Trees & Utilities

Homeowner Guidance for planting & managing trees around Utility Lines



north carolina urban forest council

Trees and Utilities–Working Together to Create Beautiful and Functional communities



The aim of this brochure is to provide guidance for homeowners regarding the planting of trees and shrubs adjacent to overhead utility lines. It is always important to pick the right plant for a site, but it becomes even more important when dealing with electric lines. You should select plants that meet your design goals, but also respect proper distances from overhead utilities. In this publication, we give you important information regarding electric line safety, picking the right plant for the right site, and provide a short list of species well suited to various regions of the southeast.

Trees are an integral part of our urban and suburban communities. They line our streets, parking lots, and hold significant places in our home landscapes. They provide enumerable benefits:

- shading our buildings, which reduces the cost and demand for energy;
- slowing and intercepting stormwater, which reduces particulate pollution, filters water, and helps hold soil in place;
- sustaining environments that enhance human health, well-being, and economics;
- providing habitat for wildlife;
- supporting safe play for our children;
- and beautifying our communities.

To maximize all these benefits, we select plants to match the requirements of the site. Many times, trees are planted simply where there is space, which often is in the right of way (along our streets). This puts our trees in direct conflict with overhead and underground utilities in many cases. If you want to make sure you have high performing, healthy trees, you need to consider where trees are placed with regards to utilities, particularly overhead electric lines, this is the **Right Tree, Right Place** concept.

Electric Line Safety

Eliminating contact between trees and electric lines helps prevent accidental injury or death when someone climbs a tree for recreation or work that may be unaware of the danger.

Every year in the United States people are unnecessarily injured or killed due to inadvertent contact with a utility line.

Tree limbs are poor conductors, but in the right environment can conduct electricity. Pruning trees that are in direct contact or are within 10' from overhead powerlines should be pruned by a **Qualified Line Clearance Arborist**. American National Standards Institute (ANSI) has developed professional standards, ANSI Z133, which covers working in proximity to Electrical Hazards specifically Utility Line Clearance (29 CFR 1910.269). When someone decides to do their own pruning, several things can go wrong. Lay people do not understand tree pruning techniques and a branch can swing in an unpredictable manner, falling into an energized line, which can then contact the person, or the limb can knock the person to the ground. The person likely

For more details on proper pruning techniques, you can also visit http://cals.ncsu.edu/hort_sci/extension/documents/ (There are four publications in this series.). You should always refer to a certified professional if you are unsure how to proceed or if the necessary work exceeds 10-12 feet in height.

does not notice the energized wire, touching it with their hands, the metal pruning tools or a metal ladder. Such accidents are preventable. Don't be fooled, the low voltage service lines coming into your home are no less of a hazard than that of those higher voltage distribution lines that are connected to the pole near the street. Maybe you have been shocked changing a light switch in your home, and that is nothing compared to the type of shock you would receive from a low-voltage utility line. A typical light switch carries 120 volts, but the current is about 10 – 20 amps. A common service line into your home carries 240 volts and over 200 amps, it only takes 0.1 - 0.2 amps to stop your heart. While it is possible to get a shock sufficient enough to kill you from a light switch, you can break the circuit much more readily. That is not true when you come into contact with an energized utility line as you climb a tree or stand on a ladder to prune off a branch.



How can you avoid injury or death when pruning your trees?

- Look for power lines before pruning trees or shrubs. If there are lines nearby, DO NOT attempt to perform any work in these trees.
- Never climb a tree to prune it. Even if the lines are not currently touching the branches, a tree can readily shift and come into contact with the wires once you begin to climb or prune.
- Wearing rubber-soled shoes or rubber gloves will NOT protect you from a potentially fatal shock.
- Never extend long-handled pruners or saws into the tree without checking very closely for power lines. Electricity readily travels through metal, water, trees, and the ground.
- Don't move ladders or long-handled pruning tools around the yard without looking up. Always read and follow ladder use safety labels.
- The most important tip to follow is to hire a Qualified Line Clearance Arborist who can identify energy sources and knows minimum approach distances (MAD). Of course, to protect your property and limit liability you want a certified arborist that is licensed and insured.

