Virginia Cooperative Extension

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Trees for Problem Landscape Sites

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Trees and Shrubs that Tolerate Saline Soils and Salt Spray Drift

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Concentrated sodium (Na), a component of salt, can damage plant tissue whether it contacts above or below ground parts. High salinity can reduce plant growth and may even cause plant death. Care should be taken to avoid excessive salt accumulation from any source on tree and shrub roots, leaves or stems. Sites with saline (salty) soils, and those that are exposed to coastal salt spray or paving de-icing materials, present challenges to landscapers and homeowners.

Salt tolerant rugose roses in a park bordering the Chespeake Bay.

Saline Soils

Saline soils occur when salts accumulate in the soil. Significant salt accumulation is uncommon in areas where rainfall exceeds 20 inches per year. Since Virginia averages 40-50 inches of rain most years, saline soils generally are not a widespread problem. However, saline soils do occur in specific situations such as:

- Along the coastline and barrier islands where seawater may overwash, and where salt from spray may collect in the soil.
- Along brackish tidal rivers and estuaries. Flooding during storms and high tides can deposit salt in low-lying areas. Wooded wetlands are frequently found in these locations.

Turf along the sidewalk edge has been killed back by de-icing salts.

To reduce de-icing salt damage, open pavers have replaced turf along the sidewalk edge.

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- Along sidewalks and roads where salt is used to remove ice and snow, where treated ice and snow are piled when pavement is cleared, or where vehicles cause salt spray. As the snow melts, runoff carries the salt to low-lying areas. Salt accumulation usually occurs within 30-50 feet of roads.
- In cultivated areas when fertilizers are over applied, when high salt index fertilizers are used, or when fresh animal wastes (manures) are spread on fields.
- In areas where crops or landscape plants are irrigated with water containing dissolved salts. Repeated light watering without leaching or adequate drainage can result in salt accumulation in the soil.
- In areas with high groundwater tables.

How do saline soils affect trees and shrubs?

Plant root cells contain a membrane which allows water to pass through, but which prevents salt from entering. As the soil's salt content increases, it becomes more difficult for water to pass through the membrane into the root. In addition, if salt levels get high enough they may actually dehydrate roots or cause "salt burn" by drawing water out of root cells.

High levels of soluble salts also cause changes to soil structure, resulting in compacted soils that are problematic for plants. Because salts bind with soil clays, causing them to swell, compaction occurs more frequently in clayey soils than in sandy soils. Compaction causes reduction of pore spaces between soil particles, reducing water and oxygen penetration into the soil, and water drainage from the soil. As a result, water and oxygen availability to plant roots, and consequently plant growth and pest resistance, is affected.

Plants vary in their ability to grow in salty soils. Plants that grow only in saline soils are called "halophytic" or salt loving. Halophytic plants are generally found in coastal areas, in salt-water marshes, and in brackish (moderately saline) wetlands. The presence of some of these plants (such as spartina and sea oats) is generally indicative of a saline soil.

Sea oats, a highly salt tolerant grass, growing along a coastal area.

Most landscape plants are sensitive to soil salinity. Seedling trees and shrubs and young transplants can be particularly sensitive to salt exposure. The severity of salt damage to plants depends upon the amount and duration of exposure, and the concentration of salt. For example, coastal areas that receive consistent salt spray may always have elevated levels of soil salinity, whereas areas adjacent to roads where de-icing salts are applied may incur salt exposure only sporadically during winter storms. Similarly, areas subject to flooding by brackish water may only be affected by salinity following storms and high tides.

If there is adequate precipitation to leach the salt out of these areas soon after the initial exposure, the amount and duration of salt exposure will be brief. If salt exposure persists, or is repeated, damage will be more severe. There is a direct relationship between the amount and duration of salt exposure and potential damage to plants. The higher the amount of salt in the soil, the greater the impact on plants. Salt damage is generally more severe during periods of hot, dry weather.

Measuring soil salinity

The amount of salt in the soil can be measured with a soil test. The Virginia Cooperative Extension Service Soil Test Laboratory reports salt levels using the measure "parts per million" or "ppm." Salt concentrations of 1-1000 ppm are considered low, and those from 1000-2000 ppm medium. With the exception of very salt sensitive plants, most landscape plants can tolerate salt concentrations in the medium range.

Symptoms of saline soil damage

Plant damage due to saline soils becomes evident more slowly than plant damage due to salt spray. At elevated levels, soil salts are harmful to seed germination and plant growth. General symptoms include stunted growth and reduced yields. All parts of the plant, including leaves, stems, roots and fruits, may be reduced in size. The signs and symptoms displayed by deciduous and broad-leaved trees and shrubs include leaf necrosis (death), marginal leaf or needle burn, leaf drop, and eventual plant death. Entire leaves can be affected and drop prematurely. Buds may fail to open or grow, and branches may die. Sometimes deciduous trees may exhibit early fall color and leaf drop. Salt damage on deciduous trees and shrubs usually

becomes evident in late summer following the growing season, or during periods of hot, dry weather (summer drought).

