The eastern half of the United States is generally characterized by frequent summer rains that are sufficient to meet the water requirements of most, if not all, landscape plants. However, late summer water stress is common in the Midwest. The more severe droughts that occur in some years remind us that we cannot take adequate rainfall for granted.

Some locations — whether several square miles or a few square feet — are more prone to drought than others. For such locations, it is important to select plants that can tolerate dry conditions. Since they are such an important part of the landscape, this publication describes characteristics that make trees tolerant to drought, and then lists drought-resistant trees, shrubs, and groundcovers for Midwest landscapes.

Characteristics of Drought-tolerant Trees

Leaves can tell us a lot about whether a particular plant is likely to be more or less drought-tolerant. Understanding some common leaf traits and how they relate to drought tolerance can be useful when selecting trees for a particular landscape.

Plants lose water through a process called transpiration. Stomata (the pores in leaves) are necessary to allow carbon dioxide to enter the leaves for photosynthesis, but in the process, water is lost. Transpiration is important for other processes, including the movement of nutrients throughout the plant. However, water loss can lead to reduced growth or even death if it is not controlled in the plant.

Plants have a number of ways to reduce the water loss that occurs through transpiration. One is to simply reduce leaf area. When water stress is an issue, large leaf areas can be detrimental to growth and survival because there is more surface area from which water can be lost. Therefore, drought-tolerant plants will often have small leaves, or in the case of conifers, needles with small surface areas (Figure 1).
While this is generally true, there are many plants that have large leaf areas that are drought-tolerant, such as southern magnolia, hardy rubber trees, and sycamore. Many of the plants on our List of Drought-tolerant Trees, Shrubs, and Groundcovers (below) have very large leaf surface areas, so leaf size alone does not always indicate drought tolerance.

Another way plants can reduce leaf area is to have deep sinuses (the indentations between lobes on a leaf). Trees that are more tolerant of dry conditions often have deep sinuses, which decreases their total leaf area (Figure 2).

Another sign of drought-tolerance is leaves that have a heavy accumulation of waxes. The waxes often appear as a whitish-blue coating, such as that seen on blue spruce needles (Figure 1). The waxes that plants produce have many functions, but one of them is to reduce the amount of water that leaves or needles lose during dry conditions. The waxes simply make it more difficult for water to evaporate from inside the leaf to the outside.

While we still don't fully understand how leaf hairs (or trichomes) affect plant water loss, leaves that are covered with these small hairs typically lose less water than those that do not. Therefore, when selecting trees and shrubs for dry areas of the landscape, look for leaves with a thick covering of trichomes (Figure 3).

Native Trees and Drought Tolerance

Does native mean drought tolerant? Not necessarily. First, it is important to carefully define the term native. If two different species grow in natural populations that are, for example, just 10 miles apart (and have been present in those areas for, say, hundreds of years), they might be grouped together with other plants of the greater geographical region as being “native.” However, if the different local areas where these plants grow differ drastically in their soil conditions (water and nutrient availability, structure, and so on), exposure, or temperature, you should not assume they will perform similarly when transplanted to a new site in the landscape.

Figure 2. Deep sinuses (the indentations between leaf lobes) reduce leaf area, which can limit water loss.

Figure 3. Trichomes (hairs) may reduce water loss from leaves.
For example, a perennial plant that is native to the Midwest prairie is a drought-tolerant plant, but a fern that is native to high rainfall mountain ranges is not, even if these two areas are within the same state or local region. Many people assume that all native plants will thrive in a dry area with no additional water. Many native species in the eastern United States, in fact, require large amounts of water because they are either native to high-rainfall areas or stream banks.

Even trees that are native to dry environments can experience drought stress. Severe seasonal droughts with lower than average rainfall can produce water stress even in drought-tolerant plants. In landscape environments, trees compete with turf and other plants for water. Hardscapes such as sidewalks also can limit water entry into soils, as can the soil compaction typical of suburban and urban areas. Furthermore, in natural environments, leaf debris helps maintain soil water. But that debris is usually removed from managed landscapes.

This concept becomes even more applicable when we talk about plants that are native to the United States. If we compare red maple trees from Texas to those from the northeast part of the country, they are very different in their adaptations, even though they are the same species. The trees from Texas will have many of the characteristics of drought-tolerant trees described above: small leaves, thick cuticles, and deeper sinuses. These are all adaptations to low-water environments and, as described above, indicate that these trees will be more tolerant of dry landscape conditions.