Electric Lines

Electric utilities are often regulated by state appointed Public Utility Commissions that require the utility to deliver reliable power. Tree-caused outages are by far the most common reason for interruptions in power supply. As a result, utilities continuously maintain trees and other vegetation that grow in and near their right-of-way.

Trees can cause power outages in several ways:

- Serve as a ground for high voltage electric current (moving electricity from power source through tree into soil)
- Portions of trees break off and land on electric lines.
- Storms can cause trees or tree parts to fall on electric lines
- Improper tree care (particularly improper pruning) can cause portions of trees or entire trees to fall on electric lines
- Trees can catch on fire

There are two types of power lines: transmission and distribution (Figure 1). Transmission lines are the interstate highway system of the electric grid. Transmission lines are placed on concrete or metal poles or towers and are seen crossing the country side from community to community. Transmission lines transmit high voltage electricity ranging from 69,000 volts to 750,000 volts, from power generation facilities to substations in communities. The substations step down the high voltage electricity to distribution voltages of 4000 volts to 35,000

(Figure 1): Transmission and Distribution lines

Spiral vibrator damper reduces vibration in lines generated by wind.

Insulators - prevent eneraized wires from coming in contact with each other or the utility pole.

Cutouts - hold a fuse and open when there is a problem with the line or a section of it.

Lightning arresters protect the pole and equipment from lighting strikes.

Transformers - convert higher voltage electricity carried by primary wires to a lower voltage for use by members.

URD riser - primary underground cable feeding the member.

volts. Distribution lines distribute power from the substations along city streets to homes and businesses. Distribution lines are typically found at the top of wood poles and are identified by cross arms, transformers, and street lights.

Further down on the poles you will find telephone and cable lines that carry only a few volts and are not typically impacted by vegetation. There are different clearance requirements for transmission and distribution lines and both vary depending on the

width of the right-of-way that was established when the line was constructed. Major utilities can spend over \$100 million annually for their vegetation management programs; and the costs keep going up. Electric utilities use Integrated Vegetation Management (IVM) to manage overhead power lines. Planned line clearance, risk-reduction tree patrols, chemical growth management, and reactive customer-requested work are just a few ways that utility arborists ensure reliable delivery of power vear round.

Primary wires - on

top of the pole and carry 7,200 volts of electricity.

Crossarm brace holds up the crossarm which holds the wires on multiphase poles

Neutral wire - below the primary and acts as a ground wire.

Squirrel quards protects animals and prevents outages.

Secondary wire carries the lower voltage electricity to the member's meter after it passes through the transformer.

Ground wire - runs the entire length of the pole. It directs any electricity on the pole safely into the earth.

Pruning Around Utility Lines

To obtain clearance, electric companies must often remove trees entirely or employ directional pruning techniques that can impact the aesthetics of trees planted near powerlines. In the past this often meant topping trees. Topping is severely heading back branches larger than 3" diameter to stubs within the canopy (Figure 2).

Topping removes large stores of the tree's energy, upsetting the balance between the crown and roots. Sudden removal of the crown through topping opens the canopy to sunlight causing sun scald. This is much like when we go to the beach after a long winter and are unprepared for the sun. The removal of most of the canopy leads to rapid new growth. Topping is usually done to shorten the tree but does not accomplish this for the long term. The wounds created by topping allow for the entry of fungal diseases, organisms and insect pests. In addition, the resulting sprout growth is weakly attached, and will quickly reach the former height. These sprouts are often lost during a storm and can cause outages. While it may cost less to top trees now, the true costs will be realized later and can include:

- Expense to remove and replace trees
- Loss of understory plants
- Enhanced risk of branch failure of weakly attached branches
- Perceived reduction in property value

Utility companies employ directional and crown reduction pruning practices aimed at reducing the risk of failure of weakly attached branches. These cuts established by ANSI A300/Z133 are made at the branch collar or back to a lateral branch (Figure 3). Often, however, these cuts, while proper, leave trees with crowns that are one-sided ("L-shaped") or have a "goal-post" or "V" crown (Figure 4).



Figure 2. Topped trees beneath powerlines. These trees will quickly regrow into the lines. Most utility companies DO NOT allow topping of trees anymore. Instead reduction cuts are employed.



