Cultural Perspectives

Sex and the Single *Salix*

The family Salicaceae contains hundreds of common woody shrubs and trees but consists of only 2 genera: the willows (*Salix* spp.) and the poplars, cottonwoods, and aspens (*Populus* spp.). This plant family is unusual for several different reasons:

1) They are dioecious (each plant is either male or female).

2) They more commonly reproduce by vegetative processes rather than seed.

3) Members of the Salicaceae dominate woody riparian vegetation in the northern hemisphere

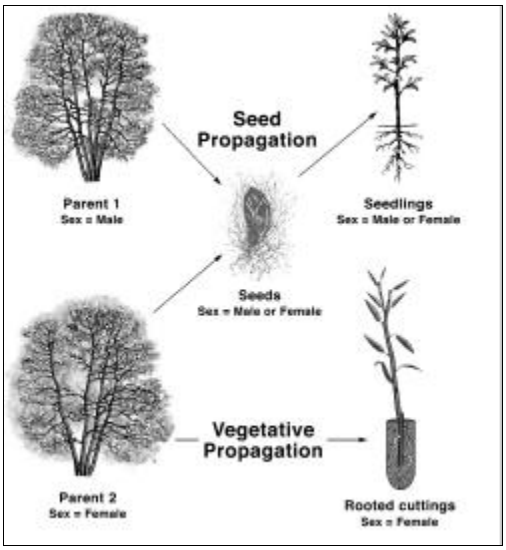


Figure 1 - Plants of the family Salicaceae are unisexual. This creates challenges for nursery managers and restorationists because vegetative propagation is the rule and produces individuals of the same sex.

Demand for willow and cottonwood species has become more common in the last decade because of an increased interest in riparian restoration. As we discussed in the July, 2000 issue of FNN, hardwood cuttings of these genera are widely being used both for bioengineering structures. Dormant unrooted hardwood cuttings of willow and cottonwood are collected on the project site or from stooling beds in the nursery, and then fabricated into vertical bundles, fascines, and brush mattresses. The hardwood cuttings in these structures are expected to sprout roots to increase soil stabilization and also grow into pioneer plants in the riparian ecosystem.

In addition, many riparian restoration projects stick unrooted cuttings directly in stream and river banks with the expectation that they will root and revegetate the site. Some nurseries also sell unrooted hardwood cuttings. Experience has shown that rooting success and plant establishment is much better if the cuttings are rooted in the nursery as bareroot stock or in containers. As a consequence, nurseries offer many species of willow, cottonwoods, and aspen for conservation projects.

The Problem

The concern is that all of these propagation techniques are vegetative, not sexual. Sexual propagation results in a mixture of genetic characteristics so that the offspring contain both male and female plants. On the other hand, asexual propagation methods produce exact clones of the mother plant. This is of particular concern with dioecious plants, such as *Salix* and *Populus* because all the progeny produced by vegetative propagation will have the same sex as their parent (Figure 1).

Restorationists and nursery workers have been collecting cuttings of willow and cottonwood without any consideration to the sex of the parent plant. In nature, these species often reproduce naturally from root sprouts or buried branches and, as a result, adjacent plants on the project site are often from the same clone. Branches often break off parent plants during floods, become buried further downstream, and root into new plants. If there are not many genetically different plants to start with, all the willows or cottonwood plants in a riparian community can be from only a few parents. A recent collecting trip to Little Butte Creek in Southern Oregon revealed that all the cottonwood plants in the watershed were female and probably from the same parent. Because of the lack of male plants, no seed or seedlings could be found and collectors had to go to an adjacent drainage to find any male plants.

The unisex problem becomes even worse when cuttings are brought back to the nursery and used to start stooling beds. Because cuttings will be collected from these beds for years, this greatly multiplies the number of plants of the same genetic origin. Walk through the stooling beds in your local nursery next spring when the willows or

cottonwoods are flowering and you might be surprised.

