Propagating Native Plants for the Hopi Nation©

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INTRODUCTION

The Hopi reservation is located in northeast Arizona (Fig. 1) where the tribe has been working to eradicate exotic salt-cedar (*Tamarix ramosissima* Leneb.[Tamaricaceae]) and Russian-olive (*Elaeagnus angustifolia* L.[Elaeagnaceae]) from streams and wetlands. Although only comprising about 2% of the reservation, these riparian and wetland communities are ecologically and culturally valuable for livestock grazing, wildlife habitat, traditional gathering, and ceremonial use (Lomadafkie, 2003). Even though the initial eradications were successful, the salt-cedar is already resprouting. Consequently, the tribe asked the U.S.D.A. Forest Service for help in propagating willows and cottonwoods to plant in these areas at the first Intertribal Nursery Council meeting in 2001.

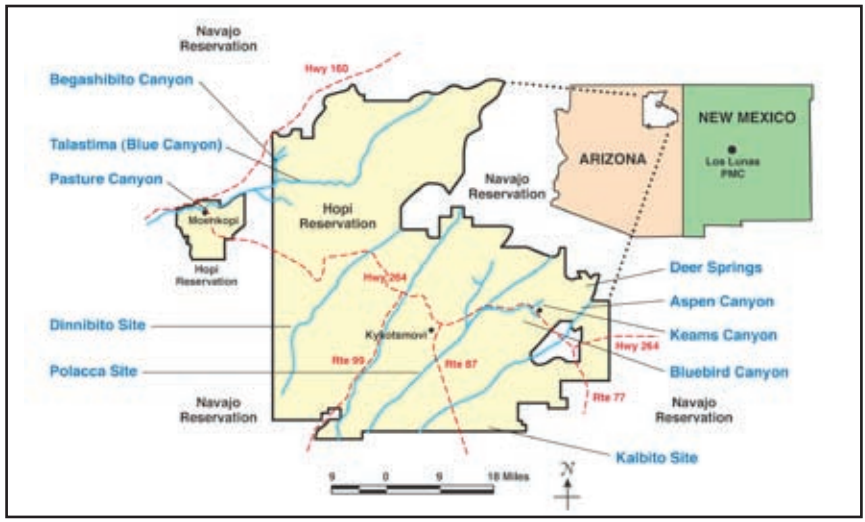

Figure 1. Riparian and wetland restoration sites on the Hopi reservation are widely separated, and some contain natural clones of only one sex.

During initial visits to project areas on the reservation, we identified the principal riparian trees and shrubs: Fremont cottonwood, Goodding's willow, coyote willow, and arroyo willow. Tribal members also took us to remote sites where we found small stands of lanceleaf cottonwood, and quaking aspen (Table 1). It is important to note that many of the wetland and riparian areas on the Hopi reservation are geographically isolated and not always contiguous (Fig. 1). In addition, the aggressive invasion of salt-cedar and Russian-olive has severely reduced and separated the populations of native willows and cottonwoods. From our field observations, we suspected that several of the existing plant stands were comprised of only one sex and sometimes only a single individual (Pinto and Landis, 2003). For example, one extended stand of arroyo willow along Bluebird Canyon was found to contain only female plants, while a small grove of lanceleaf cottonwood at Deer Springs was observed to be all males (Table 1).

Table 1. List of important Salicaeae (cottonwoods, willows, and aspen) found on the Hopi Reservation, Arizona.

Scientific name	Common name	Form	Abundance	Sex of cuttings collected Males	Females
Populus fremontii S. Wats.	Fremont cottonwood	Large tree	Common	X	X
Populus × *acuminata* Rydb. (pro sp.) [*P. angustifolia* × *P. deltoides*]	Lanceleaf cottonwood	Large tree	Very rare	X	
Populus tremuloides (Michx.)	Quaking aspen	Small tree	Very rare		
Salix goddingii (Ball)	Gooding's willow	Small tree	Uncommon	X	
Salix exigua (Nutt.)	Coyote willow	Shrub	Common	X	X
Salix lasiolepis (Benth.)	Arroyo willow	Shrub	Rare		X

WHY SEED PROPAGATION?

Once the native plants had been identified, the next step was to determine where and how to propagate them. Because the Hopi do not have their own nursery, we did the initial propagation at the U.S.D.A. Natural Resources Conservation Service Los Lunas Plant Materials Center (PMC) in New Mexico (Fig. 1).

Traditionally, willows and cottonwoods are vegetatively propagated with woody cuttings but, because all Salicaceae are dioecious, we had concerns about using vegetative propagation (Landis et al., 2003). Therefore, to obtain the greatest possible genetic diversity and create plant communities that were self-sustaining, we decided to produce all our plant material from seeds. Our initial plan was to mix the rooted cuttings from different locations, allow them to flower and cross-pollinate, and produce locally adapted but genetically diverse seeds.