On conifers (firs, junipers, pines, spruces), damage appears as brown needle tips. The brown discoloration progresses toward the base of the needles as salt exposure increases. Salt damage on evergreen trees and shrubs [both conifers and broadleaf (hollies, photinia, southern magnolia)] usually first appears in late winter to early spring and becomes more extensive during the growing season. In extreme situations, trees and shrubs will die due to soil salt damage.

When trying to diagnose plant damage, keep in mind that all of the above signs and symptoms can also be caused by a variety of other factors including root damage, drought, diseases, chemical misuse, etc. Try to eliminate these other possibilities, and use tools such as soil and water analyses, and weather data to help you arrive at a correct damage diagnosis.

Reducing soil salinity or soil salt damage

Numerous options exist for reducing salt damage including:

- Improving soil structure, drainage and moisture holding capacity by adding organic matter.
- Planting salt sensitive plants uphill or on berms where salty water will not drain or accumulate. Also planting sensitive plants at least 50-60 feet back from paving that may be de-iced.
- Leaching the soil with thorough irrigation after salt exposure. Flush salt through the soil by applying 2 inches of water over a 2-3 hour period, stopping if runoff occurs. Repeat this treatment three days later if salt levels are still high.
- Irrigating thoroughly (deeply) rather than watering lightly (shallow watering). For established landscapes, one inch of water applied once a week is generally adequate.
- Mulching to prevent evaporation and subsequent build-up of salt in the soil.
- Fertilizing only when a soil test or plant symptom indicates that fertilizer is needed, and then only at rates recommended by soil analyses and fertilizer labels.
- Keeping plants healthy because healthy plants are more tolerant of salt damage.
- Using abrasive materials such as cinders, fly ash and sand instead of de-icing salts.
- Selecting and planting salt tolerant trees and shrubs.

Salt tolerant tree – Chinese fringetree.

Salt tolerant shrub – Rugose rose.

Salt Spray

The aerial drift of salt-laden water droplets that are deposited on trees and shrubs causes salt spray damage. When droplets evaporate, the salt's sodium and chlorine ions can penetrate stems, buds and leaves, causing direct damage. Salt spray damage to trees and shrubs is most frequently seen on seaside plants and near sidewalks and roads where de-icing salts are applied. Additional stresses in these areas, including wind, sun, heat, exposure, heavy traffic and saline soils, increase the likelihood of damage.

How does salt spray affect trees and shrubs?

Exposure to salt spray can cause stem and foliage disfigurement, reduced growth, and often plant death. Because aerial salt spray damage may appear similar to damage caused by other stresses, a tree or shrub's location and damage symptoms should be carefully evaluated to correctly identify the damage's cause. Consider the distance from sidewalks, roads, and parking lots, or

salty water sources, the frequency and severity of storms and winds that carry aerial salt drift inland, the traffic levels and speeds on adjacent roads, and how often winter de-icing salts are used. Remember that salts used for de-icing can cause damage when salty ice or snow contacts adjacent vegetation.

Salt deposits on a holly leaf after the water has evaporated.

Symptoms of salt spray damage

Examine injury patterns on trees and shrubs. Winter salt spray damage to deciduous plants causes bud death and twig dieback. Tree and shrub growth after this damage will have a "witches-broom" (tufted) appearance. On foliage, salt spray causes leaf burn or scorch, or needle browning. Direct signs such as white salt residue are a strong indication that salt spray may be injuring landscape plants.

Salt spray damage on new sweetgum leaves.

Salt spray marginal burn on Bradford pear leaves.

For roadside areas, salt spray damage is often localized on the side of the plant facing the road, and on portions of the plant within the spray drift line. Trees located farther from roads will display fewer symptoms. Symptoms become more pronounced when more salt is

Top: Trees and shrubs "salt burned" on the windward side.

Middle: The left tree was more exposed to salt spray than the right tree.

Left: Salt damage on trees with tops above the overhang.

applied. Road de-icing salt spray damage is usually seen in late winter on evergreens and during spring growth on deciduous trees. For seashore areas, salt spray damage is seen soon after storms, and occurs inland if salt spray is carried farther by strong winds.