### List of Drought-tolerant Trees, Shrubs, and Groundcovers

We have compiled a list of trees, shrubs, and groundcovers that are drought-tolerant and suitable for landscapes in the eastern United States. This list is based on the personal experiences of professional horticulturists and scientific research reports in various publications. To “make the cut,” each of these plants had to appear in at least three independent scientific or professional reports of woody plant drought tolerance. Use this list as a guide when selecting plants that need to tolerate dry conditions.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer buergeranum</td>
<td>trident maple*</td>
</tr>
<tr>
<td>Acer campestre</td>
<td>hedge maple*</td>
</tr>
<tr>
<td>Acer saccharinum</td>
<td>silver maple</td>
</tr>
<tr>
<td>Acer tataricum ssp. ginnala</td>
<td>amur maple</td>
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<tr>
<td>Asimina triloba</td>
<td>pawpaw</td>
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<td>Carpinus carolinensis</td>
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<td>Carya spp.</td>
<td>pecan</td>
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<tr>
<td>Catalpa speciosa</td>
<td>northern catalpa</td>
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<tr>
<td>Cedrus libani</td>
<td>cedar of Lebanon*</td>
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<tr>
<td>Celtis occidentalis</td>
<td>hackberry</td>
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<tr>
<td>Cercis canadensis</td>
<td>eastern redbud</td>
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<tr>
<td>Cladrastis kentukea</td>
<td>yellowwood</td>
</tr>
<tr>
<td>Corylus colurna</td>
<td>Turkish filbert</td>
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<tr>
<td>Crataegus spp.</td>
<td>hawthorns (most)</td>
</tr>
<tr>
<td>Diospyros virginiana</td>
<td>persimmon</td>
</tr>
<tr>
<td>Elaeagnus angustifolia</td>
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<tr>
<td>Ginkgo biloba</td>
<td>ginkgo</td>
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<tr>
<td>Gleitsia triacanthos</td>
<td>honey locust</td>
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<td>Gymnocladus dioicus</td>
<td>Kentucky coffee tree</td>
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<td>Koelreuteria paniculata</td>
<td>goldenraintree</td>
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<td>Maclura pomifera</td>
<td>osage orange</td>
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<tr>
<td>Morus alba</td>
<td>white mulberry</td>
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<tr>
<td>Ostrya virginiana</td>
<td>hop hornbeam*</td>
</tr>
<tr>
<td>Parrotia persica</td>
<td>Persian parrotia*</td>
</tr>
<tr>
<td>Phellodendron amurense</td>
<td>amur corktree</td>
</tr>
<tr>
<td>Picea omorika or P. pungens</td>
<td>Serbian spruce/Colorado spruce</td>
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<tr>
<td>Pinus spp.</td>
<td>pines (most)</td>
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<tr>
<td>Platanus x acerifolia</td>
<td>London plane tree</td>
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<tr>
<td>Populus tremuloides</td>
<td>quaking aspen</td>
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<tr>
<td>Prunus cerasifera</td>
<td>cherry plum</td>
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<tr>
<td>Quercus macrocarpa</td>
<td>bur oak</td>
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<tr>
<td>Quercus prinus</td>
<td>chestnut oak</td>
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<tr>
<td>Quercus muehlenbergii</td>
<td>chinquapin oak</td>
</tr>
<tr>
<td>Quercus rubra</td>
<td>red oak</td>
</tr>
<tr>
<td>Quercus alba</td>
<td>white oak</td>
</tr>
<tr>
<td>Robinia pseudoacacia</td>
<td>black locust</td>
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<tr>
<td>Sassafras albidum</td>
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<tr>
<td>Styrhnolobium japonicum</td>
<td>Japanese pagodatree</td>
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<tr>
<td>Syringa reticulata</td>
<td>Japanese tree lilac</td>
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<tr>
<td>Tilia tomentosa</td>
<td>silver linden</td>
</tr>
<tr>
<td>Ulmus parvifolia</td>
<td>lacebark elm</td>
</tr>
<tr>
<td>Ulmus propinqua</td>
<td>Japanese elm</td>
</tr>
<tr>
<td>Zelkova serrata</td>
<td>Japanese zelkova*</td>
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### Shrubs

