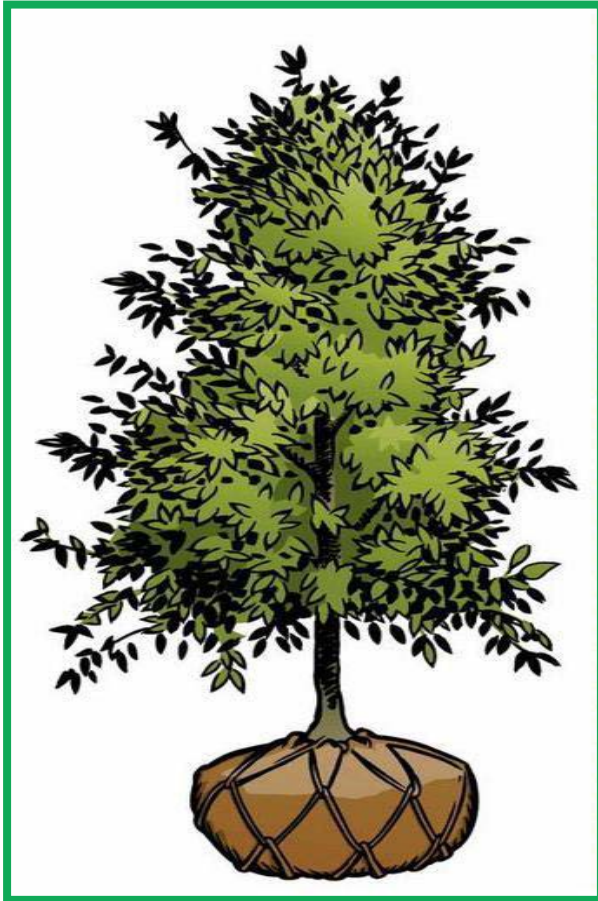


Georgia Tree Planting & Care Series

# *Tree Planting Stock Selection*



Center for Invasive Species  
and Ecosystem Health  
**UNIVERSITY OF GEORGIA**

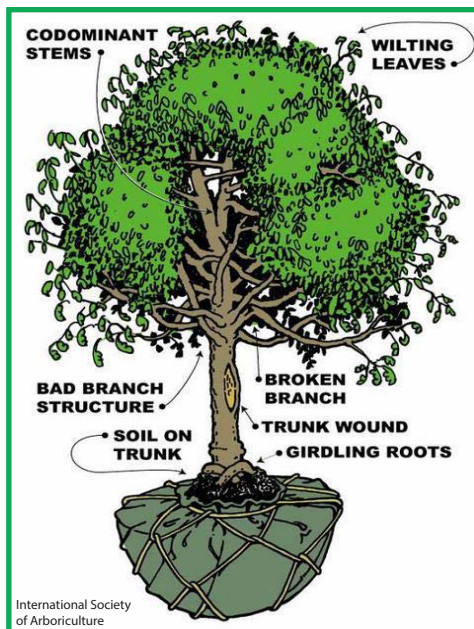
# Introduction

This is the second publication in the Georgia Tree Planting & Care Series (see references for others). The better the condition in which a tree is purchased and arrives to a planting site, the higher the likelihood it has of survival. Tree stock selection is a crucial step in the process of planting. A tree species must be appropriate for a site and climate, and the tree robust enough to become established and thrive (Figure 1).

The methods outlined in this publication are meant to summarize for homeowners and community tree care specialists within the state of Georgia specific Best Management Practices (BMPs) developed by the International Society of Arboriculture (Watson, 2014) on how to select appropriate nursery stock. This document is meant to be introductory and cannot fully answer all questions. Specific questions can be directed to a local extension office and further information can be found in the references listed at the back of this publication.

Questions to keep in mind when assessing tree stock are:

- What type of maintenance will be required?
- What is the best tree species for long-term success?



