

Propagation of Riparian and Wetland Plants¹

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Abstract. Bitterroot Native Growers, Inc. propagates 46 riparian and wetland species by seed and by cuttings. The nursery is experimenting with species specific seed treatments, cultural regimes, and microbial inoculation with the goal of enhancing production at the nursery and survival in the field.

Bitterroot Native Growers (BNG) is a full service plant production and restoration company, specializing in native plants. BNG offers a systems approach to revegetation projects that consists of the following 4 parts: consulting and project planning, on-site seed collection, growing and inoculation with appropriate soil microbes, and planting. Nursery staff collect 80% of the seed used, from sites throughout the West. This enables BNG to offer genetically site-adapted plants to all of our customers.

Of the 160 species propagated at the nursery, 46 are riparian and wetlands species (see Table 1). Riparian species are propagated from cuttings and from seed. When collected, cuttings and seed are assigned seed codes that enable us to track particular sources throughout the growing process. This attention to site specific seed sources, combined with appropriate microbe inoculation, allows us to offer customers plants with superior, long term survival, growth, and reproductive capabilities.

CUTTINGS

Eleven species are propagated from cuttings at BNG. Cuttings are taken from 50 or more plants in a specific location in order to ensure genetic diversity. Collection occurs during late February through early April. Cuttings are treated with indolebutyric acid at differing concentrations, depending on ease or

difficulty of rooting, then placed in 10 cubic inch Ray Leach cells. The growing media is Black Gold forestry mix (50% peat and 50% coarse vermiculite). Cuttings are placed in a hoop house with bottom heat and an intermittent mist system.

SEED

The majority of propagation at BNG is done by seed, because seed production is more economical and, in general, provides greater genetic diversity. Seed is collected and cleaned as it matures. The seed biologist at BNG performs various seed treatments, including the following:

warm and cold stratification, mechanical and acid scarification, hot and cold water soaks, and treatment with gibberellic acid and other growth regulators.

Seed treatment methods and timing differ between and often within species. In order to develop species specific seed treatments, we start with all available ecological and cultural data, such as elevation, climate and site preference. For example, we know that a species such as *Prunus virginiana* (chokecherry) most often occurs in moist riparian sites and has coevolved with birds who digest the fruit and eventually deposit the seeds. The seed treatment we have developed for chokecherry is designed to simulate natural pretreatment and germination conditions:

Chokecherry fruit is removed and the seeds receive a bleach and water treatment for 8 minutes to reduce possible surface pathogens. The

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bleach soak is followed by a 48 hour cold water soak and then 90-120 days of cold stratification. Temperatures of 60-68 degrees Farenheight are optional for germination.

Seed viability and germination rate are evaluated before sowing. In general, seed is not sown until germination rates are between 55% and 75%. Waiting for higher germination rates allows us to be sure that we are not selecting for quick germinators only, and decreases loss due to competition from plants that get an early start.

Seed is sown in one of four greenhouses, depending on the cultural needs of the species. We have one greenhouse to house wetland species, another for xeric species and two for riparian and more mesic species. Humidity, light quality/intensity, and temperature requirements differ among species and can be critical for germination and early growth. All of the greenhouses at BNG are climate controlled and provided with supplemental lighting in order to minimize the germination failures that have plagued native plant restoration projects in the past.

BNG has moved entirely to container growing because of enhanced plant survival and growth, flexibility in planting dates and greater control over conditions affecting plant growth. Container size depends on species growing habit. We use 4 and 10 cubic inch Ray Leach cells and 20 cubic inch Spencer Lamaire books. Growing media is the same as for cuttings.

Most seeds are treated prior to sowing with one or more fungal and bacterial biocontrol agents to aid in the prevention of disease organisms including Fusarium, Phytophthora, Rhizoctonia, and Pythium. We begin fertigation when 75% emergence occurs, using nutrient solutions based on species vigor and specific nutritional needs. Seedlings are pruned to enhance branching and caliper. We have found a strong correlation between caliper and survival in the field.

Plants are measured bi-weekly. When standard heights and calipers are attained, plants are moved to the shadehouse and the nutrient regime is changed to encourage further development of caliper and root tightness (a root system that remains intact when pulled from the container at planting). Many species are inoculated with mycorrhizae just prior to leaving the greenhouse. We are experimenting with the collection and culturing of our own site specific mycorrhizae to accompany custom grown seed collections back to the planting site. At present, we are monitoring plants from custom seed collections which have been inoculated with mycorrhizae from the same sites and outplanted back to the site.

