risks of wildfire loss and destruction will increase.

Fortunately there are simple, proven ways to reduce the risk of wildfire. This publication explains how following basic forest stewardship practices can help reduce the risk of wildfire on your forested property.

Is your forest at risk?

The first step in minimizing the risk of a wildfire is to assess your risk level. Get out and explore your land and surroundings. What is the major land use in your area? Are the surrounding forests thinned and burned regularly? Do the surrounding forests appear park-like? Is the land around you heavily vegetated with a continuous layer of impenetrable shrubs, trees, and vines and no clear view into undeveloped areas?

If you are surrounded by forestland that is open or park-like, it is unlikely that you are at a high risk of a wildfire. But if the land around you is heavily vegetated with a continuous layer of impenetrable shrubs, trees, and vines and no clear view into undeveloped areas, you are at a greater risk of wildfire.

Situations that need attention

- Dense vegetation
- Continuous “ladder-like” vegetation, such as vines and small trees, that allow fires to climb
- Hazardous buildup of vegetative fuel for a fire
- Lack of firebreaks throughout the property.

Forest conditions/characteristics



Forest at risk of wildfire.



Safe forest.

Photos by Robert Barron

What makes forests burn?

Fires are influenced by three major factors: weather, topography, and vegetation (fuel).

These factors determine:

- Risk—the likelihood of a wildfire starting
- Spread—how fast a wildfire will burn
- Behavior—the direction and intensity of a wildfire and firefighters' ability to extinguish it.

Weather

Wind, relative humidity, temperature, rainfall, and atmospheric stability affect fire behavior by drying fuel and making it more flammable. High winds that are gusty, low humidity, high temperatures, and drought conditions lead to the rapid spread of a wildfire. The combination of severe weather conditions and hazardous fuel levels can generate devastating, nearly uncontrollable wildfires.

Topography

Steep slopes and forest openings affect the direction and spread of wildfires. Steep slopes can expose fuel to more solar radiation, increase winds, and cause wildfires to spread faster. A wildfire can spread twice as fast on moderately steep slopes (40 percent incline) and four times as fast on very steep slopes (70 percent incline). Narrow draws often act like chimneys, allowing wildfires to spread faster than they ordinarily would.

Vegetation

Ground-level fuels are vegetation that accumulates on the forest floor, such as pine needles, fallen limbs, and leaves, as well as low-growth plants, such as weeds, shrubs, and small trees. These fuels are the primary means by which wildfire spreads. Many of these plants are adapted to fire. They have thick bark or can resprout quickly after a fire. Without periodic fire these fuels can accumulate to dangerous levels. For example, in the coastal plain, pine stands can accumulate hazardous levels of fuels in as little as five to six years, posing a serious

threat to all forest resources from wildfire.

Wildfires that begin in forests with heavy levels of ground-level fuels spread rapidly and often move into the tops, or crowns, of tall trees by climbing up shrubs, vines, and small trees. These types of fuels, which allow fire to spread up into the crowns, are called ladder-fuels.

Although weather and topography cannot be changed, the vegetation (fuel) can be modified. Many of our opportunities to reduce the risk of wildfire lie in the proper management and manipulation of wildland vegetation.

What type of forest do you have?

While exploring your land and surroundings, determine what kind of vegetation is on your property. The type of vegetation will affect your level of risk.

- *Upland hardwood forests*—These forests, dominated by deciduous trees, burned naturally only about every 10 years. Wildfires can occur in these forests, causing catastrophic damage, but they are rare. The exception is laurel-rhododendron thickets on mountainous terrain. Wildfires occur more frequently there and also cause catastrophic damage.
- *Longleaf pine/turkey oak sandhills*—This ecosystem is adapted to fire, with fires burning naturally there every two to four years. Because fires occur rather frequently, the fires are relatively cool, which helps maintain a pine forest with an understory of grass and herbs. Exclusion of fire from this ecosystem leads to a **high risk** of catastrophic wildfire.
- *Loblolly pine/shortleaf pine/Virginia pine*—Fires tend to occur naturally every three to four years in these forests. Because fires occur fairly frequently, pines are the dominant species. Exclusion of fire from these forests can lead to catastrophic damage if wildfires do occur.
- *Southeastern wetlands*—Fires can occur naturally every 10 to 100 years in wetlands or pocosins, promoting vast areas of switch-

These management practices can help manage and reduce fuel load while also potentially benefiting aesthetics, recreation, wildlife, and timber production.



