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Forestry and Natural Resources



Right Tree - Right Place

White Pine and Salt Tolerance

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It's easy to spot white pines along the highway. They are the browned, dying, and dead conifers along many well-traveled roads. Whether the trees are adjacent to an interstate, a city street or a sidewalk, the reason they're dying is probably salt injury, compounded by the drought conditions from previous years. White pine is simply the wrong species for that location. Every tree species has specific growing needs. Specific environmental conditions, such as moisture regime, chemistry, nutrition, temperature, and light intensity are necessary for the survival and healthy growth of every species. White pine prefers soil that has moist to average moisture levels, with acidic soil (pH 4.5-6.5). It doesn't tolerate salt, drought-heat conditions and soil compaction. It's sensitive to many urban pollutants (SO₂, O₃, NO_x, HFI, and Cl).

States with climates that include snow will likely have salt mixed into the equation. Salted roads and traffic produce salt spray. This salt laden moisture travels long distances, often as far as 75-100 yards. Windy conditions carry the salt spray even further. Salt lands on the foliage and the soil, affecting the tree in several way.

Salt accumulation in the soil or on the needles is a problem for white pine. Sodium chloride, used on most roadsides, accumulates as a chloride ion in the needle tissue and damages the tree at the cellular level. Chloride moves to the twig tip and accumulates to a lethal concentration. Normal chloride values in a woody species are 0.1% (dry weight). Severe damage occurs with toxic levels at 1.25-2%. For plants intolerant of salt, dam-



age will occur with as little as 0.3% chloride levels. Salt pollution of soil occurs when sodium and chloride accumulate in the soil. Besides the toxic levels being transported to the needles from the soil, excess sodium in the soil interferes with the tree's ability to gather important minerals by replacing nutrient elements on the soil particles with sodium ions. Sodium also raises soil pH, which interferes with the solubility of iron, an important nutrient. In addition, high sodium levels interfere with soil particle aggregation which contributes to soil compaction.

White pine may recover from occasional salting, but continued salt "abuse" eventually causes death of the needles, branches, and the entire tree. When the needles die, the processes of photosynthesis, respiration, and transpiration cannot function within the tree. Weakened trees die or succumb to insects and diseases because they are not able to fight off the invaders.

Planting the right tree in the right place is the surest way to avoid this type of problem. If white pines are already planted, an alternative to removing the trees is to choose a less problematic deicer for sidewalks and highways, and to encourage the Department of Transportation to use calcium chloride.

The following list of species with varying salt tolerances has been compiled from many sources. For more information contact:

Department of Forestry and Natural Resources,
 Extension Office 765/494-3583, <http://www.agriculture.purdue.edu/fnr/index.html>

Local Cooperative Extension Office

International Society of Arboriculture (ISA) (217) 355-9411 or
<http://www.isa-arbor.com>

