Establishing trees and shrubs on salt-affected sites

By Joe Scianna

It sometimes seems the most undesirable spot of ground on the property is reserved for a tree or shrub!

If we can't graze it, raise crops on it – or play football on it – the site was surely intended for a woody plant. The importance of woody plants in a landscape cannot be ignored. Offering roosting, nesting, and loafing areas for birds; producing food for people, livestock, and wildlife; creating protection from the sun and wind; managing snow deposition; producing wood products; and providing scaffolding for tree houses and swings, trees and shrubs are arguably an invaluable landscape asset.

Although challenges to tree and shrub establishment and growth in our region come in many forms, soils are often the limiting factor. Consider the case of a "salt-affected" site – soils with enough salt to limit plant growth (often identified at 70 miles per hour as the "white spot" out in a Wyoming field).

Salt-affected soils are one of the most limiting of all growing environments. Salts influence plant survival and growth in multiple and complex ways, and ferreting out the most limiting factor on a given site is difficult. In some cases, the salinity level itself is hindering plant growth, as excessive soil salt restricts uptake of soil moisture by essentially creating a suction that works against the plant (like trying to suck liquid from a crimped straw).

In other cases, toxicity of a particular salt is the problem. Sodium is a salt toxic to plant tissue in relatively low concentrations, for example. Sodium also creates secondary problems by damaging soil structure by decreasing permeability, which causes low soil aeration – a condition detrimental to trees and shrubs. In some situations, total salt level, specific salt toxicity, and secondary affects are all involved. Establishing and growing trees on salt-affected soils depends largely on your ability to recognize and address the critical limiting factor(s).

Table 1. Soil Salinity Classes

Salinity class	EC (electrical conductivity)
	dS/m or *mmhos/cm*
Non-Saline	<2
Very Slightly Saline	2 to <4
Slightly Saline	4 to <8
Moderately Saline	8 to <16
Strongly Saline	≤16

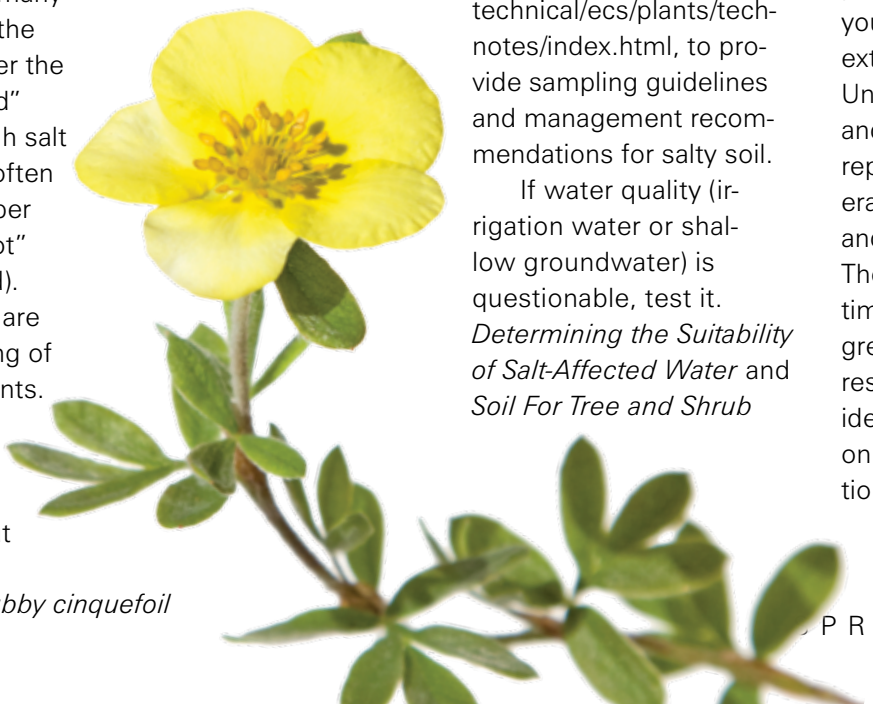
Steps Landowners Can Take

So, where does the landowner begin? The first step is to sample the soil in the planting area and have it analyzed for salts and other important characteristics. For information, use *Testing and Interpreting Salt-Affected Water for Tree and Shrub Plantings* and *Determining the Suitability of Salt-Affected Water and Soil For Tree and Shrub Plantings,* both available at www.mt.nrcs.usda.gov/technical/ecs/plants/technotes/index.html, to provide sampling guidelines and management recommendations for salty soil.