*Figure 1: Poor-quality stock is unlikely to grow to deliver full benefits, and may even become a costly hazard because defects may become magnified as a tree grows.*

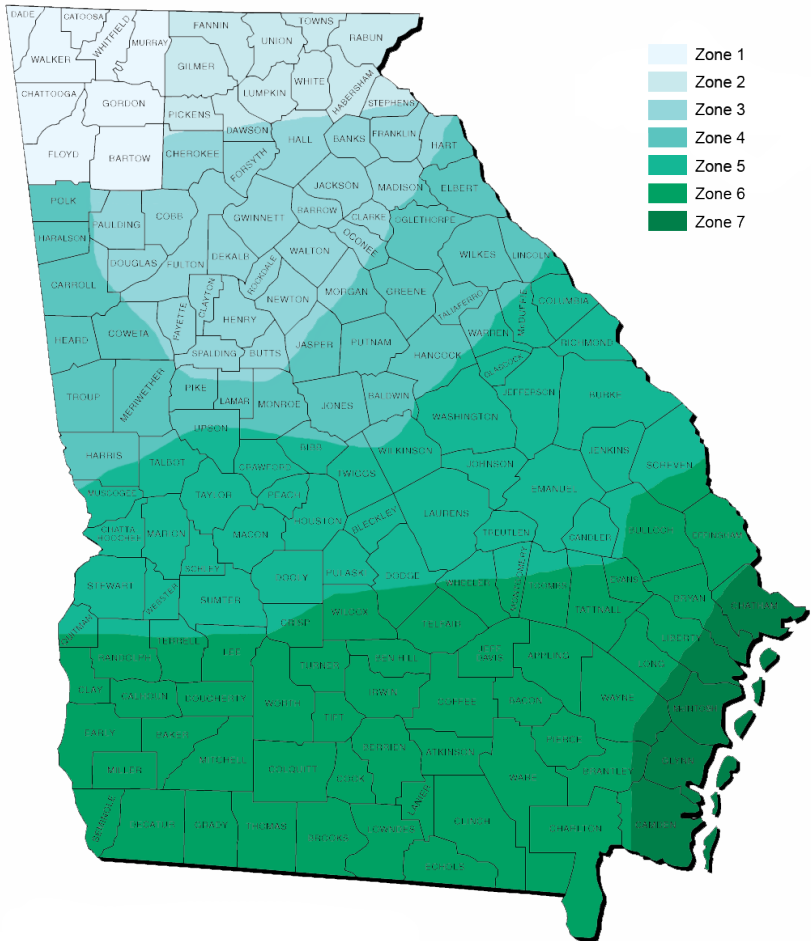
## General Considerations

### BENEFITS OF GOING NATIVE

Native tree species are usually well suited to their ecosystem, having had thousands of years to develop alongside associated species, to interact with local soil and weather conditions, and to fine-tune their ecological niche.

- Native trees are adapted for the local climate of their geographical region, benefit local wildlife, grow more vigorously and can be less susceptible to heat stress, winterkill, frost damage, and insect and disease problems than most non-native/exotic trees.

- Request trees that are locally-adapted and are from local genetic materials. Pick trees from areas close to your site and at least within the tree planting zone where you are located (Figure 2).
- ▶ Some native tree species may have been raised in a nursery from genetic stock well outside the local area or planting zone.
- ▶ The publication *Alternatives for Invasive Landscape Trees in Georgia* (BW-2016-05) suggests the most appropriate native Georgia tree species for the various Coder Tree Planting Zones of Georgia depicted in Figure 2. See references section.
- Try to mimic natural landscapes to preserve local ecosystems.