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<th>Scientific Name</th>
<th>Common Name</th>
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</thead>
<tbody>
<tr>
<td>Abelia x grandiflora</td>
<td>glossy abelia</td>
</tr>
<tr>
<td>Acanthopanax sieboldianus</td>
<td>fiveleaf aralia</td>
</tr>
<tr>
<td>Amorpha fruticosa</td>
<td>indigobush</td>
</tr>
<tr>
<td>Aralia spinosa</td>
<td>devil-walkingstick</td>
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<tr>
<td>Aronia arbutifolia</td>
<td>red chokeberry</td>
</tr>
<tr>
<td>Aronia melanocarpa</td>
<td>black chokeberry</td>
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<tr>
<td>Buddleia davidii</td>
<td>butterfly-bush</td>
</tr>
<tr>
<td>Calycanthus floridus</td>
<td>sweetshrub*</td>
</tr>
<tr>
<td>Calycarpa dichotoma</td>
<td>purple beautyberry*</td>
</tr>
<tr>
<td>Caragana arborescens</td>
<td>Siberian peashrub</td>
</tr>
<tr>
<td>Carpinus caroliniana</td>
<td>white ash</td>
</tr>
<tr>
<td>Ceanothus americanus</td>
<td>New Jersey tea</td>
</tr>
<tr>
<td>Ceanothus ovatus</td>
<td>inland ceanothus</td>
</tr>
<tr>
<td>Cephalotaxus harringtoniana</td>
<td>Japanese plum yew</td>
</tr>
<tr>
<td>Chaenomeles speciosa</td>
<td>flowering quince</td>
</tr>
<tr>
<td>Chionanthus virginicus</td>
<td>white fringe tree</td>
</tr>
<tr>
<td>Cornus racemosa</td>
<td>gray dogwood</td>
</tr>
<tr>
<td>Corylus avellana</td>
<td>European hazel</td>
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<tr>
<td>Cotinus coggyria</td>
<td>smokebush</td>
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<tr>
<td>Cotoneaster spp.</td>
<td>cotoneasters (most)</td>
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<tr>
<td>Cytisus scoparius</td>
<td>Scotch broom</td>
</tr>
<tr>
<td>Deutzia gracilis</td>
<td>slender deutzia</td>
</tr>
<tr>
<td>Diervilla sessilfolia</td>
<td>southern bush honeysuckle</td>
</tr>
<tr>
<td>Eucommia ulmoides</td>
<td>hardy rubber tree</td>
</tr>
<tr>
<td>Genista tinctoria</td>
<td>woadwaxed</td>
</tr>
<tr>
<td>Hamamelis virginiana</td>
<td>common witch-hazel*</td>
</tr>
<tr>
<td>Hamamelis vernalis</td>
<td>vernal witch-hazel*</td>
</tr>
<tr>
<td>Indigofera kirkowii</td>
<td>kirlow indigo</td>
</tr>
<tr>
<td>Itea virginica</td>
<td>Virginia sweetspire</td>
</tr>
<tr>
<td>Juniperus spp.</td>
<td>junipers (all)</td>
</tr>
<tr>
<td>Kerria japonica</td>
<td>Japanese kerria</td>
</tr>
<tr>
<td>Kolwitzia amabilis</td>
<td>beautybush</td>
</tr>
<tr>
<td>Lavandula angustifolia</td>
<td>English lavender</td>
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<tr>
<td>Ligustrum vulgare</td>
<td>common privet</td>
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<tr>
<td>Myrica pensylvanica</td>
<td>northern bayberry</td>
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<tr>
<td>Perovskia atriplicifolia</td>
<td>Russian sage</td>
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<tr>
<td>Physocarpus opulifolius</td>
<td>ninebark</td>
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<tr>
<td>Potentilla fruticosa</td>
<td>bush cinquefoil</td>
</tr>
<tr>
<td>Prunus x cistena</td>
<td>sand cherry</td>
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<tr>
<td>Prunus glandulosa</td>
<td>dwarf flowering almond</td>
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<tr>
<td>Prunus maritima</td>
<td>beach plum</td>
</tr>
<tr>
<td>Prunus tomentosa</td>
<td>Nanking cherry</td>
</tr>
<tr>
<td>Pyracantha coccinea</td>
<td>scarlet firethorn</td>
</tr>
</tbody>
</table>

### Groundcovers and Vines

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
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<tbody>
<tr>
<td>Arctostaphyllum uva-ursi</td>
<td>bearberry</td>
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<tr>
<td>Campsis radicans</td>
<td>trumpet vine</td>
</tr>
<tr>
<td>Celastrus scandens</td>
<td>American bittersweet</td>
</tr>
<tr>
<td>Clematis tangutica</td>
<td>golden clematis</td>
</tr>
<tr>
<td>Clematis texensis</td>
<td>scarlet clematis</td>
</tr>
<tr>
<td>Euonymus fortunei</td>
<td>wintercreeper euonymus*</td>
</tr>
<tr>
<td>Hypericum prolificum</td>
<td>shubby St. Johnswort</td>
</tr>
<tr>
<td>Juniperus horizontalis</td>
<td>blue rug juniper</td>
</tr>
<tr>
<td>Juniperus procumbens</td>
<td>Japanese garden juniper</td>
</tr>
<tr>
<td>Juniperus sabina</td>
<td>’Tamariscifolia’ tam juniper</td>
</tr>
<tr>
<td>Liriope spicata</td>
<td>lily turf</td>
</tr>
<tr>
<td>Lonicera japonica</td>
<td>Japanese honeysuckle</td>
</tr>
<tr>
<td>Lonicera sempervirens</td>
<td>trumpet honeysuckle</td>
</tr>
<tr>
<td>Microbiota decussata</td>
<td>Russian arborvitea</td>
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<tr>
<td>Parthenocissus quinquefolia</td>
<td>Virginia creeper</td>
</tr>
<tr>
<td>Parthenocissus tricuspidata</td>
<td>Boston ivy</td>
</tr>
<tr>
<td>Sedum spp.</td>
<td>sedum (all)</td>
</tr>
<tr>
<td>Vaccinium angustifolium</td>
<td>lowbush blueberry</td>
</tr>
<tr>
<td>Wisteria spp.</td>
<td>wisterias (most)</td>
</tr>
</tbody>
</table>

*This species is quite tolerant once established.*
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