If water quality (irrigation water or shallow groundwater) is questionable, test it. *Determining the Suitability of Salt-Affected Water* and *Soil For Tree and Shrub Plantings* includes a list of laboratories, contact information, and addresses for water quality testing. These publications explain units of measure, provide interpretation guidelines, and assess the usefulness of your soil and water for growing woody plants. Keep in mind some soils and waters are too salty to support trees and shrubs, and, in some cases, any vegetation at all.

Neighbors can also be a source of good advice for plant recommendations.

The simplest solution occurs when salt-tolerant plants will grow well in your site conditions without extraordinary measures. Unfortunately, the salt tolerance of trees and shrubs reported in popular literature is often optimistic, and, therefore, misleading. These tolerances are sometimes extrapolated from greenhouse and laboratory research conducted under ideal conditions or based on favorable field observations and anecdotes.



Shrubby cinquefoil

Salt/Saline Definitions Problematic

Another problem is the manner in which tolerance is described. The terms "salt tolerant" and "saline tolerant" are quite subjective and are defined differently by different people. To compare apples to apples, determine how reported tolerances fit in the USDA soil salinity classification system (Table 1, page 19). Many woody plants described as "salt-tolerant" only tolerate soils classified as "Very Slightly Saline" to "Slightly Saline" in the USDA classification system.

Consider two salt-affected soil scenarios common in our region. The first is characterized by soils classified as "Slightly Saline" or "Very Slightly Saline," with not much sodium, fairly well-drained, and without prolonged periods of water saturation. These sites are usually found in upland (higher elevation) locations and are typical of many backyard soils in housing developments perched on rims or buttes. The soils are well-drained but droughty, receive limited natural precipitation, and have poor soil water retention.

Several tree and shrub species will grow well on these soils if good-quality supplemental water is provided at least periodically during the establishment period, usually one to three years (Table 2). Circling spaghetti tubes with multiple emitters around the drip line (outer edge of canopy) of the tree provides supplemental water while leaching salts from the root zone of the plant. Improve establishment by applying mulch (coarse bark mulch not exceeding 4 inches in depth is preferred, but other products may be acceptable), installing weed fabric and tree shelters, controlling herbaceous competition, and using anti-desiccants or anti-transpirants. Anti-desiccants are waxy emulsions sprayed on the plant canopy that prevents evaporative losses.

The second scenario is the "white spot" or seep and surrounding area. Soils in these locations are high in total salinity, possibly high in sodium, heavy-textured (high clay and poorly drained with low soil aeration), and can remain saturated for

Table 2. Woody plants predicted to grow well on some slightly saline soils (full performance to 6 dS/m. See "Several tests measure soil saltiness" on page 21 for explanation of measure).

Common name	Latin name	Full Performance	Reduced Performance	Native Status (US)	Primary Uses
		dS/m	*dS/m*		*(c, o)*[1]
ash, green	*Fraxinus pennsylvanica*	6	>6 to 12	native	c, o
black locust	*Robinia pseudoacacia*	6	>6 to 8	native	c
cottonwood, white	*Populus alba*	6	>6 to 8	non-native	c
elm, Siberian	*Ulmus pumila*	6	>6 to 8	non-native	c
honeylocust	*Gleditsia triacanthos*	6	>6 to 8	native	c, o
juniper, Pfitzer	*J. chinensis 'Pfitzeriana'*	6	>6 to 8	non-native	o
shrubby cinquefoil	*Dasiphora floribunda*	6	>6 to 8	native	c, o
silverberry	*Elaeagnus commutata*	6	>6 to 8	native	c
silver buffaloberry	*Shepherdia argentea*	6	>6 to 8	native	c
snowberry, common	*Symphoricapos albus*	6	>6 to 8	native	c
sumac, skunkbush	*Rhus trilobata*	6	>6 to 8	native	c, o
sumac, staghorn	*Rhus typhina*	6	>6 to 8	native	c, o
Virginia creeper	*Parthenocissus quinquefolia*	6	>6 to 8	native	o
yucca	*Yucca filamentosa*	6	>6 to 8	native	c, o
currant, golden	*Ribes aureum*	6	no inform.	native	c
juniper, common	*Juniperus communis*	6	no inform.	native	c
maple, amur	*Acer ginnala*	6	no inform.	non-native	c, o
rubber rabbitbrush	*Ericameria nauseosa*	6	no inform.	native	c
sagebrush, basin big	*Artemisia tridentata*	6	no inform.	native	c
willow, golden	*Salix alba*	6	no inform.	non-native	c