Figure 3. Cuts can be made back to the branch collar to thin the canopy or to a lateral to shorten a longer branch.



Figure 4. Utility line clearance pruning can often require branch removal at the collar that can lead to a "goal-post" shaped crown.

Pruning

Directional pruning using crown reduction is one tool that the utility can use to keep tree canopies below the power lines and maintain a somewhat normal-shaped crown. Reduction of the entire canopy makes a tree smaller by shortening the upright stems and some of the spreading branches back to live lateral branches (Figure 5). Large maturing trees planted in the wrong site often require reduction pruning to reduce risk of failure or reduce hardscape damage from roots. Proper reduction pruning reduces size while more-or-less maintaining a tree's form and minimizes regrowth.

Tree growth regulators (TGRs) are another tool utilities can use to manage tree and utility conflict. TGRs are used to slow fast growing species and/or species near structures such as overhead utility lines. They are typically applied to the soil adjacent to the trunk which the tree takes up and transports throughout the crown. When applied, these products don't stop growth, but slow shoot and leaf growth for up to 2-3 years (Fig 6). This can lead to controlling the height and spread of a tree's canopy and help keep root to crown ratios in control, without the need for severe pruning.



Figure 5. Utilities can use reduction pruning to shorten trees growing underneath the utility. This practice also slows growth of large branches, which can help extend the pruning cycle interval. Pictures courtesy of http://hort.ifas.ufl.edu/woody/ reduction-illustration.shtml



Figure 6. Tree growth regulators



Right Tree, Right Place

The best way to prevent such issues is to plant trees that will not mature at a size that puts them in direct conflict with electric lines.

The goal of this publication is to help you select the "right tree for the site" whether it is planted along the street or in your own back yard.

Before planting anything in the public right-of-way, be sure to contact your city forester, public services department, or zoning/code officer to understand any legal restrictions that may apply to these spaces. Often, the city prohibits adjacent homeowners from planting anywhere in the public right-of-way at all, and certainly not without written permission. It is within these public spaces that overhead utility lines are often located; therefore, it is very important to be aware of the rules that control these spaces and to plant species that will not grow into the overhead lines.





The wrong tree in the wrong place can create undue unintended risks to pedestrians, motorists, and/or homeowners.



While pushing limb growth away from powerlines "normal" tree shapes are lost and risks created for someone else to contend with.

The Right Tree

Consider the following criteria when selecting a tree species:

- 1. **Specific site** Will this tree have enough space both horizontally and vertically to reach its mature size without conflicting with buildings, hardscapes, and overhead or underground utilities? Is the site sunny or shady? Is it windy or hot?
- 2. **Tree function** Is this a specimen, screening plant, street tree, shade tree? Should it be evergreen or deciduous? What shape do you want? Are flowers and fruit okay? Is fall color important to you?
- 3. **Soil type and volume** Is there sufficient rooting space available? Will the soil hold enough water or drain quickly? Is the soil pH acidic or basic? Is the soil fertile enough to support a healthy tree?
- 4. Maintenance requirements Will it need annual or less frequent pruning?
- 5. Lifespan How long will it potentially live?
- 6. **Susceptibility** to insect pests and diseases, and abiotic stressors (heat, cold, drought, flooding, storms, etc.): Are there significant problems that would limit its usefulness?

It may not be possible to select a species that meets every criterion, so selecting a tree that meets the most challenging issues in your yard will minimize costly practices such as pruning and pest management and provides the greatest benefits.

This booklet includes a shortened list of recommended trees and shrubs that will mature no bigger than 30-feet, which should make them suitable for many sites located around overhead utilities. A full list of recommended species can be found on our website, www.ncufc.org. Mature plant height is essentially genetically programed, and the plant can obtain this if all site and environmental conditions are ideal. For example, a *Cercis canadensis,* eastern redbud, is a small maturing tree. Its genetic makeup determines that it can reach about 20-30' tall. If, however, the soil is compacted, or it is too hot in the planting location then the redbud would not likely reach its potential.

To avoid conflicts you need to know not only the possible mature height of the tree, but also the height of the utility lines. Take note of the cultural requirements for each species, the tolerances for various regions of the Carolinas, ornamental characteristics, native range, and growth rate.