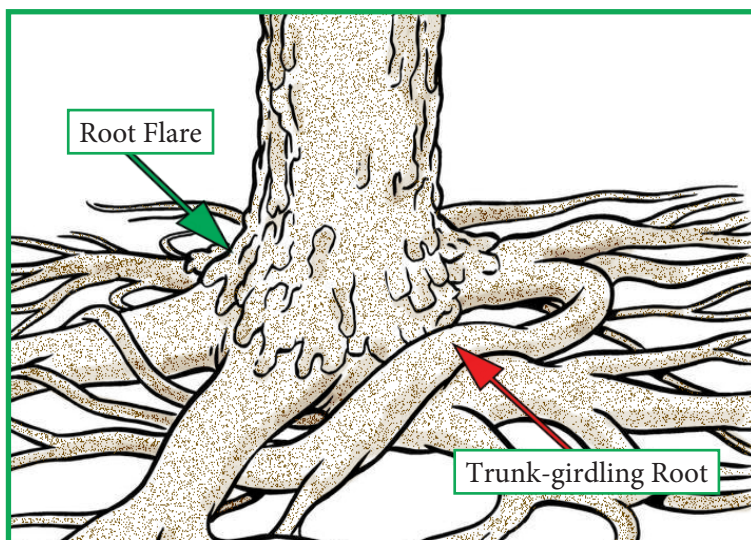
E. Moss, based on Coder, K. D. 2016. Native Trees Found Statewide Across Georgia. University of Georgia. Pub. No. 34.7. p.

**Figure 2: Coder Tree Planting Zones of Georgia.** This map statistically integrates historic growing season monthly and yearly temperature regimes, historic average monthly precipitation and growing season monthly averages, plus a simple growing season evaporation value. This reveals areas of Georgia that share similar temperature and precipitation weather patterns over time.

## Basic Guidelines for Selecting Nursery Stock

Select the most vigorous nursery stock that is relatively free of damage and pests. Investing up front minimizes both long-term tree and site liability, as well as future management costs, while maximizing tree value and benefits.

- Conduct a site assessment- what species would grow best on the site? See the references section and consult the first publication in this Georgia Tree Planting & Care Series: *Site Selection & Assessment* (BW-2019-01).
- Make sure any trees purchased are properly identified with their scientific, variety and/or cultivar name.
- Look for a tree with:
  - ▶ a trunk which widens slightly before it meets the roots at the soil line (root flare)— this ensures the tree was not buried too deep;
  - ▶ at least 3-4 visible buttress roots with no major trunk-girdling roots (Figure 3);
  - ▶ a trunk which is well-tapered and secured to the root ball with no signs of damage or pests;
  - ▶ a trunk and branches which are tapered without appearing overly long and spindly, or “leggy;”
  - ▶ no structural supports, and the ability to stand on its own, resisting wind drag without staking;



International Society of Arboriculture

*Figure 3: Stem-girdling roots occur when nursery stock is planted too deeply in its container or in the field, is poorly root-pruned or is held too long in too small a container. The root flare should be visible above the soil.*

- ▶ living branches composing  $>2/3$  total height (orange bar, Figure 4);
  - ▶ a single dominant leader with no competing side branches (Figure 4, left);
  - ▶ a balanced crown having evenly spaced scaffold branches which do not exceed  $1/3$  the diameter of the trunk where they are connected, or grow from the same origin as other branches on the trunk (Figure 4, right, and Figure 5).
- \* These larger “codominant” branches/leaders make for a risky structure as the tree grows larger and may shear off where they fork (Figure 6).