Photo by Robert Bardon

Dense vegetation.

- Thinning lowers the risk of wildfire by reducing the number of standing trees or the amount of woody debris that may accumulate on the forest floor. Thin existing trees so that their crowns have space to grow. First remove trees that are overtopped, dead, or damaged, or that have forked crowns or other signs of poor health and quality.



Photo by Robert Bardon

Ladder fuels (continuous fuel from ground to tree tops).

- Remove one "ladder rung" of vegetation by pruning lower tree branches and reducing the density of vines.
- Remove three times the height of the lowest fuel level. If shrubs average 3 feet tall, for example, clear an additional 9 feet of vegetation above them.



Photo by Robert Bardon

Buildup of vegetative fuels to hazardous levels.

- Conduct an initial burn to reduce fuel, then conduct periodic burns. The interval between burns can vary, although a four-year burning cycle is typical after the initial burn.



Photo by N.C. Division of Forest Resources

Lack of firebreaks throughout the property.

- Develop a network of firebreaks, both natural and man-made, in order to reduce the risk of wildfires spreading. Use logging roads, skid trails, streams, and cultivated fields when possible. To be effective, firebreaks need to be at least 10 to 12 feet wide, and wider in hazardous areas, with no abrupt change in direction. Remove all vines and overhanging brush that may carry fire across the line.

cane, grasses, and herbs while reducing shrub competition. Exclusion of fire from wetlands and pocosins has resulted in a loss of habitat for many wildlife species and has led to a **high risk** of catastrophic wildfire during dry periods.

Management practices to minimize risk

To get the most benefit from forest management practices, you should seek assistance from a registered forester. For a list, contact the N.C. Board of Registration for Foresters at 919-772-5883 or online at <http://members.aol.com/ncbrf/>. Forest management practices go a long way toward reducing the risk of wildfire. There are several forest management "transgressions" that can increase a landowner's risk of wildfire (see box on left).

Thinning

Thinning is the cutting or removal of trees from a stand to regulate the number, quality, and distribution of the remaining crop trees. Thinning lowers the risk of wildfire by reducing the density of standing trees (ladder-fuel) or woody debris that may accumulate on the forest floor. It also promotes forest health, aesthetics, and timber production by concentrating growth on fewer, faster-growing trees and by reducing the time to final harvest. Table 1 gives spacing guidelines for

the crop trees to be left per acre at various levels of density. The spacing varies according to the average diameter of a stand's dominant and co-dominant trees measured 4.5 feet above the ground. Dominant and codominant trees are those trees that form the forest canopy, receiving sunlight from the top and sides. When thinning, first remove trees that are overtopped, dead, damaged, or have other signs of poor health and quality.

Pruning

Pruning reduces the risk of wildfire by removing low-hanging vegetation that could ignite shrubs, vines, and eventually the tops of trees. Pruning crop trees also helps improve timber value, appearance, and access to the property. Pruning branches before they reach 1½ inches in diameter will speed wound closure and minimize knot size. To maintain tree vigor, however, do not prune excessively (Figure 1). It's best to maintain at least one-half to two-thirds of the tree height with live branches. For guidelines on

pruning woodland trees properly, refer to *Pruning Woodland Trees*, Woodland Owner Note 34, N.C. Cooperative Extension Service. This publication is available online at <http://www.ces.ncsu.edu/nreos/forest/woodland/won-34.html>.

To reduce the threat of a wildfire climbing a ladder of vegetation, make sure each level of vegetation (branches, etc.,) begins at three times the height of the next lowest level (Figure 2). If this cannot be achieved through recommended pruning, remove the lower shrubs and/or trees completely.

Hazardous buildup of fuels

Fuel reduction burning

A fuel reduction burn lowers the risk of wildfire by reducing the dangerous levels of combustible fuels under forest stands. In as little as five to six years, forest fuels can accumulate to dangerous levels in Southern pine forests, subjecting all forest resources to a serious threat from wildfires. Prescribed, or periodic, burning is typically conducted in pine-dominated forests that include loblolly, longleaf, table-mountain, or pond pines rather than in hardwood forests. To reduce the risk of wildfire in pine-dominant forests, it is

Table 1. Ideal density and spacing for pine and upland oak by average tree diameter.