To Pick the Right Tree for Your Site Follow This Checklist:

- Did you check with an expert? Ask your county extension agent, your city forester or other tree care professional.
- Did you look around for any conflicts above, below or around?
- How sunny or shady is the site? Select a plant with low susceptibility to various insects or diseases. Is the plant hardy here? Select a tree suitable for your zone.
- Did you check your soil? Test the pH and nutrient content. If it is compacted, then you may need to till the area to give roots the best chance to grow.
- What shape? Do you want flowers and/or fruit? Do you have a certain function in mind?





The Right Place

We recommend that you do not plant directly under powerlines, unless you are confident they will not mature at a height that puts them in direct contact with utility lines. It is better, where possible to offset the tree to one side or the other. If you are planting multiple trees or shrubs around a utility line, you need to consider the spacing between the plants. If you are planting a berm or a high-density planting area, please consult a certified arborist as well as the local utility. Consider as well that line crews need access to the right-of-ways to repair and replace equipment. Blocking off the right-of-way to access can and often results in extended outage repair times.

The above graphic illustrates the recommended mature height for trees placed adjacent to utility lines, based on the type of line. When planting any tree, it is important to make note of how big the tree will get when it is mature. Then select a plant species that will fit in that planting space, taking into consideration above and below ground utilities, nearby buildings and confined soil space.

Be On the Look Out

Electric utilities have developed management plans to address trees growing in proximity to their powerlines and related equipment. Their aim is to provide reliable electrical service to you and to keep you safe by reducing the potential risk of fire and tree failures

Many environmental conditions, like droughts and flooding, can lead to stressed trees that may decline, become more prone to pests, become dangerous, or may die.

Be observant. Do you see bare branches? Are the leaves or needles brown? Are there dead limbs? Does the tree lean? Are there any unusual growths, or sawdust at the base of the tree? Do you see any cracks or holes in the tree?

If you are concerned about trees in your yard, contact a certified arborist. If you are concerned about trees in the public right-of-way, contact your city forester. These professionals can help determine the steps you need to take to ensure your trees remain healthy and pose the least possible risk to you or your neighbors.

TABLE ONE: Recommended Trees

The following is a list of a few trees (Table 1) that could work in a variety of sites in North and South Carolina. This table, and the pictures on the following pages, represents only a portion of the tree species recommended for planting around powerlines. The full list is available on our website (www.ncufc.org) on the Trees & Utilities page. You should always contact your utility company and/or your city arborist (manager) prior to planting anything under the utility lines. Often the utility lines are located within the public right-of-way, therefore you may need to get permission to plant anything in this area.

Name	Comments	Height x Spread (feet)	Form*	Light*	Drainage*	Region†	Ornamental qualities	Native SE	Maintenance Level
Acer buergerianum, trident maple	Great for small spaces; drought resistant; may break apart due to severe ice and snow	20-30 x 30-35	OR	S	W	C, P, M	Red to golden, yellow fall color; exfoliating orangish-brown bark	Ν	medium
<i>Acer truncatum</i> Main Street®, Main Street purpleblow maple	Extremely drought tolerant, resistant to leaf scorch	20-30 x 10-15	OV	S, PS	W, D	С, Р, М	Excellent red fall color	Ν	low
Cornus alternifolia, Pagoda dogwood	Multi-stemmed tree; best in shaded areas in Piedmont	15-25 x 20-30	I, S	S, PS	W, M	P, M	Yellowish-white showy flowers borne in clusters in May-June; bluish-black fruit ripens in July-August; reddish-purple fall color	Y	low
Cornus florida, flowering dogwood	Multi-stemmed tree; best in shaded areas; best if not grown in competition with turfgrass	15-30 x 15-30	I, S	S, PS	W, M	P, M	White, pink or reddish flower bracts in April-May; red fruit in September through November; excellent reddish fall color	Υ	medium
Cornus kousa, Kousa dogwood	Multi-stemmed tree; more drought tolerant than flowering dogwood	20-30 × 20-30	I, R	S, PS	W	C, P, M	White flower bracts in May-June; red fruit in August through October; reddish- purple fall color	Ν	medium
<i>llex vomitoria,</i> Yaupon holly	Great for small areas; tolerant to swampy areas but also tolerates drought; salt tolerant	15-20 x 15-20	I	S, PS	M, W, D	С, Р, М	Very adaptable small tree, produces red fruit in late summer and fall	Y	low
Pistacia chinensis, Chinese pistache	Great street tree and small landscape uses	30-35 x 25-35	R	S	W	C, P, M	Great fall color; some but not all trees produce reddish fruit	Ν	medium

