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Cluster Plantings: A way to plant live unrooted cuttings in coarse soils including sands, gravels and cobbles

J. Chris Hoag, Wetland Plant Ecologist, USDA - Natural Resources Conservation Service, Plant Materials Center, Aberdeen, ID 83210

Introduction

Planting unrooted dormant cuttings of riparian woody species such as willow, cottonwood, dogwood, and Baccharis is a proven method of establishing this type of woody vegetation on degraded or destroyed riparian areas. There are two main things that affect the establishment of live cuttings: 1) the bottom of the cutting needs to be well into the lowest water table of the year, and 2) there needs to be good soil to stem contact to allow significant root growth.

There are a number of planting methods that have been used to plant live cuttings. They include but are not limited to: low tech methods such as dibble bars and handheld augers; to high tech methods such as backhoes, The Stinger (see Idaho Technical Note No. 6), and the waterjet (see Idaho Technical Note No. 39). The more mechanized the technology, the more expensive it is to plant the cuttings.


NCD, Flagstaff, AZ


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In addition, the coarser the soils, the more mechanized the planting method needs to be especially if the water table is deep. Sandy to gravelly to cobbly soils are probably the hardest

soils to plant live cuttings into. The most successful planting method found so far for plant establishment in these soils is the cluster planting method.

The cluster planting method is based on planting multiple cuttings in the same hole. Riparian woody species are much different than upland woody species. First, willow, cottonwood, dogwood and *Baccharis* riparian woody species can sprout from hardwood cuttings, i.e. branches, stems or whole trunks. Second, planting the root collar (where the stem cells meet the root cells) at the ground surface is not as critical as it is with most evergreen or hardwood species. This is primarily due to the fact that many riparian woody species have adapted to high sediment loads typical of riparian flooding systems. Their reproductive strategy is that they have root primordia up and down the entire stem and when any part of the stem is in contact with soil, the root primordia will sprout roots and when the stem is exposed to the air and sunlight; the buds will sprout stems and leaves. In this way, when a branch is broken off and washes downstream, it can lodge in deposited sediment right side up, sideways, or even upside down and it will grow.

In most cases, the most expensive part of planting an unrooted cutting is digging the hole. If you plant a single cutting in a hole and it dies, you have lost your investment. If you plant multiple cuttings in the same hole and one grows, you have paid for digging the hole and your success rate increases significantly. If all the cuttings grow, you will have paid for the hole many times over and it is not detrimental to the growth of the cuttings. Multiple cuttings will grow in the same hole and the strongest will survive over time. They will not really suffer from competition because the main limiting factor that they are competing for is water and by planting the cuttings with 6-12 inches of the bottom of the cuttings into the lowest water table of the year, water is not limiting.