Native plant propagation is still an inexact science. But as a result of the feedback BNG gets from its planting staff, project evaluations, and follow-up reports, we are learning to predictably produce plants that will survive even the most harsh sites.

Table 1.--Species Propagated at BNG.

Trees and Shrubs

Abies concolor	Fir, White
Abies grandis	Fir, Grand
Abies lasiocarpa	Fir, Alpine
Amelanchier alnifolia	Serviceberry
Arctostaphylos uva-ursi	Kinnickinnick
Artemisia cana	Sagebrush, Silver
Artemisia frigida	Sagebrush, Fringed
Artemisia nova	Sagebrush, Black
Artemisia tridentata	Sagebrush, Big
Atriplex confertifolia	Shadscale
Berberis repens	Oregongrape
Ceanothus sanguineus	Ceanothus, Redstem
Ceanothus velutinus	Ceanothus, Snowbrush
Cercocarpus ledifolius	Curlleaf Mountain Mahogany
Cercocarpus montanus	Mountain Mahogany
Chrysothamnus nauseosus	Rubber Rabbitbrush
Cowania stansburiana	Cliffrose
Fallugia paradoxa	Apache Plume
Holodiscus discolor	Oceanspray

<i>Juniperus communis</i>	Juniper, Common
<i>Juniperus deppeana</i>	Juniper, Alligator
<i>Juniperus horizontalis</i>	Juniper, Creeping
<i>Juniperus monosperma</i>	Juniper, One-Seed
<i>Juniperus osteosperma</i>	Juniper, Utah
<i>Juniperus scopulorum</i>	Juniper, Rocky Mountain
<i>Larix occidentalis</i>	Western Larch
<i>Lonicera involucrata</i>	Black Twinberry
<i>Lonicera utahensis</i>	Utah Honeysuckle
<i>Pachistima myrsinites</i>	Mountain Lover
<i>Physocarpus malvaceus</i>	Mallow Ninebark
<i>Pinus albicaulis</i>	Pine, Whitebark
<i>Pinus contorta</i>	Pine, Lodgepole
<i>Pinus edulis</i>	Pine, Pinyon
<i>Pinus flexilis</i>	Pine, Limber
<i>Pinus ponderosa</i>	Pine, Ponderosa
<i>Pseudotsuga menziesii</i>	Douglas-fir
<i>Purshia tridentata</i>	Antelope Bitterbrush
<i>Quercus gambelii</i>	Oak, Gambel's
<i>Quercus macrocarpa</i>	Oak, Bur
<i>Rhus glabra 'cismontana'</i>	Sumac, Dwarf Smooth
<i>Rhus trilobata</i>	Sumac, Oakleaf
<i>Ribes aureum</i>	Currant, Golden
<i>Ribes cereum</i>	Currant, Wax
<i>Shepherdia argentea</i>	Buffaloberry, Silverleaf
<i>Shepherdia canadensis</i>	Buffaloberry, Russet
<i>Spirea betulifolia</i>	Spirea, White
<i>Spirea douglasii</i>	Spirea, Pink
<i>Symphoricarpos albus</i>	Snowberry, Common
<i>Symphoricarpos occidentalis</i>	Snowberry, Western
<i>Thuja plicata</i>	Western Redcedar
<i>Typha latifolia</i>	Common Cattail
<i>Vaccinium globulare</i>	Globe Huckleberry
<i>Yucca filamentosa</i>	Adams Needle
<i>Yucca glauca</i>	Great Plains Yucca