**Tolerance of Woody Landscape Plants to Highway
De-Icing Salt**

Plant Names	Unspecified Salt Source	Salt Spray	Soil- Borne Salt	Legend
				T - Tolerant
				M-Moderate
				S - Sensitive
Alder Buckthorn (<i>Rhamnus frangula</i>)		M		
Alleghany Serviceberry (<i>Amelanchier laevis</i>)		S		
Alpine Currant (<i>Ribes alpinum</i>)	T	T		
American Arborvite (<i>Thuja occidentalis</i>)	T,M	M,S	M	
American Beech (<i>Fagus grandifolia</i>)	S	M,S		
American Elm (<i>Ulmus americana</i>)	T,M,S	M	T,M,S	
American Hornbeam (<i>Carpinus caroliniana</i>)	S			
American Linden, Basswood (<i>Tilia americana</i>)	S	M	S	
American Sycamore (<i>Platanus occidentalis</i>)		S		
American Yellowwood (<i>Cladrastis lutea</i>)		M		
Amur Maple (<i>Acer ginnala</i>)	M	M,S		
Andorra Juniper (<i>Juniperus horizontalis</i>)			T	
Apple Serviceberry (<i>Amelanchier x grandiflora</i>)		S		
Apple, Crabapple (<i>Malus species</i>)	M,S	S		
Apricot (<i>Prunus armeniaca</i>)	T			
Autumn Olive (<i>Elaeagnus umbellata</i>)		S		
Balsam fir (<i>Abies balsamea</i>)	M,S	M	S	
Barberry (<i>Berberis species</i>)	S	M,S	S	
Beauty Bush (<i>Kolkwitzia amabilis</i>)		S		
Bigtooth Aspen (<i>Populus grandidentata</i>)	T	T,M		
Black Cherry (<i>Prunus serotina</i>)	T,S	S		
Black Currant (<i>Ribes nigrum</i>)	T,M	T		
Black Hills Spruce (<i>Picea glauca</i>)	T			
Black Locust (<i>Robinia pseudoacacia</i>)	T	T	T	
Black Oak (<i>Quercus velutina</i>)			T	
Black Pine (<i>Pinus nigra</i>)	T,M	T		
Black Willow (<i>Salix nigra</i>)		M		
Blank Walnut (<i>Juglans nigra</i>)	S	M	S	
Blue Colorado Spruce (<i>Picea pungens</i>)	T,M	T		
Box-elder (<i>Acer negundo</i>)	M,S	M,S	M	
Buffalo Berry (<i>Shepherdia argentea</i>)	T	T,M		
Bumalda Spirea (<i>Spirea x bumalda</i>)	M	S		
Bur Oak (<i>Quercus macrocarpa</i>)	T,M	M	T	
Canoe Birch, Paper Birch (<i>Betula papyrifera</i>)	T, M, S	M		
Carpathian Walnut (<i>Juglans regia</i>)		M		
Cherry Birch, Sweet Birch (<i>Betula lenta</i>)	T			
Chinkapin Oak (<i>Quercus muehlenbergii</i>)		S		
Chokecherry (<i>Prunus virginiana</i>)		T,M		
Cockspur Hawthorn (<i>Crataegus crus-gallie</i>)	S	S		
Colorado Spruce (<i>Picea pungens</i>)			M,S	
Common Boxwood (<i>Buxus sempervirens</i>)	S		S	
Common Buckthorn (<i>Rhamnus cathartica</i>)		M		
Common Lilac (<i>Syringa vulgaris</i>)	M	M,S		
Common Privet (<i>Ligustrum vulgare</i>)	S	M,S	S	
Coralberry (<i>Symphoricarpos orbiculatus</i>)	S	S		
Cornelian Cherry (<i>Cornus mas</i>)		S		
Crack Willow (<i>Salix fragilis</i>)	T	T	T	
Crimean Linden (<i>Tilea x euchlora</i>)		S		
Dahurian Birch (<i>Betula davurica</i>)	S			