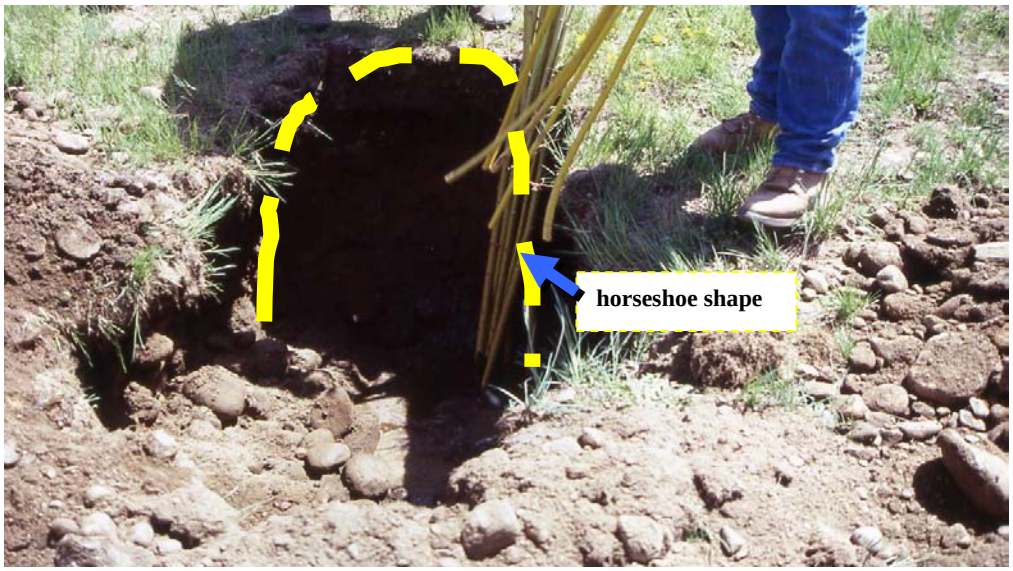
Planting Methods

1 Cluster planting in Goose Creek, ID with a small backhoe supplied and operated by the landowner

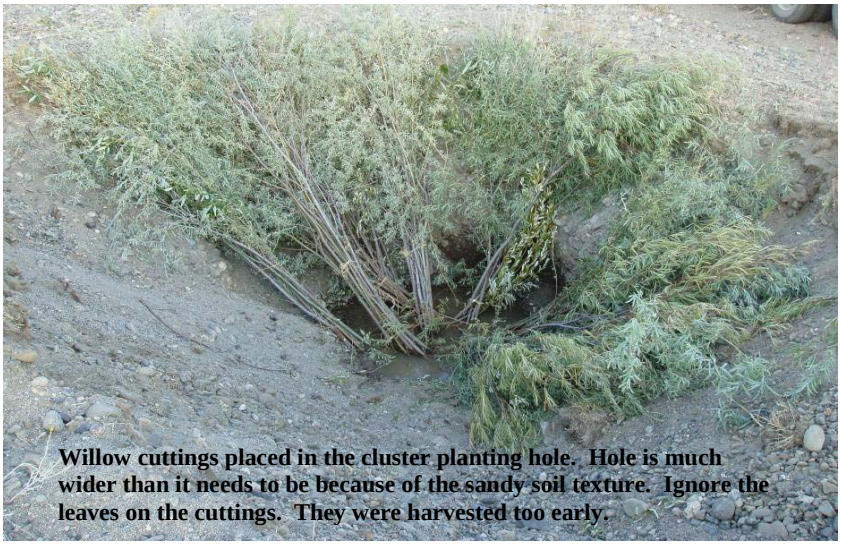
For fine textured soils, the Waterjet is the best tool we have found for planting unrooted hardwood cuttings. It is fast and efficient. It hydrodrills a hole with water which liquefies the

soil placing it in solution. When the cutting is placed in the hole filled with the water and soil solution, the water eventually goes into the soil profile and the soil that is in solution settles out and deposits in the bottom of the hole around the cutting. This eliminates air pockets around the stem and results in perfect soil to stem contact. The waterjet is very successful in clay, silt, and loam soils, but is very difficult to use in sandy, gravely and cobbly soils.

In coarse textured soils, other planting methods are more successful for planting unrooted hardwood cuttings. Most of these methods are mechanical and require heavy equipment. The most common method is to use a backhoe or excavator. The backhoe or excavator should have a 12, 18, or 24 inch bucket.



The procedure for digging a cluster planting hole with a backhoe is to dig a straight up and down hole. Minimizing the size of the hole ensures there is as small a human footprint as possible and results in less area of disturbed soil and water to deal with. If the hole is dug in this manner, it will look like a horseshoe with the open side where the bucket has pulled up and out of the hole. The final size of the hole will depend on the soil texture. If the soil is sandy and the hole is deep, it will be very wide at the top as the sides tend to slough into the bottom of the hole.



Willow cuttings placed in the cluster planting hole. Hole is much wider than it needs to be because of the sandy soil texture. Ignore the leaves on the cuttings. They were harvested too early.

Dig the hole to the lowest water table of the year. This may or may not be where you hit water when you are digging and depends on the time of year and the natural soil hydrology. This is critical. The bottom of the cuttings needs to be in the water the year round. Hopefully, you have done your homework and know how far down the water table is at its lowest point of the year. Once the backhoe hits the lowest water table, continue to dig at least another foot deeper. When you stop digging, there should be about 1 foot of water in the bottom of the hole (assuming that is the lowest water-table of the year).

Once the hole is complete and into the water table, place 3-5 unrooted cuttings that are long enough to reach about 1 foot into the water table and that will stick about 1-3 feet above the ground, in the hole. The height of the cutting above the ground will depend on the height of the competing vegetation that surrounds the hole and the depth of the water during runoff. The above ground portion of the cuttings need to be above the shade generated by competing vegetation and tall enough to be sticking out of the water during high water runoff events. Don't cut off any excess material until after planting the cutting to ensure the cutting is not too short.

Willow cuttings placed in the hole before they are cut off.
Note: cuttings were harvested too early so ignore the leaves.

When harvesting the cuttings, always pick the best looking, most vigorous cuttings you can find. They should not be damaged by disease or insects. The cutting source should not be stressed, i.e. under drought conditions with low or from excessively high water conditions. Stress will negatively affect establishment success (see Idaho Technical Note No. 23, *How to plant willows and cottonwoods for riparian restoration*).

Always soak the cuttings for 7 to 14 days before planting. Soaking hydrates the cuttings and research has determined that it promotes establishment by reducing the level of water stress as the cutting begins to grow new roots and leaves. Soaking increases shoot and root growth which results in improved drought tolerance and lower mortality (Edwards and Kissock 1975, Tilley and Hoag 2007). If cuttings have been cut for longer than a month, cut off a small section of the bottom of the cutting to create a fresh cut before soaking. This will increase the amount of water uptake by the cutting.