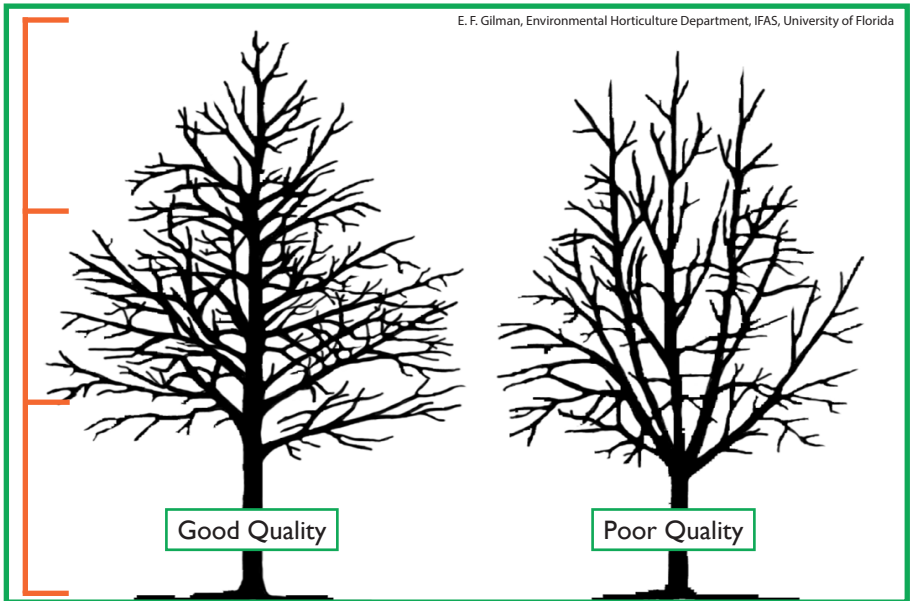


Figure 4 : The left tree has a single dominant leader, evenly-spaced, alternating scaffold branches and good trunk taper. Also, its live tree crown ratio is  $>2/3$  its total height. The tree on the right has competing leaders with a common origin on the trunk.



Figure 5: An example of unacceptable planting stock. There are many similarly sized competing leaders growing from the same origin on the trunk, and no discernible dominant leader.



## Types of Nursery Stock

Selecting the appropriate species and nursery stock type, as well as proper handling to avoid unnecessary damage in transport, is extremely important for successful planting. In addition, the more intact the root system of the tree planting stock, the more robust it will be and the quicker it will recover from transplanting. A general rule of thumb is the larger the diameter of the tree, the proportionally larger the root system needs to be. The pros, cons, and recommended minimum root spread or container size of each type of tree planting stock are presented in the following pages.

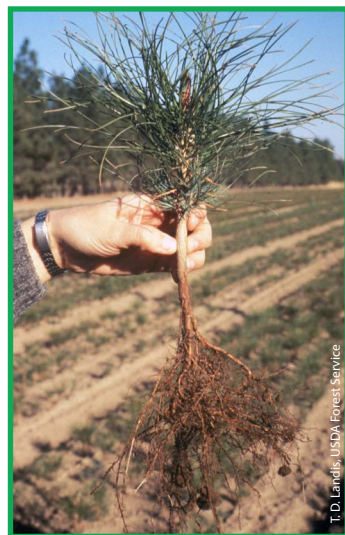
### BARE-ROOT STOCK

Bare-root stock is smaller trees dug from the field while dormant, having many roots but with no soil covering or protection for roots (Figure 7). In some cases, a clay slurry or water gel coating may be applied to roots to minimize water loss.

- Large trees can also be produced bare-root. Bare-root trees are best dug from the field after 1 to 2 root pruning cycles spaced several years apart.
  - ▶ Root pruning is performed on field-grown trees one or more times to generate a more compact, container-like root ball. Trees should be left to grow for at least one season after root pruning before digging.
  - ▶ Trees can be left in the field to meet needs and requirements of the planting objective and tree age and/or size specifications.
  - ▶ Traditional taproot species like oak and hickory should have a minimum base diameter of at least 1 inch.
- In GA, this stock is best planted in late fall to early winter so fine roots can develop before leaves emerge. This stock may be stored outside with roots “heeled in” under a cover of sawdust, mulch or soil (Figure 8). If left exposed, roots desiccate and die within hours.



*Figure 6: As competing leaders grow, they can become codominant, which can lead to hazardous structure in a larger tree when it contains included bark. These codominant leaders can shear off or separate easily.*



*Figure 7: Bare-root stock. These trees may take 1-3 years or more to produce, depending on desired final size and root pruning regimen.*

- Tends to be smaller and may recover from transplant quicker. Size and minimal packaging usually makes these trees lower in price, making them a more economical choice for reforestation where the cost of larger trees may be prohibitive.
- Table 1 provides guidelines for minimum root spread based on trunk diameter. The larger the trunk diameter, the proportionally larger the root spread (total diameter of the reach of the root system) should be.



Figure 8: Bare-root stock that has been "heeled in."

A. LeBude, NC State University

**Table 1: Guidelines for minimum root spread of nursery-grown bare-root trees, based on ANSI Z60.1 (AmericanHort, 2014). It is suggested to select a larger root spread than the minimum to maximize tree performance.**

Stem Diameter* (in.)	Height (ft.)	Minimum Root Spread (in.)
0.5	5-6	12
1	8-10	18
1.5	10-12	22
2	12-14	28

\*Measured 4 inches above ground line.