Dahurian Buckthorn (<i>Rhamnus davurica</i>)		T		
Dawn Redwood (<i>Metasequoia glyptostroboides</i>)		S		
Dog Brier Rose (<i>Rosa canina</i>)	S	S		
Douglas-fir (<i>Pseudotsuga menziesii</i>)	M,S	M,S	M,S	Legend
Dwarf Arctic Willow (<i>Salix purpurea</i>) 'Nana'	S		S	T - Tolerant
Dwarf Eastern Ninebark (<i>Physocarpus opulifolius</i>)	M,S			M-Moderate
Eastern Cottonwood (<i>Populus deltoides</i>)	T,M,S	T	T,S	S - Sensitive
Eastern Hemlock (<i>Thuja occidentalis</i>)	S	S	S	
Eastern Redbud (<i>Cercis canadensis</i>)		S		
Eastern Red-Cedar (<i>Juniperus virginiana</i>)	T,M	T,M	M	
Eastern White Pine (<i>Pinus strobus</i>)	S	S	S	
Elderberry (<i>Sambucus species</i>)		S		
English Hawthorn (<i>Crataegus laevigata</i>)		S		
English Oak (<i>Quercus robur</i>)	T	S	T	
English Yew (<i>Taxus baccata</i>)		S		
European and Blank Alder (<i>Alnus glutinosa</i>)	M,S	T,M,S	S	
European Ash (<i>Fraxinus excelsior</i>)		T		
European Beech (<i>Fagus sylvatica</i>)	S	S	S	
European Bird Cherry (<i>Prunus padus</i>)		T,M	T	
European Filbert (<i>Corylus avellana</i>)	S	S	S	
European Fly Honeysuckle (<i>Lonicera xylosteum</i>)	T	T,M		
European Hornbeam (<i>Carpinus betulus</i>)	S	S	S	
European Larch (<i>Larix decidua</i>)		T		
European Mountain-ash (<i>Sorbus aucuparia</i>)	S	M,S		
European Spindletree (<i>Euonymus europaea</i>)		S		
European White Birch (<i>Betula pendula</i>)		M		
Flowering Quince (<i>Chaenomeles speciosa</i>)		M,S		
Goat Willow (<i>Salix caprea</i>)	M	M		
Golden Weeping Willow (<i>Salix alba</i> 'Tristis')	T	S	T	
Golden Willow (<i>Salix alba</i> 'Bitellina')	T,M	M,S	T,M	
Gray Birch (<i>Betula populifolia</i>)	T	M		
Gray Dogwood (<i>Cornus racemosa</i>)		S		
Gray Poplar (<i>Populus canescens</i>)	T	T	T	
Green Ash (<i>Fraxinus pennsylvanica</i>)	T,M	M	T,M	
Hackberry (<i>Celtis occidentalis</i>)	M,S	S		
Hawthorn (<i>Crataegus species</i>)	T	M,S	M	
Hedge Maple (<i>Acer campestre</i>)		T,M		
Hickory (<i>Carya species</i>)	S			
Honey Locust (<i>Gleditsia triacanthos</i>)	T	T,S	T	
Honeysuckle (<i>Lonicera sp.</i>)		S		
Horse Chestnut (<i>Aesculus hippocastanum</i>)		T	T	
Jack Pine (<i>Pinus banksiana</i>)		T		
Jackman Shrubby Cinquefoil (<i>Potentilla fruticosa</i>)	T			
Japanese Black Pine (<i>Pinus thunbergiana</i>)		T		
Japanese Honeysuckle (<i>Lonicera japonica</i>)	M		M	
Japanese Maple (<i>Acer palmatum</i>)		S		
Japanese Pagoda-tree (<i>Sophora japonica</i>)		S		
Japanese Rose (<i>Rosa multiflora</i>)	S		S	
Japanese Tree Lilac (<i>Syringa reticulata</i>)		M		
Japanese Yew (<i>Taxus cuspidata</i>)	T	M,S		
Juniper Species (<i>Juniperus sp.</i>)		T,M		
Kentucky Coffee Tree (<i>Gymnocladus dioica</i>)		T		
Kwanzan Flowering Cherry (<i>Prunus serrulata</i>)		S		
Larch (<i>Larix sp.</i>)	S	T		
Largeleaved Linden (<i>Tilia platyphyllos</i>)		T		
Laurel Poplar (<i>Populus laurifolia</i>)	S		S	