The literature suggested that rooted cuttings of mature plant material would flower in 1–2 years (Wycoff and Zasada, 2003; Zasada et al., 2003); accordingly, we collected cuttings during the winter dormant period and rooted them at the Los Lunas PMC (Landis et al., 2003). Unfortunately, this strategy didn't work. Although rooting success was acceptable, we only generated a small amount of seed from coyote willow.

So, we collected Fremont cottonwood and Goodding's willow seed, cleaned it, and sowed it immediately in Ray Leach Super Cells [164 cm^3 (10 $inches^3$)]. Even though the seeds were collected in mid-June, we were still able to produce large seedlings by the end of September—a growing season of only 4 months. In fact, we decided to top prune these seedlings to maintain a favorable root-to-shoot balance.

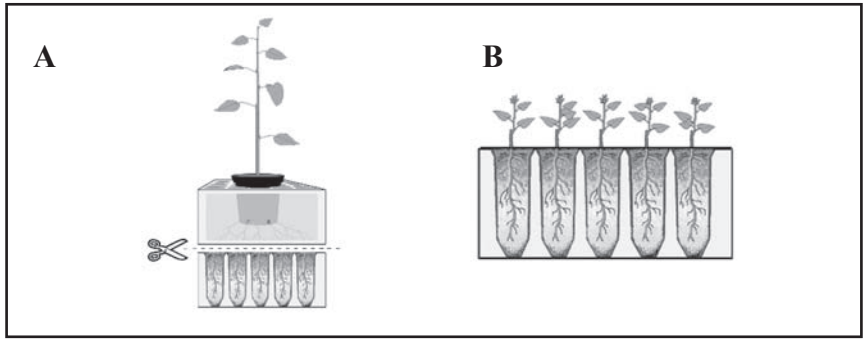

Figure 2. Because traditional propagation techniques didn't work, we are using a new "stacked propagation" technique for quaking aspen.

CONVENTIONAL PROPAGATION OF QUAKING ASPEN DIDN'T WORK

Woody cuttings of quaking aspen root poorly; however, forcing sprouts from underground stems and rooting them is effective. Although we collected underground stems of aspen from two locations, they did not produce sprouts. This may be due to the timing of the collections or the lack of vigor in the parent trees.

Therefore, we were excited when we noticed aspen catkins on some of the trees in Aspen Canyon. When they were taken to Los Lunas PMC and cleaned, however, the catkins yielded no viable seeds. On a subsequent trip, we collected some viable seed from healthier aspen stands on the adjacent Navajo Reservation. This time, the catkins did yield some viable seeds, and around a dozen seedlings were grown in 262 cm^3 (16 $inches^3$) DeePots™ containers and later transplanted into 1-gal containers for further growth.

STACKED PROPAGATION

In discussions with Larry LaFleur of Smoky Lake Nursery, we learned about a new vegetative propagation method for quaking aspen that we are calling "stacked propagation" (LaFleur, 2004). This technique takes advantage of the rapid and extensive root growth of aspen seedlings and the fact that severed roots will form new shoots. So, we created a stack of Styroblock® containers with a 3.785-L (1-gal) aspen seedling inserted in the top block. Lower blocks were filled with a growing medium of composted pine bark, pumice, and peat moss; a thin layer of media was also sandwiched between the blocks. After a few months, the roots of the aspen seedlings had grown down through the cavities in the lower blocks, and were cut with a sharp knife blade (Fig. 2A). Once the blocks were separated, new aspen shoots formed that grew into shippable plants in a few months (Fig. 2B).

In spite of its novelty, this is still vegetative propagation, and so, to ensure wide genetic variation, we will still try to collect more aspen seeds from the Hopi sites. We will also plant some of the Navajo aspen plants at these sites to encourage eventual cross-pollination.

A CULTURAL PLANT PROPAGATION CENTER

With funding from the USDA Forest Service, we are working with the Hopi Tribe to develop a greenhouse at the Moenkopi Day School in Tuba City, Arizona. We are calling this facility a cultural plant propagation center (CPPC) because it will be used for growing native plants that have cultural value to the tribe. Located at a school, this nursery can also serve as an environmental education center that will bring together students and tribal elders. The CPPC will continue the plant propagation heritage of the Hopi, which is well characterized by this quote from the tribal website: "Farming and gardening are essential elements of Hopi culture—acts of faith that provide religious focus."

LITERATURE CITED

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General Session V: Question and Answer Session©

Mike Bone: I've worked with the tray-on-tray arrangement you mentioned and had problems with irrigations washing out the soil. I found you can take 50% shade cloth to place between the trays and the roots will grow through that into the bottom tray. This will also reduce soil compaction of the bottom tray by the top tray.

Tom Landis: Thank you, that's good information. I'm anxious to see what we get with the oak and any of those species that are bunching or cloning species; you'd think it would work very well.