

Propagation of Riparian Species in Southern California¹

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Abstract. --Riparian corridors in southern California are typically vegetated with a tree cover, an understory shrub layer of woody plants and a sub-shrub component of herbaceous plants. As mitigation for the Least Bell's Vireo, an endangered species, habitat is being restored using nursery produced container and bare root plants. Propagation and production techniques are presented.

INTRODUCTION

In propagating and producing riparian plant species for habitat restoration in southern California, the grower must utilize several different techniques for a variety of plant species. Depending on the species and habitat restoration objectives, plants can be installed during the dormant period as bare root, or during the entire year from containers. Container sizes vary in a range which supports healthy nursery-grown plants from eight inches to eight feet in height. Large quantities of plants are often required for large restoration projects. The objective on certain projects, is the creation (or enhancement) of habitat for Least Bells' Vireo (LBV), an endangered species, as mitigation for impact to its habitat elsewhere. Because of the nesting habits of the LBV, construction and planting are allowed only between November and March, with no mechanized equipment permitted on the site after March 15. This paper discusses propagation techniques utilized in the production of several species of riparian plants in varying container and bare root sizes. The various plants must be made ready for simultaneous delivery during the winter/spring season. By planting both large and small plants from the nursery, the effect is a sort of "instant age class". If planted properly, the assemblage of different sized plants resembles habitat shortly after establishment. When several different species are required, in different and numerous container sizes and bare root grades, all to be ready during the short planting window of November through March, the grower is presented with quite a challenge.

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Figure 1. -- Three typical landscape container sizes with riparian species for revegetation. Left to right - One gallon Arroyo Willow (*Salix lasiolepis*), fifteen gallon Red Willow (*S. laevigata*), five gallon western cottonwood (*Populus fremontii*). These container sizes may seem impractical for revegetation because they are so much larger than the containers typically used in reforestation. When the principle objective is creation of habitat in a very short time period, the larger plants become cost effective.

MATERIALS AND METHODS

PLANT BOTANICAL NAME	PLANT COMMON NAME	PROPAGATION		PRODUCTION	
		SEED	CUT	CONT	BARE ROOT
<i>Artemisia douglasiana</i>	Mugwort	✓	✓	✓	
<i>Artemisia palmeri</i>	San Diego Sagewort	✓	✓	✓	
<i>Baccharis glutinosa</i>	Mulefat	✓	✓	✓	
<i>Platanus racemosa</i>	California Sycamore	✓		✓	✓
<i>Populus fremontii</i>	Western Cottonwood	✓	✓	✓	✓
<i>Populus trichocarpa</i>	Black Cottonwood	✓	✓	✓	✓
<i>Rhus laurina</i>	Laurel Sumac	✓		✓	
<i>Rosa californica</i>	California Rose	✓		✓	
<i>Rubus ursinus</i>	California Blackberry	✓		✓	✓
<i>Salix goodingii</i>	Black Willow	✓	✓	✓	✓
<i>Salix hindsiana</i>	Sandbar Willow	✓	✓	✓	✓
<i>Salix laevigata</i>	Red Willow	✓	✓	✓	✓
<i>Salix lasiandra</i>	Lance-Leaf Willow	✓	✓	✓	✓
<i>Salix lasiolepis</i>	Arroyo Willow	✓	✓	✓	✓
<i>Sambucus mexicana</i>	Mexican Elderberry	✓		✓	
<i>Toxicodendron divers.</i>	Poison oak	✓		✓	

CONTAINERS

Seeds and softwood cuttings are planted in plastic nursery flats popularly called "California propagation flats". The flat is rectangular and measures 17" long x 18" wide x 2 3/4" deep with mesh bottom. Propagation medium for seed consists of coarse, well-drained mixture of sand, perlite, vermiculite, and peat. The ratio of inorganics to organics is about 4 to 1. Planting medium for cuttings consists of varying percentages of the same components with the ratio of inorganics to organics at about 9 to 1. All seed and softwood cuttings are started outdoors in a shade house. Softwood cutting flats are placed under intermittent mist. After germinating or striking root, the plants are hardened off in preparation for transplanting into individual containers. A good container size as an intermediate step to the one gallon nursery container is popularly called a "rose pot liner". The pot measures 2 1/4" square x 3" deep with a slight taper to a narrower bottom. The potting medium is steam pasteurized and consists of a coarse, well-drained mixture of sand, perlite, vermiculite, peat, composted sawdust (pine, fir, redwood), and bark (pine, redwood) with inorganics and organics represented in equal proportions. The plants are grown in the rose pot liners for approximately three or four months, usually in a shade (40%) house. They are irrigated as needed to keep the root ball moist, without keeping it overly saturated.