Wildflowers and Grasses

<i>Anaphalis margaritacea</i>	Pearly Everlasting
<i>Anemone nuttalliana</i>	Pasque Flower
<i>Antennaria microphylla</i>	Rosy Pussytoes
<i>Balsamorhiza sagittata</i>	Arrowleaf Balsamroot
<i>Carex geyeri</i>	Sedge, Elk
<i>Castilleja spp.</i>	Indian Paintbrush
<i>Clematis ligusticifolia</i>	Western Clematis
<i>Dodecatheon jeffreyi</i>	Shooting Star
<i>Echinacea purpurea</i>	Purple Coneflower
<i>Eriogonum umbellatum</i>	Sulphur Buckwheat
<i>Festuca ovina 'glauca'</i>	Blue Fescue
<i>Gaillardia aristata</i>	Blanket Flower
<i>Geum triflorum</i>	Prairie Smoke
<i>Gilia aggregata</i>	Scarlet Gilia
<i>Iliamna rivularis</i>	Mountain Hollyhock
<i>Lewisia rediviva</i>	Bitter Root
<i>Liatris punctata</i>	Gayfeather, Dotted
<i>Liatris pycnostachya</i>	Gayfeather, Thick-spike
<i>Lupinus argenteus</i>	Lupine, Silvery
<i>Lupinus sericeus</i>	Lupine, Silky
<i>Mentzelia laevicaulis</i>	Blazing Star
<i>Mirabilis multiflora</i>	Desert Four O'Clock
<i>Oenothera caespitosa</i>	Evening Primrose
<i>Penstemon cyananthus</i>	Penstemon, Wasatch
<i>Penstemon deustus</i>	Penstemon, Hotrock
<i>Penstemon eatonii</i>	Penstemon, Firecracker
<i>Penstemon fruticosus</i>	Penstemon, Shrubby
<i>Penstemon palmeri</i>	Penstemon, Palmer
<i>Penstemon pinifolius</i>	Penstemon, Pineleaf
<i>Penstemon strictus</i>	Penstemon, Rocky Mountain

Polemonium pulcherrimum
Ratibida columnifera
Xerophyllum tenax

Jacobs Ladder
Prairie Coneflower
Beargrass

Riparian and Wetland Plants

Acer glabrum	Maple, Rocky Mtn.
Acer grandidentatum	Maple, Bigtooth
Acer negundo	Boxelder
Alnus incana	Alder, Mountain
Alnus sinuata	Alder, Sitka
Aquilegia coerulea	Columbine, Colorado
Aquilegia flavescens	Columbine, Yellow
Betula occidentalis	Birch, Water
Betula papyrifera	Birch, Paper
Carex aquatilis	Sedge, Water
Carex microptera	Sedge, Small Winged
Carex nebraskensis	Sedge, Nebraska
Carex rostrata	Sedge, Beaked
Cornus stolonifera	Redosier Dogwood
Crataegus douglasii	Douglas Hawthorn
Elymus cinereus	Basin Wildrye
Fraxinus pennsylvanica	Green Ash
Geranium viscosissimum	Sticky Geranium
Iris missouriensis	Rocky Mtn. Iris
Juncus balticus	Rush, Baltic
Juncus torreyi	Rush, Torrey
Mimulus lewisii	Red Monkey flower
Philadelphus lewisii	Mockorange
Picea engelmannii	Spruce, Engelmann
Picea glauca 'densata'	Spruce, Black Hills
Picea pungens 'glauca'	Spruce, Colorado Blue
Populus sargentii	Cottonwood, Plains
Populus tremuloides	Quaking Aspen
Populus trichocarpa	Cottonwood, Black
Prunus americana	American Plum
Prunus besseyi	Western Sand Cherry
Prunus virginiana	Chokecherry
Prunus virginiana 'schubertii'	Canada Red Chokecherry
Rosa nutkana	Rose, Wild
Rosa woodsii	Rose, Woods
Rubus idaeus	Western Raspberry
Rubus parviflora	Thimbleberry
Salix amygdaloides	Willow, Peachleaf
Salix bebbiana	Willow, Bebb's
Salix drummondiana	Willow, Drummond
Salix exigua	Willow, Sandbar
Salix geyeriana	Willow, Geyer's
Salix lutea	Willow, Yellow
Salix scouleriana	Willow, Mountain
Sambucus cerulea	Elderberry, Blue
Sambucus racemosa	Elderberry, Black
Scirpus acutus	Bulrush, Hardstem
Scirpus americanus	Bulrush, American
Scirpus validus	Bulrush, Softstem
Sorbus scopulina	Mountain-ash, Dwarf
Sorbus sitchensis	Mountain-ash, Sitka
Spartina pectinata	Prairie Cordgrass
Typha latifolia	Common Cattail