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Integrating Western Native Plants to East Coast North American Environments©

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INTRODUCTION

With today's considerable interest in native plants there is still much to be learned on how to bring those natives to the forefront of nursery production and utilization in the landscape. When highly desirable natives found in natural environments are displaced and brought into much more foreign locales, the degree of success can be adversely affected. Perhaps the most notable example is the arbitrary movement of high-altitude species to much lower ranges. These transitions are often fraught with difficulties and such difficulties are even more exacerbated by accompanying changes in longitude and latitude. The scope of this paper is to look at some of the problems with regards to particular species and possible suggestions on how to increase survival of non-endemic Western species to East coast environments.

MINING THE ROCKY MOUNTAINS

The Eastern Slope of the Rocky Mountains and the high plains offer a treasure trove of unique native plants from environments ranging from desert at 3500 ft altitude to alpine arctic tundra at 14,500 ft. Many nurseries in the high plains and the metropolitan areas of Colorado have ventured with considerable success in bringing Eastern Slope natives to commercial success. Some of which have been so successful that they have made their way to other less austere surroundings such as the Pacific Northwest and the mid-western states with plants and cultivars of *Mahonia repens, Prunus virginiana*, *Populus deltoides*, *Potentilla fruticosa*, and *Prunus besseyi* to name a few. However, the march of these plants eastward has often been stymied by significant environmental challenges.

FACTORS TO CONSIDER

Heat. One key element that affects the cultivation of Rocky Mountain natives in the East is climate, in particular, heat. Plants from the mountains have evolved to withstand the unique circumstances of warm to excessively hot temperatures in the day, which are quickly followed by cool to down-right cold temperatures at night. From personal experience on Squaw Pass outside of Evergreen, Colorado, on 4 July during the early 1980s, daytime temperatures were close to 80 °F and were followed by snowfall during the night. East coast temperatures during summer rarely change as much as 30 °F from day to night and usually only change on the order of 15–20 °F and never change as much as 50 °F. And even if by the odd chance that there are dramatic shifts in temperature from day to night, the shifts are often only for 1 day and not a regular occurrence. High night temperatures in the East have many dramatic effects but foremost is a continuation of rapid plant respiration. This situation causes plants to "burn" excessive amounts of carbohydrate otherwise destined for the storage and survival during the winter thereby eventually starving the plants over the long term. Table 1 lists a number of western species that are negatively affected by high night temperatures. Another effect of high night temperatures is the cessation of flowering. Tomatoes (*Lycopersicon esculentum*) a high-altitude plant from Peru and pansy (*Viola* sp.) will not flower during periods of high night temperatures and many of the Rocky Mountain natives follow a similar pattern. The many highly colored forms of *Potentilla fruticosa* such as 'Tangerine', 'Red Ace', and the new pink forms do not flower readily in the East nor do they hold their color and fade to a dismal dirty yellow. Even old standbys such as *P. fruticosa* 'Jackmanni' will not perform as vibrantly as when they are grown in the high altitude west.

On the contrary many of the members of the Pinaceae from Colorado do seem to function well in the East in spite of the lack of temperature differentials. Table 2 lists a number of conifers from the Rockies that adapt well to the East. Three notable exceptions though are *Picea englemannii*, *Abies lasiocarpa,* and *Pinus edulis*, which do not thrive in East Coast conditions.

Soil Conditions. East Coast soil conditions vary considerably from the Eastern edge of the Appalachian Mountains to the Atlantic shores. Sand, heavy clays, limestone ridges, and essentially weathered rock all can be found with many different types of strata adjacent to one another. Erosion of the Appalachian Mountains, which were once higher than the Rockies, has created soils that are noticeably deficient in many water soluble minerals. Under most circumstances calcium and magnesium are particularly absent except where glacial action has brought in isolated deposits. Many mountainous areas of the East are not made of limestone whereas along the eastern slope of the Rockies, limestone mountains are common. Rainfall in the East is acidic and exacerbates the calcium deficiency situation. Acid rain also converts aluminum salts into soluble forms, which have phytotoxic properties. In addition to theses circumstances the mychorrizal fungi found naturally in the Rocky Mountain soils are not endemic to the Eastern soils and probably would not survive even if brought in.

Above all, the biggest problem with Eastern soils is poor drainage, which causes the higher annual precipitation to be particularly troubling. This is particularly problematic in fall and winter when waterlogged soils can be frequently frozen and ice bound, thereby slowing or even stopping the entrance of oxygen to root zones.