## BALL-AND-BURLAP (B&B) STOCK

B&B stock has been root-pruned in the nursery field and the root ball is typically wrapped in natural or synthetic burlap and/or a wire basket (Figure 9).

- B&B stock has a larger trunk diameter with a limited root system due to being dug and wrapped, so these trees may have a longer establishment period (Figure 10). The size also adds to cost.
- Table 2 provides guidelines for minimum root ball to trunk diameter ratios. The larger the root ball, the more complete the root system of the B&B tree.
  - ▶ Be sure to identify the root flare to get the best idea of root ball size, because trees that are sunk into the ground too deep may be dug up too shallowly, and be missing a significant portion of the root ball (Figure 11).
  - ▶ Note that size is a limiting factor when considering the effort involved in transport and placement of this larger stock— the bigger the root ball, the heavier the tree, possibly necessitating the use of machinery.
- May require frequent watering to avoid drought stress, even in transport! In the growing season, these newly transplanted trees may need to be watered twice daily depending upon soil texture, drainage and aeration.



A. LeBude, North Carolina State University

Figures 9 & 10: A B&B tree before and after it is dug out of the ground by a tree spade.

Table 2: ANSI Z.60.1 Examples of American guidelines for minimum root ball sizes of nursery-grown B&B trees, based on ANSI Z60.1 (AmericanHort, 2014). Such minimum values can be exceeded for more effective tree establishment and growth.

Max Trunk Diameter* (in.)	1.0	1.5	2.0	2.5	3.0	4.0
American Standard for Min. Root Ball Diameter (in.)	16	20	24	28	32	42

\*Measured 6 inches above ground line.



G. Watson, Morton Arboretum

Figure 11: A B&B tree buried too deep in the field has its root system over-pruned when dug by the spade. The outline demonstrates how the tree was planted too deep.



## CONTAINER-GROWN STOCK

This stock is grown in pots, boxes or bags with a complete root system, but may develop circling roots if left too long in a container (Figures 12 and 13).

- Table 3 contains recommendations for minimum container size based on diameter, as container size is generally commensurate with root ball size. The larger the diameter of the trunk, the proportionally larger the container needs to be.
- Look for a root flare above the soil line. If it is below the soil line, the functional root ball may be considerably smaller and there may be trunk-girdling roots or trunk rot.
- Remove the container and look for trunk-girdling roots and circling roots (refer back to Figure 3; Figures 13 and 14).
  - ▶ Some of these roots can be corrected by careful pruning before planting.
  - ▶ If left uncorrected, girdling roots can compress the trunk as a tree grows larger, “strangling” conductive tissues (Figure 15) and causing symptoms which mimic drought stress. Whole tree failure can result (Figure 16).
- May require frequent watering to avoid drought stress, even in transport! In the growing season, these newly transplanted trees may need to be watered twice daily, depending upon soil texture, drainage and aeration.



*Figure 12: Containerized stock can be grown in pots, boxes or bags.*



*Figure 13: Container-grown trees planted too deeply and/or left too long in a container develop circling roots. This tree will not perform well and may not survive long.*

A. LeBude, North Carolina State University

E. Bush, VA Polytechnic Institute and State University



Figures 14, 15 & 16 (clockwise from top left): Root circling/binding can limit root development and spread, and trunk-girdling roots can cut off water and nutrient flow to the rest of the tree. Both root defects can compromise stability as the tree grows larger.

**Table 3: Recommended minimum container sizes by trunk diameter, based on ANSI Z60.1 (AmericanHort, 2014). It is suggested to go above and beyond these minimums for more effective tree establishment and growth.**

Trunk Diameter* (in.)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0
Minimum Container Size (Gallons)	5	10	15	20	25	45	65	95/100

\*Measured 4 inches above ground line.

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AmericanHort. 2014. *American Standard for Nursery Stock (ANSI Z60.1)*. American Horticulture Industry Association, Columbus, OH. 97 pp.

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