TABLE TWO: Recommended Shrubs

The following is a list of a few shrubs (Table 2) that would work in a variety of sites in North and South Carolina. This table, and the pictures on the following pages, represents only a portion of the shrub species recommended for planting around powerlines. The full list is available on our website (www.ncufc.org) on the Trees & Utilities page. You should always contact your utility company and or your city arborist (manager) prior to planting anything under the utility lines. Often the utility lines are located within the public right-of-way, therefore you may need to get permission to plant anything in this area.

Name	Comments	Height x Spread (feet)	Form*	Light*	Drainage*	Region†	Ornamental qualities	Native	Maintenance Level
Chionanthus virginicus, White fringetree	More shrub-like; air pollution tolerant; may be susceptible to emerald ash borer	10-15 x 10-12	I, R	S, PS	W, M	P, M	White, showy flowers; purple-bluish fruit on females; yellow fall color	Y	low
Hydrangea quercifolia, oakleaf hydrangea	Large, coarse shrub with exfoliating bark	4-8 x 6-10	U	S, PS	W	P, M	Large white flowers, changing to pinkish; reddish fall color	Y	low
Illicium floridanum, Florida anise-tree	Evergreen for shady, moist areas	6-10 x 4-8	U, I	PS, Sh	W, P	P, M	Large, maroon-purple flowers April to May	Y	low
Lindera benzoin, spicebush	Deciduous shrub for wooded areas, naturalizing	6-12 x 6-12	U, R	S, PS	W	P, M	Yellow flowers April; fruit bright red in September; yellow fall color	Y	low
<i>Morella cerifera,</i> Southern waxmyrtle	Evergreen shrub for screens, borders, rain gardens	10-15 x 10-15	U, S	S	W, D, P	C, P, M	Fragrant stems; salt tolerant	Y	low
Viburnum awabuki, Awabuki viburnum	Evergreen large shrub, great for borders and hedges	15-20 x 10-15	U	S, PS	W	P, M	Lustrous dark green leaves; white flowers with red fruit but not often produced	Ν	low
Viburnum lentago, nannyberry viburnum	Large shrub to small tree, good for naturaliz- ing and shrub border	15-18 x 10-15	U, S	S, Sh	W	М	White flowers in May; bluish- black fruit in September (good for birds)	Y	low

S- full sun, Sh- shade, PS- partial sun or light shade

• W- well-drained, M- moist, D- dry soil acceptable, P- poorly drained acceptable

* Form at maturity: C- columnar, I- irregular, OV- oval-rounded, R- rounded, S- spreading, U- upright, V- vase-shape

† Area will tree will perform well: C- Coastal, P- Piedmont, and M- Mountains

Recommended Trees



Aesculus pavia, red buckeye

Red buckeye is a small maturing native tree, growing only to about 20 feet tall. It has a somewhat irregular habit that lends to its appeal. You can plant it in full sun, but it does prefer some light shade, especially in the heat of our southern summers. Its best feature are the beautiful red flowers growing in large clusters blooming from April to May. It does produce small "buckeyes" in October, and does lose its leaves early in the fall, which means no prolonged raking! Cercis canadensis, eastern redbud

This native tree reaches about 25 to 30 feet in height and width. Numerous varieties are available that offer flower colors from white to light pink and magenta. The leaves are heart-shaped and can be bright green or some varieties even have white and green variegated leaves. They turn bright yellow in the fall. In autumn, the tree produces fruits that look like a little like dried peapods. You can grow this tree in full sun to partial shade in the mountains and Piedmont of the southeast. Chionanthus retusus, Chinese fringetree

Although this tree is not native to the U.S., it is a great addition to any landscape. It produces an abundant display of white, lacy flowers in spring and some produce bluish-purple fruit in the fall, which can be very attractive. It grows to about 20 feet in height and width. It has yellow fall color and interesting bark. It is air pollution tolerant so is a great choice for urban and suburban landscapes. Its cousin, *Chionanthus virginicus* is native to the southeast, but tends to be more of a large shrub than a tree in habit. Either species would work well under a utility line.