Pine			
Average tree diameter (inches)	Density level		
	Low	Medium	High
	Spacing between trees (feet)		
8	16	14	12
10	20	17	15
12	24	21	19
14	29	24	21
Upland oak			
Average tree diameter (inches)	Density level		
	Low	Medium	High
	Spacing between trees (feet)		
8	19	15	14
10	24	20	17
12	29	24	21
14	34	27	24

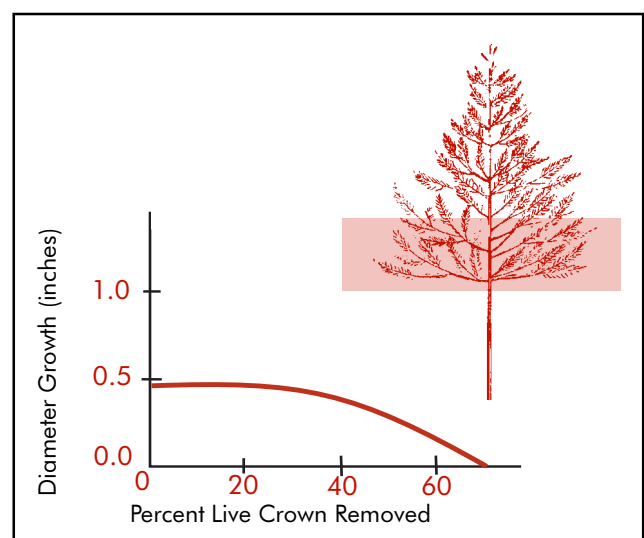


Figure 1. Excessive pruning can reduce the growth rates of trees. Remember, young, vigorously growing trees have a disproportionate amount of foliage in the lower portion of their crown.

(courtesy of NCDFR *Living With Fire*)

important to conduct an initial burn to reduce fuel, then to conduct burns periodically. Burning on a regular interval can improve wildlife habitat, enhance appearance, improve access to the property, and enhance timber production. Initial fuel reduction burns can be conducted when the dominant pines are 15 to 20 feet tall or at least 4 inches in diameter. The interval between burns can be as little as a year, although a three- to four-year burning cycle is usually adequate after the initial burn. In hardwood forests dominated by oak, prescribed burning on a longer cycle would be more appropriate. This allows for adequate accumulation of fuels in order for the burn to be successful. Historically, Southern hardwood forests on dry sites and south-facing slopes burned every 10 years and often were characterized by open stands of oak with a well-developed grass and herb understory.

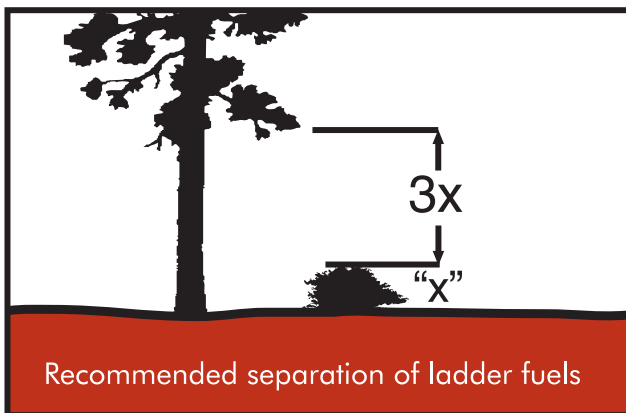
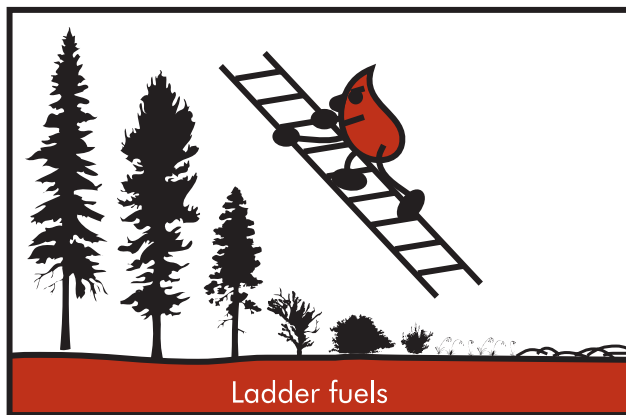


Figure 2. Create adequate vertical separation between trees and shrubs. For example, if the shrubs average 3 feet tall, then 9 feet should separate the top of the shrubs and the lowest tree branches. Therefore, prune the trees to a height of 12 feet above the ground.