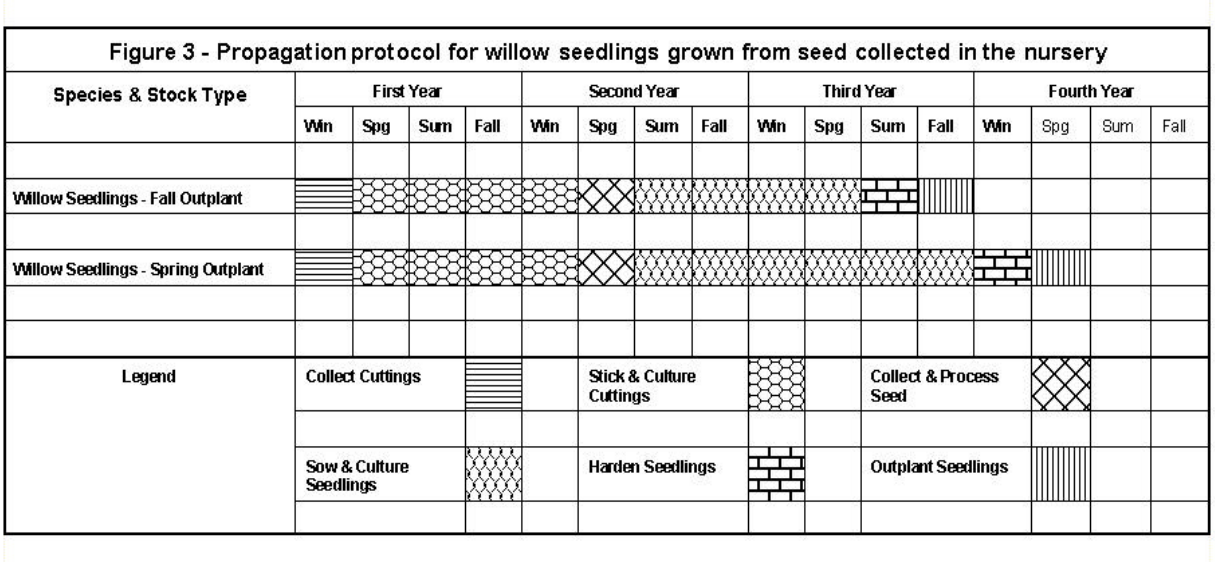
A Solution

Because sexual and genetic diversity are critical in ecological restoration, the best solution is to propagate all plants by seed. However, due to the difficulty of collecting wild seed of *Salix* and *Populus*, it makes more sense to bring cuttings of known male and female plants back to the nursery and root them in containers or bareroot beds. The trick is to be able to distinguish male and female plants in the field. The easiest way to do this is to collect cuttings during the spring when they are flowering, and it is relatively easy to identify the anthers in male catkins (Figure 2A) and the pistils in female ones **(**Figure 2B). Unfortunately, the cuttings will not be dormant at this time and so rooting success will likely be poor. It is possible to identify the sex of dormant willows and cottonwoods by examining the size and location of the sexual buds. Male buds are typically larger than female buds and the floral structure can also be checked by slicing the buds with a razor blade. Either way, having a good mixture of sexually and genetically different plants in your stooling beds will insure that the cuttings that you harvest will promote biodiversity on your conservation and restoration projects.

Collecting a good mixture of male and female cuttings also gives you the option of producing seed in the nursery. Direct stick the cuttings in containers and mix male and female plants in the beds. Many willows are sexually precocious and will produce flowers that same season and both willows and cottonwood should flower the following year. Because the plants are growing in close proximity, the percentage of seed set is high, and quality seed can be collected a few weeks after flowering. To insure good seed quality, collect the female capsules just before they open and place them in a brown paper bag to afterripen. When the cotton is just emerging from the capsules, the seed can be separated by using screens and compressed air. Cottonwood seed can be processed by hammer-milling the capsules and separating the seed with screens at low air flow. The exact procedure including screen sizes is given in Dreesen and others (2002).

Willow and cottonwood seed should be sown immediately with several seeds per cavity. They can be direct sown

Figure 2 - The sex of willows, cottonwoods, and aspens can easily be determined when the plants are in flower (A = male, B = Female).



in medium-sized containers such as RL SuperCells (10 in^3 or 164 cm^3) or sown in miniplugs which are later transplanted into larger containers. Willow seed should be sown with no covering whereas cottonwood seed can be lightly covered. Seed must be kept *moist but not wet* by frequent light irrigations or ideally with a timed mist system. Germination is usually visible in a few days and germinants should be thinned by clipping to one plant per cavity within a few weeks.

A typical propagation protocol for willow seedlings grown from seed at the Los Lunas Plant Materials Center in New Mexico is shown in Figure 3. If the dormant hardwood cuttings are collected during the winter, they can be stuck in the nursery the following spring. The plants will flower the first or second season and seed can be collected and processed. By immediately sowing, shippable seedlings can be ready by the third or fourth year, depending on the container and desired target seedling size.

Summary

Plants of the Salicaceae are unique and so special measures must be taken to insure that genetic and sexual diversity is maintained during propagation. The critical thing is to identify the sex of willows, cottonwoods, and aspen when collecting cuttings in the field. Then, a sexually and genetically diverse mixture of cuttings can be obtained for bioengineering structures, direct sticking or for establishing stooling beds in the nursery. Seed propagation is encouraged whenever possible and it is relatively easy to force seed production from rooted cuttings in the nursery. Seedlings of the Salicaceae can be produced in as little as 3 years.

Sources:

Dreesen, D.; Harrington, J.; Subirge, T.; Stewart, P.; Fenchel, G. 2002. Riparian restoration in the Southwest: species selection, propagation, planting methods, and case studies. IN: Dumroese, K.; Riley, L.; Landis, T.D. tech. coords. National Nursery Proceedings.

Karrenberg, S.; Edwards, P.J.; Kollmann, J. 2002. The life history of Salicaceae living in the active zone of floodplains. Freshwater Biology 47: 733-748.