After the cuttings have been soaked, line the outside of the horseshoe shape with cuttings placed about 1-2 inches apart. Make sure they are firmly pushed into the wet soil at the bottom of the hole so they won't fall over. In a bigger hole, it might be necessary to kick some soil into the bottom of the hole to hold the cuttings upright. Cuttings should be al least ½ inch in diameter and up to 2 or 3 inches in diameter. Younger cuttings are the best. Do not use rough bark cuttings. Use only smooth bark cuttings because they are typically younger, more vigorous, and have more rooting hormones.

Once the cuttings are in the hole, have the backhoe push some of the top soil back in around the cuttings. Pushing the top soil into the hole should be alternated with dumping buckets full of water in the hole. This will help the soil settle around the cutting and helps eliminate air pockets which result in good soil to stem contact which increases root growth.

Willow placed in cluster planting hole. Backhoe pushes top soil into the hole. Water in the hole is from the backhoe pouring it in. Leaves on the willows should have been harvested after the leaves had fallen off.

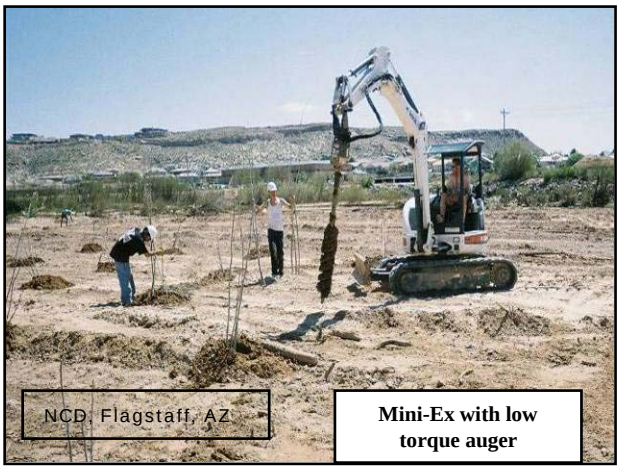
Once the hole is filled, cut off the tops of the cuttings at the appropriate height. Cutting off the apical bud will reroute the energy in the cutting to the lateral buds which include the root buds.

This stimulates much faster root growth. Consider clipping the cuttings straight across to open all cuttings to more sunlight and potential photosynthetic activity.

Other implements

There are other implements that can be used for cluster plantings. A mini-Excavator (mini-Ex), a Bobcat, tractor-mounted auger, tractor-mounted post hole digger, or skid steer can be used with a low torque auger. A low torque auger is necessary so that if the auger hits a large rock, the auger won't kick out of the hole.

These implements work very well in soils with a sandy texture. In addition, if the sand is wet, there is less chance the hole will collapse and fill in before the cuttings have been placed.

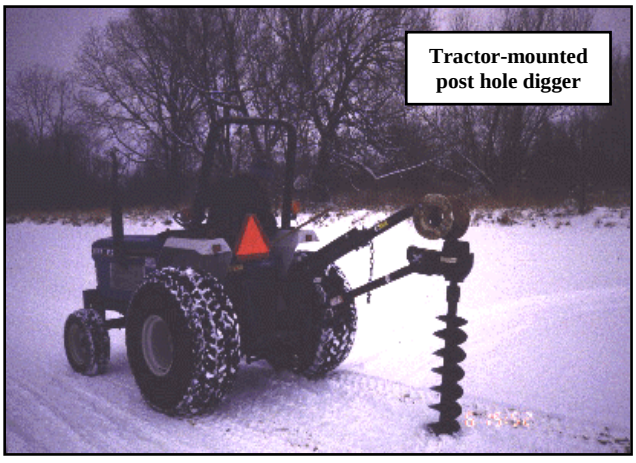


Mini-Ex with low torque auger

Bobcat with low torque auger

Tracked skid steer with low torque auger

Farm Tractor with low torque auger



Tractor-mounted post hole digger

Mini-Ex with small bucket

These implements increase the planting efficiency through increased speed and depth. However, additional people (planters) will probably be necessary to keep up with the faster drilling speed. Planters need to keep up with the implement drilling the holes so they can insert the cuttings as quickly as possible after the hole has been dug to prevent the hole from collapsing before the cuttings have been inserted into the hole.

Summary

Cluster plantings are the most effective planting method when the soils along the streambank are sands, large gravels or cobbles. This method allows multiple cuttings to be placed in the same hole thereby increasing the chance that at least one cutting will root and grow. Other methods are not very effective in planting unrooted cuttings in coarse soils.

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