Diseases. Rocky Mountain plants brought to the East Coast are prone to disease problems from two sources, soil borne pathogens and foliar diseases. Foliar diseases are caused by the huge proliferation of fungi and bacteria spores always at the ready. Many are all too familiar with common names such as black spot (*Diplocarpon rosae*) on roses; fireblight (*Erwinia amylovora*) on Roseaceae; *Phytophthora* and *Botryosphaeria* on a range of plants; grey mold (*Botrytis*); mildews on a range of plants; cedar apple rust (*Gymnosporangium juniperi-virginianae*) on many Roseacea; *Diplodia* on Pinaceae; and *Phomopsis*, *Thelaviopsis*, and *Kabatina* on members of the Cupressaceae. Western species are prone to these problems because of several things. One, there has been little or no selection pressure on them in their native environments that have allowed for the evolution of resistant forms. Two, leaves of many western plants are felted and hairy as protection against high light intensities and temperature fluctuations. Third, most Rocky Mountain species are not subject to heavy dew, seemingly nonstop periods of fog, or rainfall during the night, which serves as breeding grounds for bacteria and fungal spores. Fog conditions at 75–80 °F can be very conducive to foliar disease formation.

Table 1. Some Rocky Mountain natives negatively affected by high night temperatures.

Family	Genus and species
Aceraceae	*Acer glabrum*
Cornaceae	*Cornus canadensis*
Elaeagnaceae	*Shepherdia canadensis*
Grossulariaceae	*Ribes americanum*
	Ribes aureum
	Ribes cereum
	Ribes inerme
Hydrangeacea	*Jamesia americana*
Ranunculaceae	*Clematis ligusticifolia*
Rosaceae	*Holodiscus dumosus*
	Potentilla fruticosa
	Rubus parviflorus
	Rubus deliciosus
	Prunus pensylvanica var. *saximontana*
	Prunus virginiana var. *demissa*
	Rosa woodsii
	Rosa arkansas
	Sorbus scopulina

Table 2. Conifers from the Rocky Mountains that withstand high night temperatures in the East.

Abies concolor
Picea pungens cultivars
Pinus aristata
Pinus contorta var. *latifolia*
Pinus flexilis
Pinus strobiformis
Pseudotsuga menziesii

Determining which endemic soil pathogens will affect Rocky Mountain plants is at best a trial and error procedure. Common soil pathogens such as *Phytophthora*, *Rhizoctonia*, and *Pythium* are the usual suspects, but there are others waiting for the opportunity to try something new. Since many Rocky Mountian plants are never exposed to these pathogens selective resistance has not evolved. The high saline and high pH soils of the west often work in concert to keep pathogens to a bare minimum. However, since the soil chemistries of the East are the exact opposite, potentially hazardous disease organisms are ready for the uninitiated new plant.

The late Dr. J. C. Raulston of North Carolina State University often complained that poorly drained, oxygen-starved soils coupled with warm temperatures and virulent soil pathogens could wreak havoc on introduced species. In the upper reaches of the Atlantic states cold wet pathogens which are not prominent during the summer months manifest themselves during fall and winter when soil aeration is reduced and cause considerable trouble during the dormant periods.

Light. One seemingly innocuous adjustment for Rocky Mountain species is the light intensity and light qualities. Anyone who has spent a hot summer day in Washington D.C. or New York City might suggest that light levels should not be a problem. But the fact is, light levels in the East are not nearly that of the West with a differential of thousands of feet of elevation. One key light property that is not as nearly pronounced in the East is the presence of blue and ultraviolet light. Plants normally adapted to high levels of light perceive light intensities in the East as a near shade situation. Some plants from the Rockies normally grown in the shade in their native environment can tolerate full sun in the East. Cacti from the Mountain states may grow well but may not flower readily due to the lower intensities of light. Cacti spine formation appears to be controlled by light levels and cacti in the East do not form as many spines or glocids as they do in the West. The overall effect of lower light intensities and qualities is to limit their photosynthetic capabilities and reduces their overall carbohydrate formation. In the long run this contributes to an overall weakness in the plant often resulting in death during the winter months. Typical responses of Western natives to the lower light levels are slow growth, (species of *Salix* and *Populus* are good examples), failure to grow (frequently found in the Fagaceae), delayed or no flowering (Cactacea, Roseacea, Berberacea), and smaller leaves. These morphological changes are symptomatic of much deeper physiological changes that affect the overall health of the plants which in turn reduces the ability to withstand external stress factors such as heat, drought, and extremes of cold.

The Vicissitudes of Fall and Winter. Autumn in the East Coast presents an entirely different set of circumstances than that of the Rockies. The Rocky Mountains often have dry summers punctuated with the occasional thunderstorm, but as summer progresses into fall the rains cease and a steady decline towards winter begins with decreasing night tempertures and cold snaps. Frost in mid-September is not unusual in Denver and by the end of October snow fall can be anticipated. In contrast, frost in the mid-Atlantic states usually occurs almost a month later and snow is not common until late December or January. Cool night temperatures in the East are often accompanied by rain and wet conditions. Many plants respond to the rain by absorbing more and more water and this reduces their ability to actively harden late growth flushes. Plants that are otherwise hardy become subject to cold damage brought on by too much water in their systems. Sudden cold snaps can produce temperature differentials as much as 30–40 °F, resulting in serious bark splitting.