Reducing salt spray or salt spray damage

Numerous options exist for reducing salt damage including:

- Carefully designing planting areas to reduce exposure of trees and shrubs to aerial salt spray. Establish windbreaks to prevent "wind tunnels" that can carry aerial salts farther and at higher wind speeds. Use salt-tolerant shrubs or herbaceous borders (especially denser evergreens) as windbreaks to help intercept aerial salt drift before it reaches sensitive plants.
- Erecting burlap fencing or other barriers for winter protection of plants adjacent to roads.
- Grouping tree and shrub species to shield them from wind and drift, with the most tolerant species in higher exposure areas to shield moderately tolerant species.
- Maintaining appropriate soil fertility and moisture conditions to reduce additional stresses, and to help combat desiccation. If feasible, rinse salt spray off trees and shrubs after storms and high winds. Rinse again in early spring to remove salt residue from tender buds and leaves.
- Planting in the spring when locating trees and shrubs near roads on which de-icing salts are used. This allows plants more time to become established prior to salt exposure. Trees and shrubs that are susceptible to salt damage should be located at least 50-60 feet from roads.
- When practical, using cinders, fly ash or sand for de-icing.
- As with saline soils, selecting and planting salt spray tolerant trees and shrubs. Avoid plants, such as azaleas, that are considered especially sensitive to salt spray.

Trees tolerant of saline soils or salt spray

Common name	Latin name	Deciduous/ Evergreen	Type of salt tolerance	Cold hardiness/ Heat tolerance
Hedge maple	*Acer campestre*	D	Salt spray	5-8/8-4
Sycamore maple	*Acer pseudoplatanus*	D	Salt spray	4-7/7-1
Horsechestnut	*Aesculus hippocastanum*	D	Salt spray	3-8/8-1
Red buckeye	*Aesculus pavia*	D	Saline soils	5-8/8-4
Paper birch	*Betula papyrifera*	D	Salt spray	2-7/7-1
Gray birch	*Betula populifolia*	D	Salt spray	3-7/7-2
Catalpa	*Catalpa speciosa*	D	Salt spray	4-8/8-1
Hackberry	*Celtis laevigata*	D	Salt spray	5-9/9-3
White fringetree	*Chionanthus virginicus*	D	Saline soils	5-9/9-5
Lavalle hawthorne	*Crataegus x lavallei*	D	Salt spray	5-8/8-3
Japanese cedar	*Cryptomeria japonica*	E	Salt spray	6-9/9-6
Common persimmon	*Diospyros virginiana*	D	Saline soils, salt spray	7-9/9-7
White ash	*Fraxinus americana*	D	Saline soils, salt spray	6-9/9-3
European ash	*Fraxinus excelsior*	D	Salt spray	6-9/9-6
Green ash	*Fraxinus pennsylvanica*	D	Salt spray	4-9/9-1
Ginkgo	*Ginkgo biloba*	D	Salt spray	5-9/9-2
Honeylocust	*Gleditsia triacanthos*	D	Saline soils, salt spray	3-7/7-1
Kentucky coffeetree	*Gymnocladus dioicus*	D	Salt spray	5-9/9-2
American holly	*Ilex opaca*	E	Salt spray	5-9/9-5
Black walnut	*Juglans nigra*	D	Saline soils, salt spray	5-9/9-5
Eastern red cedar	*Juniperus virginiana*	E	Saline soils, salt spray	3-9/9-1
Goldenraintree	*Koelreuteria paniculata*	D	Saline soils, salt spray	5-9/8-5
Common larch	*Larix decidua*	D	Salt spray	3-6/6-1
Sweetgum	*Liquidambar styraciflua*	D	Salt spray	6-9/9-1
Southern magnolia[1]	*Magnolia grandiflora*	E	Saline soils, salt spray	7-9/9-3
Sweetbay magnolia	*Magnolia virginiana*	E	Saline soils	6-9/9-6
Black gum	*Nyssa sylvatica*	D	Salt spray	5-9/9-5
Colorado spruce[2]	*Picea pungens*	E	Salt spray	3-8/8-1
Austrian pine	*Pinus nigra*	E	Salt spray	5-8/8-4
Longleaf pine[1]	*Pinus palustris*	E	Salt spray	7-9/9-3
Japanese black pine	*Pinus thunbergiana*	E	Saline soils, salt spray	5-8/8-4
White poplar	*Populus alba*	D	Saline soils, salt spray	4-9/9-1
Carolina cherrylaurel[1]	*Prunus caroliniana*	D	Saline soils	7-9/9-3
Black cherry	*Prunus serotina*	D	Salt spray	3-8/8-2
White oak	*Quercus alba*	D	Saline soils	5-9/9-5
Bur oak	*Quercus macrocarpa*	D	Saline soils, salt spray	3-9/9-1
Pin oak	*Quercus palustris*	D	Saline soils	5-8/8-4
Willow oak	*Quercus phellos*	D	Salt spray	6-9/9-5
English oak	*Quercus robur*	D	Salt spray	4-8/8-4
Red oak[2]	*Quercus rubra*	D	Saline soils	5-9/9-4
Live oak[1]	*Quercus virginiana*	E	Saline soils, salt spray	7-9/9-3
Black locust	*Robinia pseudoacacia*	D	Saline soils, salt spray	4-9/9-4
Weeping willow	*Salix alba*	D	Salt spray	6-9/9-5
Corkscrew willow	*Salix matsudana*	D	Salt spray	6-9/9-5
Japanese pagodatree	*Sophora japonica*	D	Salt spray	6-9/9-6
Japanese tree lilac	*Syringa reticulata*	D	Saline soil, salt spray	6-8/8-6
Baldcypress	*Taxodium distichum*	D	Saline soils, salt spray	5-11/12-5
Chastetree[1]	*Vitex angus-castus*	D	Saline soils	6-9/9-1