In North Carolina, fuel reduction burns and prescribed burns usually are conducted between January and March when most trees are dormant, resulting in less damage to crop trees and adjacent properties. Before initiating any burning, contact the North Carolina Division of Forest Resources. The division has a Landowner Hazard Reduction Prescribed Burning Program to encourage forest landowners to burn their forestland periodically in an effort to reduce the losses from forest fires. The division trains landowners on how to burn, plow control lines, and advises when weather conditions are suitable to burn. The division can be found in the government section of the phone book or online at www.dfr.state.nc.us.

Firebreaks

It is important to develop a network of firebreaks, both natural and man-made, in order to reduce the risk of wildfires spreading. Firebreaks can also improve access to the property and enhance wildlife habitat. Use logging roads, skid trails, streams, and cultivated fields as existing firebreaks when possible, subdividing large areas into logical one-day burning jobs. Firebreaks should be at least 10 to 12 feet wide, and wider in hazardous areas, with no abrupt change in direction. If you are establishing control lines by plowing, hold plow-lines to a minimum and plow after leaf fall to reduce the amount of leaves on plowed lines. Remove all vegetation above the firebreak, such as vines and overhanging brush, that could carry fire across the line. To avoid soil erosion, maintain firebreaks using best management practices (BMPs), such as waterbars, turn-out ditches, and reseeding with wildlife-friendly vegetation. For more information on BMPs, contact your county Cooperative Extension Center or the N.C. Division of Forest Resources.

It is important that firebreaks be maintained regularly because establishing them can be costly. Mowing, brush chopping, or disking every one to three years will maintain firebreaks that promote wildlife by maintaining annual and perennial plant species. Disking promotes annuals more than mowing does because bare soil is

exposed and weed seeds germinate there. Unlike in farming, disking to maintain firebreaks is not aimed at uprooting and turning under all vegetation. Varying the disking intensity and the season of disking influences the plant species mix (Table 2).

Minimizing risk to homes and other structures

If there is a house, outbuilding, or other structure on your forest property, you can minimize the risk of fire damage to them by creating defensible space. Defensible space is the area extending outward from the boundaries of the structure. This distance varies by the type of vegetation growing near the house or structure and the steepness of the terrain. To determine the defensible space needed for your home or structure, find the vegetation type and steepness of slope in the chart below that best describe the area where the structure stands.

Once you have determined the size of the defensible space you can begin to protect it through the “three Rs”—removal, reduction, and replacement.

Removal




Consider eliminating entire plants, particularly trees and shrubs, from around the home or structure (Table 3). This may include removing the mulch next to the house and substituting grasses or rocks. It also might include cutting down dead trees or flammable shrubs.

Reduction

The removal of plant parts, such as branches or leaves, constitutes reduction. This would include pruning dead wood from trees and shrubs, removing low tree branches, and mowing dried grass. Use the checklist below to reduce vegetation that raises the risk of damage to the home or structure due to wildfire.

- Remove branches within 15 feet of the chimney and roof.
- Remove vegetation encroaching on power lines.
- Remove vegetation touching the house or structure.
- Remove all dead vegetation and flammable debris from around the structure.
- Mow grasses and other ground cover vegetation and keep it green during North Carolina’s two fire seasons—spring and fall.

Recommended defensible space distances

Vegetation type	Steepness of slope		
	Gentle slope 0-20%	Moderate slope 21-40%	Steep slope + 40%
 Grass	30 feet	40 feet	50 feet
 Shrubs	30 feet	30-60 feet	60-100 feet
 Trees	30 feet	30-100 feet	100-200 feet

- Don't allow pine needles and leaves to accumulate to more than 2 inches thick within the defensible space of the structure.

Replacement

It is better to replace more flammable plants with vegetation that is less apt to catch fire. For example, you might replace a dense stand of flammable shrubs with an irrigated, well-maintained flower bed. See Table 4 for a list of some suggested substitute plants.

Where to get help

Managing a forest to reduce the risk of wildfire can be an overwhelming task for an inexperienced landowner. It's important to seek assistance from the N.C. Division of Forest Resources (www.dfr.state.nc.us/), your local Coop-

erative Extension Center (www.ces.ncsu.edu), or a consulting forester (www.dfr.state.nc.us/managing/consulting_foresters.htm). Another good resource is the Firewise Website: <http://www.firewise.org>.

Table 2. Herbaceous plants encouraged by seasonal disking.

Plant	Season			
	Spring	Summer	Fall	Winter
Blackberry		X		X
Partridge pea				X
Beggarweed	X	X		
Pokeweed		X		
Ragweed	X			X

Table 3. Types of dead vegetation and recommended practice.