Liners can be transplanted into 1 or 5 gallon size containers as soon as the root ball fills the pot. Care should be taken to not allow the plants to get root-bound in the liner. With some fast growing riparian plants, a couple of weeks can make a big difference. Transplanting usually takes place in April or May. For bare root production, rooted cuttings in liners can be planted in the open ground during this same season.

Species which lend themselves to dormant season propagation by hardwood cuttings (ie: *Salix* spp.) can be produced by sticking the hardwood cuttings directly into the potting medium in the desired container size. All subsequent transplanting into larger containers can be done whenever needed. Transplanting during the mid-summer growing season can be a problem because of transplant shock, wilting, and branch loss.



Figure 2. -- Paperpot® containerized lance-leaf willow (*Salix lasiandra*) grown from dormant hardwood twig. Note new branch emerging from the cutting below the soil level.

BARE ROOT

Bare root fields air prepared in the autumn and early winter months while cuttings are being harvested and prepared from the cutting orchards. Hardwood cuttings can be stored in walk-in refrigerator space. Optimal storage conditions are in the dark, at 38-40° F in 90-95% humidity. Cuttings are approximately 12 inches long and 3/8 to 3/4 inch caliper. The top end can be dipped in tree sealer paint but we noticed no recognizable difference in treated and untreated cuttings. In our climate and conditions, no hormone treatments are necessary with willow species.

After plowing, tilling and leveling the fields, we prepare our beds using a 60" bed former. This implement was originally designed for growing strawberries using the "high bed" method. We adapted the fins which determine the bed height so that they would form a bed no more than 6" high. This implement is set up for applying two drip hose lines along the bed during the bed forming process. For single row production of trees 6 to 8 feet tall, we used bi-wall drip tubing for irrigation throughout the growing season with satisfactory results.

The bare root trees are lifted during the dormant season (theoretically "winter" in sunny southern California), usually mid



Figure 4. -- Four wheel drive, high clearance, "mudder" type tractor pulling a horizontal undercutting knife for lifting bare root trees. Trees are grown in a single row per bed. Damage to the trees is minimal with a high clearance tractor.



Figure 3. -- Bare root black willow (*Salix goodingii*) grown from hardwood cuttings, approx. 12" long by 1/2" caliper, single row for specimen size, no pruning.

to late January. We straddle the row with a four wheel drive, high clearance, "mudder" type tractor pulling a horizontal knife blade which cuts the roots approximately 14 - 18 inches deep. Hand crews then lift the plants with spades and cart the plants to the barn. The roots are trimmed, and the trees are bundled and processed before being sent to cold storage or planted on the jobsite. In our climate, plants can be installed immediately after lifting from the field, which is usually preferred over intermediate storage. We dip the roots in polymer gel and wrap the bundled root systems in large plastic trash bags to keep them from desiccating during shipment or before transplanting.

ECOLOGICAL PRINCIPLES

For projects involving restoration or enhancement of natural habitat, the grower should adhere to responsible ecological principles which touch on the issues of seed and cutting collection, labeling and record keeping, pest control during production, and jobsite deliveries. The nursery professional is really part of a team attempting habitat restoration, and should not be viewed as a mere supplier or order taker.

Frequently, plants are specified to be grown from site-specific seed and cuttings. Some jobs allow more latitude than others on the origin of propagation material, but the grower should always match crops to job site vicinity, even if they are not specified that way. This will not only provide plants that perform better due to acclimatization, but will also assure that the appropriate genetic material is used. In collecting seed or cuttings from the wild, the grower should collect from numerous individuals (about 50 or more for large orders) from several stands within a single target population. A good record keeping and labeling program must be carried out to ensure that the propagules and plants do not get mixed up.

It would be completely contrary to the goals of ecological restoration to introduce harmful or exotic pests (including weeds)



Figure 5. -- Close-up of blade undercutting roots of black willow (*Salix goodingii*) in bare root production.

to a revegetation site, The grower must exercise extreme caution to ship clean plants, free from the residual effects of pesticides which may have a negative impact at the jobsite.

As part of the restoration team, the grower's responsibility does not necessarily end after the delivery. The plants must be properly hardened and prepared for the rigors of the jobsite environment. Also, we must utilize shipping techniques which preserve the plants in a healthy condition until they arrive at the jobsite. They must be protected from wind, drying, mold, extreme heat or cold, too much dirt, the build-up of high levels of ethylene gas, and breakage or crushing. A well grown plant can be mined in a single afternoon poorly spent in substandard shipping conditions.

SUMMARY

Most riparian species will prove themselves relatively easy to grow. The major challenge and responsibility lies in producing healthy nursery stock in the appropriate container or bare root size, on time, genetically diverse yet specific to the jobsite, free from harmful or exotic pests and residual chemical influence, delivered in a timely and safe manner to the restoration site.