In addition to delayed dormancy, many times fall rains can trespass well into winter, waterlogging the soil and setting up a situation for frozen soil that is impenetrable to gaseous exchange. This can suffocate root systems and bring on the activities of cold-requiring pathogens. Late summer or fall fertilization can also add to this problem by requiring the plants to absorb more water to facilitate the presence of the fertilizer and interfering with dormancy issues.

Propagation. Many plants from the arid west resent typical methods of propagation. While mist propagation is used in the west, scheduling of the mist cycle and timing are critical. Too much mist makes for certain disaster. Some western species such as *Lonicera*, *Philadelphus*, *Sambucus*, and *Potentilla* can handle it with ease. Others such as *Artemisia frigida*, *Chrysothamnus nauseosus*, *Krascheninnikovia lanata* (syn. *Eurotia lanata*), and *Purshia tridentata* are not nearly as compliant.

Propagation substrates are critical when dealing with Rocky Mountain natives with superior drainage being paramount. Pure perlite, rock wool, and crushed volcanic rock with a very small portion of peat are excellent substrates for cutting propagation.

Cuttings taken from plants with hollow stems can be especially troubling due to water entering the hollow stem and initiating rot inside the stem. This can sometimes be counteracted by sealing the end of the stem with melted wax before sticking the cutting. The hardness of the cutting wood usually has to be adjusted to fit the inability of the cuttings to tolerate excess water. Cuttings that are too soft will often rot before they can root.

Seedlings require special diligence with damping off being particularly troublesome. Ideally, superior sanitation is important with soil sterility being of paramount importance. Seedlings of plants with silvery grey leaves are especially prone to damping off and foliar fungal problems.

Container and Landscape Culture in the East. The number one feature of coaxing Western natives into containers/landscape in the East is controlling water and drainage. Ideally, subsurface watering is preferred and the use of capillary mats is quite useful for supplying adequate root moisture, but limiting foliage exposure thereby stopping some disease problems. Drip lines are preferable to overhead watering and provide the added benefit of reducing overall water usage as well. Exceptionally well-drained media is paramount and should contain a minimum of organic matter. Greenhouse growing can be helpful with a covering provided to prevent excess water from rain. Sides can be open to allow for extra sunlight and aeration. In the landscape it is impractical to provide a covering to prevent rain but ideal drainage can be provided. Amended soils can be mounded up to form a berm. Also, raised beds made of stone or railroad ties can sufficiently elevate the substrate so that drainage is constant. Many can be built to accommodate a buried French drain. The plant roots will acquire an affinity for the *in situ* soil as is needed. Direct planting into the heavy clay soils of the East is fraught with delayed if not immediate plant failure. A suitable substrate for many Western natives is two parts sharp sand, one part organic-based compost, and two parts crushed rock. Additional watering is usually required until the plants are established, but curtailed after a year or so. Fertilization can lead to problems by requiring additional water use. Nutrient imbalances created by pH problems should be carefully monitored.

Foliar disease problems can be held in check by prophylactic fungicide sprays with the heavy metal types being most effective. Cultural conditions for both containers and the landscape should incorporate limits on exposure to extraneous moisture, especially during the night. Mist cycles should be discontinued at night as well and shut down early enough so that sensitive foliage has a chance to dry completely before darkness sets in. Some cuttings and seedlings can be grown in humidity chambers or Nearing frames and vented to prevent foliage degradation problems.

Making the Transition Work. Clues to what particular plants need can be derived from a thorough understanding of where the plant grows naturally. If at all possible seeing the plant in the wild is of immense value. Special attention should be noted whether the plant grows on a north or south slope. Does it occur at the top of the incline or at the bottom? What other plants are associated with the chosen subject? What are the immediate soil conditions? Do the rocks and nearby soils contain obvious minerals of distinction, such as mica or pyrite? Is sepentine rock part of the equation? Is the area known for high concentrations of special case minerals such as selenium? In the mountains of Pennsylvania natural stands of *Betula papyrifera* are often associated with underlying deposits of coal. Similar types of plant/mineral associations can be found in the mountains of the west as well.

Whole plants raised in the West are accustomed to that particular environment and therefore the shipping and transition to a nursery or a landscape setting can be fraught with difficulties and accompanying casualties. Perhaps one of the best methods of introducing Western natives to the East is via seed. Even though damping off conditions can be quite taxing, raising seedlings will eventually result in a selection of plants that can be adapted to the new environment much quicker than bringing a stock of finished plants. Cuttings might work as well, if the source of cuttings were from a variety of plants so that some degree of variation is found. Seed above all other methods is the most practical in that seed can be safely shipped over vast distances with a minimum of loses. Whole plants of native dry land species resent inclusion in the dark in a box and cuttings have to be shipped ultra fast to avoid rotting in the bag during shipping.

With diligence and perseverance success can be had.