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Dr. Ann B. Gould, Editor,
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EFFECT OF DROUGHT STRESS ON ORNAMENTAL LANDSCAPE PLANTSp

Dr. Ann B. Gould[1p]

osts: All trees and shrubs.

Importance: Drought-stressed trees lose foliage, grow slowly, and become more susceptible to attack by insects and diseases (Table 1) and to injury by severe winter weather. This is especially true of younger tress. Severe drought may kill trees. George Hudler of Cornell University states that "Drought stress is one of the most damaging stress factors that a plant can experience." It can take 5 to 10 years for a plant to recover from the effects of a severe drought.

Causes:p Native plants in a given area are adapted to variations in water supply and show symptoms of drought stress only under unusually dry conditions. Planted trees and shrubs, however, can be more susceptible to water deficit.

Water deficit is a normal phenomenon that occurs in plants during the daytime when loss of water from the leaves exceeds water uptake in the roots. This deficit is made up at night and during periods of rain or dew formation. Under dry soil conditions, however, roots fail to extract as much water as has been lost, and physiological stress develops. Under severe drought stress, tissues lose turgor, degenerate, and die.

Water deficit may also occur in dormant plants (especially evergreens) during warm weather in winter or early spring when water evaporates from leaves and stems while the soil is cold or frozen. Roots extract insufficient water from cold soil and none from frozen soil. This is called **winter pdesiccation**. Drought stress also predisposes plants to sun scald, frost cracks, winter burn, and dieback.

Plants vary in ability to tolerate moisture stress. Some stress tolerant species are listed in Table 2. Seedlings are very susceptible to drought stress because their root systems are shallow and undeveloped. Newly transplanted trees are similarly affected because they have lost many absorbing roots during the transplant process. In some situations, highly porous rooting media present within the root ball dries rapidly, so that water shortage occurs even though surrounding soil may contain sufficient water.

ymptoms : Plants affected by drought stress cope with drought stress in various ways. Stomates may close to prevent moisture loss from leaves; photosynthesis may slow or cease, resulting in the development of yellow leaf color. Green leaves, stems, roots, and fruit may shrink; shrunken sapwood may develop radial cracks. Roots in drying soil become less permeable to water, and root tips may be damaged by drying.

Leaves on drought-stressed plant material may droop, wilt, curl, turn yellow, turn brown at the tips and margins, or drop prematurely. Older leaves usually succumb first. Severe water deficit in pines causes needles to lose turgor and droop near the needle base. Needles then fade and turn brown or remain green and permanently bent. Symptoms may not appear until a year or

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more after trees have been stressed by drought. Dead tree tops, shortened needles, and sparse foliage indicate a general decline in vigor that becomes evident in the years following severe drought stress.

Monitoring: Inspect stressed trees of all ages for injury by invading pests during and after periods of drought.

Management: 1) Control weeds and grasses in and around stock to reduce competition for water during dry periods. 2) If drought persists, irrigate to replace soil moisture in the root zone. This is especially important for young and newly transplanted trees. Remove all dead trees as soon as possible; they may harbor bark beetles. 3) Do not plant shallow-rooted species in areas of low rainfall or on drought-prone sites. 4) To increase moisture retention in dry, sandy, or gravely soils, add organic matter when planting. Application of mulch (no more than 3 inches) reduces soil moisture loss and soil temperature. Remove weeds from site before planting. 5) To help alleviate winter injury, make sure plants go into the cold winter months with adequate soil moisture. 6) Plant stress tolerant trees and shrubs (Table 2).

Table 1. Diseases and insects common on plants stressed by drought.

PEST
Armillaria root rot Borers on birch, oak, and dogwood Dogwood anthracnose Pine wilt nematode Verticillium wilt on maples	Cankers: Botryosphaeria canker (all trees, especially rhododendron and redbud); Cytospora canker (*Prunus*, poplar, willow, maple, and spruce and other conifers); Hypoxylon canker (oak); Nectria canker (hardwoods); Thyronectria canker (honeylocust)

Table 2. Stress tolerant trees and shrubs.

TREES AND SHRUBS		CONIFERS
Amur cork tree Amur maple Amur privet Anthony water spirea Ash (Green, White) Barberry (Japanese, Wintergreen) Bayberry Bearberry Birch (Gray) Blackhaw viburnum Bush cinquefoil Chaste tree Common witchhazel Crabapple (*Malus* sp., Tea, Zumi, Katherine)	Ginkgo Glossy abelia Golden raintree Hackberry Holly (American, Japanese) Ironwood Japanese pagodatree Japanese tree lilac Japanese zelkova Maple (Red, Tatarian, Trident) Mimosa Oak (Pin, Red, Scarlet, White) Saltspray rose Shadblow serviceberry Turkish filbert	Adams needle Atlas cedar Concolor fir Dense yew Douglas fir Eastern red cedar Pfitzer juniper Pine (Japanese white, Japanese black, Mugo, Scotch, White) Shore juniper) Spruce (Norway, Colorado, Colorado blue) White fir

Sources:
Hort Notes, University of MA Extension
Landscaping for Water Conservation, T. Shelton and B. Hamilton, Rutgers University