[1] c – conservation (windbreak or shelterbelt); o - ornamental

Table 3. Shrubs growing well on some moderately saline soils (full performance to 8 or 10 dS/m).

Common name	Latin name	Full Performance	Reduced Performance	Native Status (US)	Primary Uses
		dS/m	*dS/m*		*(c, o)*[2]
saltbush, fourwing	*Atriplex canescens*	10	>10 to 18	native	c
saltbush, Nuttall's	*Atriplex nuttallii*	10	>10 to 18	native	c
saltbush, Gardner's	*Atriplex gardneri*	10	>10 to 18	native	c
winterfat	*Krascheninnikovia lanata*	10	>10 t o12	native	c
sea-buckthorn (seaberry)	*Hippophae rhamnoides*[1]	8	>8 to 12	non-native	c, o
Siberian peashrub	*Caragana arborescens*	8	>8 to 10	non-native	c
blueleaf honeysuckle	*Lonicera korolkowii*	8	>8 to 10	non-native	c, o

[1] Use cautiously. This species has not been tested extensively in the western U.S.

[2] c – conservation use; o – ornamental.

many consecutive days or months.

Landowners need not worry about soil salts if extended periods of flooding occur; lack of soil aeration will kill most trees and shrubs faster than high salinity.

These soils support few desirable woody plants without extensive multi-year management such as drainage systems and leaching of salts. Even with management, most sites of this nature are better suited to the most salt-tolerant grasses. For the most adventuresome of souls, try testing small numbers of the hardiest of salt-tolerant shrubs (Table 3).

There are no comprehensive recipes or quick fixes for salt-affected soils. Success requires sampling and testing of soil and water, becoming educated on site conditions and possible solutions, and using trial and error in your own backyard to determine what works best for your situation.

Rely on the expertise of your local University of Wyoming Cooperative Extension Service educator (http://ces.uwyo.edu/Counties.asp) or specialist (http://ces.uwyo.edu/Campus_Spec.asp), Natural Resources Conservation Service (NRCS) field office (www.wy.nrcs.usda.gov/), NRCS plant materials specialist or Plant Materials Center staff members (http://plant-materials.nrcs.usda.gov/) to diagnose problems and provide possible solutions.

To receive the best assistance, have your soil and water quality information handy as you discuss your landscape goals.

References:

HortNote No. 5, *Salt-Affected Soils: Their Causes, Measure, and Classification* at www.mt.nrcs.usda.gov/technical/ecs/plants/pmpubs/index.html#hortnotes