Laurel Willow (<i>Salix pentandra</i>)	M	M	
Littleleaf Linden (<i>Tilia cordata</i>)	M,S	T,S	T,M,S
Lombardy Poplar (<i>Populus nigra</i>)	T,S	T,M	S
London Plane Tree (<i>Platanus x acerifolia</i>)		S	
Maidenhair Tree (<i>Ginkgo biloba</i>)		M	
Matrimony Vine (<i>Lycium species</i>)	T	T	T
Mazzard Cherry (<i>Prunus avium</i>)		M	
Morway Maple (<i>Acer platanoides</i>)	T,M	T	T,M
Mugho Pine (<i>Pinus mugo</i>)		T	T
Mulberry (<i>Morus species</i>)	T	S	
Northern Catalpa (<i>Catalpa speciosa</i>)		M	
Northern Red Oak (<i>Quercus rubra</i>)	T	M,S	T
Norway Pine (<i>Pinus resinosa</i>)	S	S	S
Norway Spruce (<i>Picea abies</i>)		M,S	S
Peach (<i>Prunus persica</i>)		S	
Pear (<i>Pyrus species</i>)	T,M		
Pfitzer Juniper (<i>Juniperus chinensis</i>)			T
Pignut Hickory (<i>Carya glabra</i>)		S	T,S
Pin Oak (<i>Quercus palustris</i>)	S	S	
Ponderosa Pine (<i>Pinus ponderosa</i>)	T,M		M
Privet (<i>Ligustrum species</i>)		M,S	
Purple Osier Willow (<i>Salix purpurea</i>)	T		T,M
Quaking Aspen (<i>Populus tremuloides</i>)	T,M,S	T,M	T
Red Maple (<i>Acer rubrum</i>)	S	M,S	S
Red Osier Dogwood (<i>Cornus sericea</i>)	S	S	
River Birch (<i>Betula nigra</i>)			S
Rugosa Rose (<i>Rosa rugosa</i>)	T	T,S	
Russian Olive (<i>Elaeagnus angustifolia</i>)	T	T	T,M
Salt Tree (<i>Halimodendron halodendron</i>)		T	
Sawara False-cypress (<i>Chamaecyparis pisifera</i>)		S	
Scarlet Firethorn (<i>Pyracantha coccinea</i>)	M	S	
Scarlet Oak (<i>Quercus coccinea</i>)		S	
Scotch Elm (<i>Ulmus glabra</i>)	T	T	M
Scotch Pine (<i>Pinus sylvestris</i>)	T,M,S	M,S	
Sea-buckthorn (<i>Hippophae rhamnoides</i>)	T	T,M	T
Shagbark Hickory (<i>Carya ovata</i>)	S	T,M	
Showy Border Forsythia (<i>Forsythia x intermedia</i>)		M	
Siberian Crabapple (<i>Malus baccata</i>)	M		
Siberian Elm (<i>Ulmus pumila</i>)	T	M,S	T
Siberian Pea-shrub (<i>Caragana arborescens</i>)	T	T	
Silver Maple (<i>Acer saccharinum</i>)	M,S	T,M	S
Skunkbush (<i>Rhus trilobata</i>)	T		T
Smooth Sumac (<i>Rhus glabra</i>)	M		
Smoothleaf Elm (<i>Ulmus carpinifolia</i>)		M,S	T
Snowberry (<i>Symphoricarpos albus</i>)	T	T,M	
Speckled Alder, Hazel Alder (<i>Alnus rugosa</i>)	S	M	
Speckled and White Alder (<i>Alnus incana</i>)	S	M	S
Staghorn Sumac (<i>Gus thphina</i>)		T	
Sugar Maple (<i>Acer saccharum</i>)	M,S	M,S	S
Swamp White Oak (<i>Quercus bicolor</i>)		S	
Swiss Stone Pine (<i>Pinus cembra</i>)		S	
Sycamore Maple (<i>Acer pseudoplatanus</i>)	S	T	S
Tamarisk (<i>Tamarix sp.</i>)	T	T	T
Tatarian Dogwood (<i>Cornus alba</i>)		S	
Tatarian Maple (<i>Acer tataricum</i>)	S	S	
Tree-of-Heaven (<i>Ailanthus altissima</i>)		T	

Legend
T - Tolerant
M-Moderate
S - Sensitive

Tulip Tree (<i>Liriodendron tulipifera</i>)		S		
Vanhoutte Spirea (<i>Spiraea x vanhouttei</i>)	T		S	
Viburnum (<i>Viburnum sp.</i>)	S	S		
Virginia Creep (<i>Parthenocissus quinquefolia</i>)	T	T		
Virginia Rose (<i>Rosa virginiana</i>)		S		
White Ash (<i>Fraxinus americana</i>)	T,M	M	S	Legend
White Fir (<i>Abies concolor</i>)		T		T - Tolerant
White Mulberry (<i>Morus alba</i>)	T	M,S		M-Moderate
White Oak (<i>Quercus alba</i>)	T	M,S	T	S - Sensitive
White Poplar (<i>Populus alba</i>)	T	T,M	T,M	
White Spruce (<i>Picea glauca</i>)	M,S	T,S	M	
White Willow (<i>Salix alba</i>)	M	T,M,S		
Winged Euonymus (<i>Euonymus alata</i>)	S	M	S	
Yellow Birch (<i>Betula alleghansensis</i>)	T			
Zabel Honeysuckle (<i>Lonicera tataricum</i>)	T,S	M,S		

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