Shrubs tolerant of saline soils or salt spray

Common name	Latin name	Deciduous/ Evergreen	Cold hardiness/ Heat tolerance
Red chokeberry	*Aronia arbutifolia*	D	5-9/9-4
Saltbush	*Baccharis halmifolia*	D	3-7/7-1
Littleleaf boxwood	*Buxus microphylla*	E	6-9/9-5
Beautyberry	*Callicarpa americana*	D	5-10/12-3
False cypress	*Chamaecyparis pisifera*	E	4-8/8-1
Summersweet	*Clethra alnifolia*	D	5-8/8-3
Red osier dogwood	*Cornus sericea*	D	5-8/8-3
Spreading cotoneaster	*Cotoneaster divaricatus*	D	6-8/8-3
Rockspray cotoneaster	*Cotoneaster horizontalis*	D	5-7/7-5
Scotch broom	*Cytisus scoparius*	D	6-8/8-6
Gardenia[1]	*Gardenia jasminoides*	E	7-11/12-1
Rose-of-Sharon	*Hibiscus syriacus*	D	5-9/9-1
House hydrangea	*Hydrangea macrophylla*	D	6-9/9-3
St. John's wort	*Hypericum calycinum*	D	5-9/9-4
Chinese holly[1]	*Ilex cornuta*	E	7-9/9-7
Japanese holly	*Ilex crenata*	E	5-7/7-5
Inkberry	*Ilex glabra*	E	5-9/9-5
Yaupon holly[1]	*Ilex vomitoria*	E	7-10/12-7
Anise[1]	*Illicium floridanum*	E	7-9/9-7
Chinese juniper	*Juniperus chinensis*	E	3-7/7-1
Common juniper	*Juniperus communis*	E	3-9/9-1
Shore juniper	*Juniperus conferta*	E	5-9/9-3
Creeping juniper	*Juniperus horizontalis*	E	3-9/9-1
Amur privet	*Ligustrum amurense*	D	3-7/7-2
Tatarian honeysuckle	*Lonicera tatarica*	D	3-9/9-1
Wax myrtle[1]	*Myrica cerifera*	E	6-9/9-6
Bayberry[2]	*Myrica pennsylvanica*	D	3-6/6-1
Mock orange	*Philadelphus coronarius*	D	5-8/8-3
Mugo pine	*Pinus mugo*	E	3-7/7-1
Shrubby cinquefoil	*Potentilla fruticosa*	D	3-7/7-1
Purple-leaf sand cherry	*Prunus x cistena*	D	4-8/8-1
Cherry laurel	*Prunus laurocerasus*	E	6-9/9-5
Beach plum	*Prunus maritima*	D	3-6/6-1
Pyracantha	*Pyracantha coccinea*	E	6-9/9-6
Indian hawthorn[1]	*Rhapiolepis indica*	E	7-11/12-7
Staghorn sumac	*Rhus typhina*	D	3-8/8-1
Lady Banks rose[1]	*Rosa banksiae*	D	7-9/9-3
Rugosa rose	*Rosa rugosa*	D	3-9/9-1
Scotch rose	*Rosa spinosissima*	D	3-9/9-1
Elderberry	*Sambucus canadensis*	D	4-9/9-1
Japanese spirea	*Spiraea japonica*	D	3-8/8-1
Bumalda Japanese spirea	*Spiraea x bumalda*	D	3-8/8-1
Snowberry	*Symphoricarpos albus*	D	3-7/7-1
Lilac	*Syringa vulgaris*	D	4-8/8-1
Tamarisk	*Tamarix ramosissima*	D	2-8/8-1
English yew[2]	*Taxus baccata*	E	5-7/7-5
Japanese yew[2]	*Taxus cuspidata*	E	4-7/7-5
Highbush blueberry	*Vaccinum corymbosum*	D	5-9/9-2
Arrowwood	*Viburnum dentatum*	D	3-8/8-1
European cranberry bush viburnum	*Viburnum opulus*	D	4-8/8-1

[1]May not be suitable for northern or western Virginia (check your cold hardiness zone).

[2]May not be suitable for southeastern Virginia (check your heat tolerance zone).