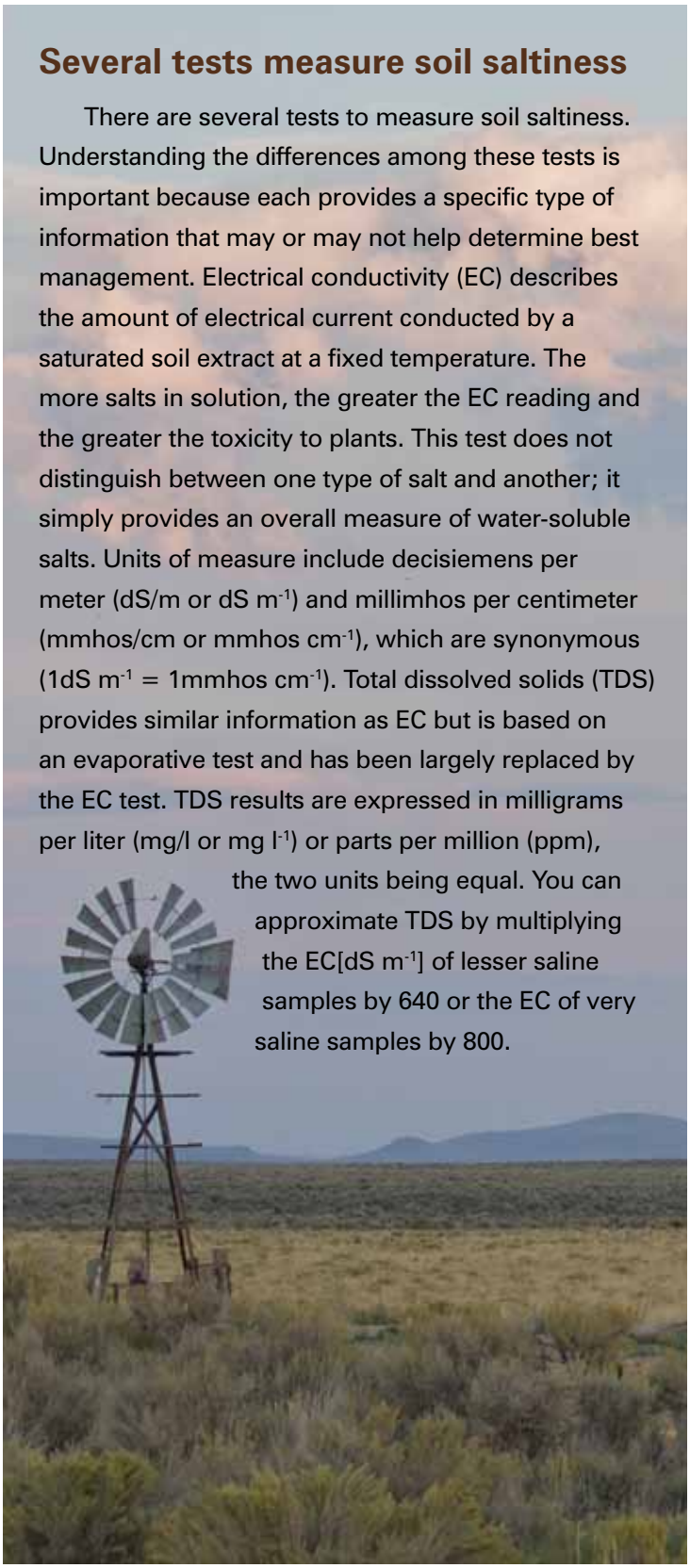
HortNote No. 6, *Selecting Plant Species For Salt-Affected Soils* at www.mt.nrcs.usda.gov/technical/ecs/plants/pmpubs/index.html#hortnotes

Testing and Interpreting Salt-Affected Water for Tree and Shrub Plantings Plant Materials Technical Note Number MT-61at www.mt.nrcs.usda.gov/technical/ecs/plants/technotes/pmtechnoteMT61/index.html.

Determining the Suitability of Salt-Affected Water and Soil For Tree and Shrub Plantings Plant Materials Technical Note Number MT-62 at www.mt.nrcs.usda.gov/technical/ecs/plants/technotes/pmtechnoteMT62/index.html.

Several tests measure soil saltiness

There are several tests to measure soil saltiness. Understanding the differences among these tests is important because each provides a specific type of information that may or may not help determine best management. Electrical conductivity (EC) describes the amount of electrical current conducted by a saturated soil extract at a fixed temperature. The more salts in solution, the greater the EC reading and the greater the toxicity to plants. This test does not distinguish between one type of salt and another; it simply provides an overall measure of water-soluble salts. Units of measure include decisiemens per meter (dS/m or dS m^{-1}) and millimhos per centimeter (mmhos/cm or mmhos cm^{-1}), which are synonymous (1dS m^{-1} = 1mmhos cm^{-1}). Total dissolved solids (TDS) provides similar information as EC but is based on an evaporative test and has been largely replaced by the EC test. TDS results are expressed in milligrams per liter (mg/l or mg l^{-1}) or parts per million (ppm), the two units being equal. You can approximate TDS by multiplying the EC[dS m^{-1}] of lesser saline samples by 640 or the EC of very saline samples by 800.



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