Cornus mas, Cornelian cherry dogwood

This small tree (25 feet tall and wide) has many great features. In later winter, from February into March, bright yellow flowers appear getting us in the mood for spring. This relative of our native flowering dogwood is multistemmed and has interesting exfoliating, flaky bark. In late summer, July, it produces a bright, cherry red oblong fruit. It is edible, but super sour, so be aware!



Oxydendron arboretum, sourwood or Lily-of-the-Valley tree

This tree is a southeast native. Its common name describes well the fragrant white flowers that bloom in June to July. The fall color is reddish maroon and can be quite spectacular. It only reaches 25 to 30 feet in height and about half that in width. It does prefer a moist, low pH soil with good organic matter content. It is well worth the space in your landscape





Prunus x yedoensis,Yoshino cherry

This beautiful cherry is a herald of spring and is the tree that graces the Tidal basin in Washington, DC. In late March and April this tree comes alive with pinkish-white blossoms. it grows to about 20-30 feet tall and about as wide. The vase-shaped habit and shiny, brown bark adds to its winter interest. It is very adaptable to our southern gardens, and is well worth the space in any landscape.

Recommended Shrubs



Chionanthus virginicus, white fringetree

This is a great native shrub for the southeast. Although a shrub, it does grow to about 25 feet tall and wide. From May to June, it is covered with white, fleecy flowers. Although only slightly fragrant, the display is incredible! It will grow in full sun or part shade, and has good yellow fall color. If you are looking for more of a tree form, try its cousin, the Chinese fringetree. Edgeworthia papyrifera, paperbush

The incredibly sweet smelling flowers make this a must in anyone's garden. The yellow, nodding flowers bloom in March through April. Although not native to this part of the world, this plant is not an aggressive spreader. It has an upright form, reaching about 4 feet tall and about 6 feet wide. It has big green leaves that turn yellow in fall. It is a great plant for shady areas and will benefit from some irrigation during prolonged drought, but is well worth the trouble! Illicium floridanum, Florida anise-tree

This is a shrub native to moist wooded ravines, so it definitely prefers a shady spot in the landscape. It grows to about 10 feet tall and about as wide. The leaves are a glossy green, evergreen. The best feature by far are the flowers. The red to maroon flowers bloom in late March to May. Although flower production is somewhat sporadic, they are unique and will certainly intrigue the neighbors!









Morella cerifera, southern waxmyrtle (bayberry)

"This open, airy, quick growing shrub gets to about 10-15 feet tall and wide. It produces evergreen, bluegreen colored leaves that emit a spicy fragrance when bruised. It also produces an abundance of silvery-grey fruit that also have the same spicy smell, which should remind you of the holiday candle scents. This multi-stem plant is great along the coast as it is very tolerant of salt spray. It is used often in rain gardens and along streambanks.



Viburnum macrocephalum, Chinese snowball viburnum

This rounded, dense shrub produces a profusion of white flowers in May to June. It reaches between 6 and 10 feet in height and width. The leaves are dark green and semi-evergreen here in the south. The flowers are sterile and so produce no seed, but also no scent. However, their awesome floral display is worth giving these shrubs a try! Aesculus parviflora, bottlebrush buckeye

This versatile plant is native from South Carolina into Florida. This plant forms large clumps, maturing at about 15-20' tall and wide. It has the typical buckeye leaves, but the best part is the white flowers that bloom in April and May. The flower spikes are about 4-8" and the display resembles a bottle brush, thus the common name. It is adaptable to a variety of sites from full to partial shade and still bloom very well. They even produce small buckeyes! Want swallowtail butterflies, this plant will attract them for sure.

North Carolina Urban Forest Council

To learn more about the North Carolina Urban Forest Council and become a member visit our website at: www.ncufc.org

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