Dead fuel type	Recommended practice
Standing dead trees	Remove all standing dead trees from within the defensible space.
Downed dead trees	Remove downed dead trees within the defensible space if they have recently fallen and are not yet embedded into the ground. But leave in place downed trees that are embedded in the soil and cannot be removed without soil disturbance. Remove all exposed branches from an embedded downed dead tree.
Dead shrubs	Remove all dead shrubs from within the defensible space area.
Dried grasses and wildflowers	Once grasses and wildflowers have dried out or "cured," cut and remove them from the defensible space area.
Dead needles, leaves, branches, and cones (on the ground)	Reduce thick layers of pine needles to a depth of two inches, but do not remove all needles. Take care not to disturb the "duff" layer (dark area at the ground surface where needles are decomposing) if present. Remove dead leaves, twigs, cones, and branches.
Dead needles, leaves, branches, and twigs (other than on the ground)	Remove all dead leaves, branches, twigs, and needles still attached to living trees and shrubs to a height of 15 feet above ground. Remove all debris that accumulates on the roof and in rain gutters at least once a year.
Firewood and other combustible debris	Store firewood and other combustible debris (wood scraps, grass clippings, leaf piles, etc.) at least 30 feet uphill from the house.

Table 4. Suggested plants for wildfire safety.

Common name	Scientific name	Use*	Comments
Large trees			
Red maple	<i>Acer rubrum</i>	S, Sp	Tolerates wet soil conditions.
Thornless honeylocust	<i>Gleditsia triacanthos var. Inermia</i>	S	Tolerates drought, soil, salts, and high pH. Use thornless forms as thorns are dangerous.
Black walnut	<i>Juglans nigra</i>	S	Prime timber tree. Phytotoxic to many other plants.
Tuliptree; Tulip poplar	<i>Liriodendron tulipifera</i>	S, Sp	Does not tolerate poor growing conditions.
Black gum; Black tupelo	<i>Nyssa sylvatica</i>	S, Sp	Not tolerant of air pollution or alkaline soils. Tolerates wet soils.
Wild black cherry	<i>Prunus serotina</i>	S	Tolerates most soil types. Poisonous to livestock.
Oak species	<i>Quercus species</i>	S	Choose species based on soils.
Black locust	<i>Robinia pseudoacacia</i>	S	Tolerates dry, saline soils. Suckering problem. Spines on young growth.
Small trees			
Serviceberry	<i>Amelanchier arborea</i>	Sp, Sc	Drought tolerant.
Eastern redbud	<i>Cercis canadensis</i>	Sp, S	Adapts to urban conditions.
Flowering dogwood	<i>Cornus florida</i>	Sp, S	Not suitable for hot, dry, exposed areas nor poorly drained soils.
Shrubs			
Shining winged sumac	<i>Rhus copallina</i>	Sc, Sp	Useful for dry, rocky sites.
Elderberry	<i>Sambucus canadensis</i>	Sc, Sp	Tolerates both wet and dry soils.
Lowbush blueberry	<i>Vaccinium angustifolia</i>	Sc	Prized for berries.
Highbush blueberry	<i>Vaccinium corymbosum</i>	Sc	Tolerates acid, sandy soil conditions. Wildlife food.
Mapleleaf viburnum	<i>Viburnum acerifolium</i>	Sc, Sp	Tolerates shade and poor soils.
Ground covers			
Wintergreen	<i>Gaultheria procumbens</i>		Good for woodland sites.
Virginia creeper	<i>Parthenocissus quinquefolia</i>		Tolerates urban conditions. Will cover walls.
Red fescue	<i>Festuca rubra species</i>		Tolerates dry to wet sites. Requires full sun.
Partridge pea	<i>Chamaecrista species</i>		Tolerates dry to wet sites. Requires full sun. Wildlife food.
Christmas fern	<i>Polystichum acrostichoides</i>		Prefers wet sites. Tolerates partial to full shade. Wildlife cover.
*S=Shade, Sp=Speciman, Sc=screen			
FOR A MORE COMPLETE LIST OF PLANTS OF THE SOUTH, VISIT www.ext.vt.edu/pubs/turf/430-300/lists.html			

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Prepared by
Robert Bardon, *Forestry Extension Specialist*, NC State University
Robin Carter, *Public Information Officer*, North Carolina Division of Forest Resources

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