

LIVE CUTTINGS

Live woody cuttings, often willow, are tamped into the soil to root, grow, and create a dense root mat that stabilizes the bank.

Applications

- Re-vegetate stream banks, slopes, floodplain
- Repair small earth slips and slumps that are frequently wet
- Effective where site conditions are uncomplicated
- Construction time is limited
- Inexpensive method if material is available

Design and Construction Techniques

- Can be used to stake down geotextile erosion control fabric or stabilize areas between other soil bioengineering techniques
- Where appropriate, should be used with other soil bioengineering and vegetative plantings
- Enhances conditions for establishment of vegetation from the surrounding plant community
- Stakes are 2 to 4 feet long, 0.5 to 1.5 inch in diameter, and are inserted with basal end to water table or saturated soil (~75% of stems covered in soil)
- Using rebar or dibble speeds installation with a starter hole
- Most successful if planted while dormant - in fall after leaves fall off to spring prior to leaves budding
- Most native willow species are suitable; using more than one species of locally sourced willows is most successful
- Beaver, rodents, and livestock can reduce survival of new plantings
- Locations within the floodplain, or where erosive forces are low, can be sprigged with cuttings alone



Live willow cuttings seem to survive best when cut and planted in the early spring prior to bud break.



Willow cuttings work well planted through geotextile fabric if the basal end of the cutting can reach the water table. Irrigation is also useful to help establish new cuttings.

CAUTION

- Requires toe protection where excessive toe scour is anticipated
- Most successful if used in conjunction with geotextile (organic fabric) or rock treatments within the high water mark
- Must be in contact with the groundwater for substantial portions of the year to establish cuttings
- May require protection from animals during establishment

DORMANT POLE PLANTINGS

Plantings of cottonwood, willow, dogwood, or other species are driven into streambanks to increase channel roughness, reduce flow velocities near the slope face, increase shade, and trap sediment.

Applications

- Most types of streambeds where poles can be inserted to reach water table
- Stabilize rotational failures on streambanks where minor bank sloughing is occurring
- Establishing riparian trees in arid regions where water tables are deep
- Will reduce near-bank stream velocities and cause sediment deposition in treated areas
- Joint plantings in pre-existing rip-rap
- Generally self-maintaining and will re-stem if damaged by beaver or livestock, but limiting livestock access will speed recovery
- Best suited to non-gravelly streams and where ice damage potential is low
- Poles are less likely to be removed by erosion than are live stakes or smaller cuttings
- Can be used with geotextiles and vegetative plantings to stabilize the upper bank



Dormant willow poles have the best survival when they do not compete with mature sod.



An excavator with a dibble is used to place plantings.

Design and Construction Techniques

- Pole plantings are often used in conjunction with rock or geotextile treatments.
- Robust species such as yellow willow or cottonwood are preferred.
- Plantings will generally require a dibble for effective installation of poles below water table.
- Use 1 inch to 5 inch diameter, dormant material collected in early spring.

CAUTION

- Unlike smaller cuttings, pole harvesting can be very destructive to the donor stand.
- Poles should be gathered as “salvage” from sites designated for clearing, or thinned from dense stands.
- Equipment access should be carefully planned to avoid damaging banks.

REVEGETATION CONSIDERATIONS

Revegetation efforts are a key component for most restoration and stabilization projects. Establishing woody shrubs and trees will promote long-term bank stability on softer bioengineering projects and can provide some ecosystem benefit to harder approaches such as rip-rap. Willow is often used because it can root and establish quickly providing bank stability even in areas where different plant composition is expected over time.

Willow Cuttings

Know Your Willows

Willows have the highest survival rate when harvested locally. Nearby plants are already adapted to local climate and soil conditions. Species such as: sandbar or coyote willow (*Salix exigua*), booth willow (*Salix boothii*), yellow willow (*Salix eriocephala*, *S. lutea*), and geyer willow (*Salix geyeriana*) have the highest survival rates. Drummond and Booth willow can be used successfully. Bebb's can be more difficult to establish.

Harvest Dormant Plants

Dormant willows divert energy from leaf production to root production. Establishment of plants requires growing roots, not leaves. For this reason, they are more likely to successfully root from a cutting without leaves. The dormant season extends from leaf drop in the late fall/early winter to bud break in the early spring.

Size Matters

The optimal size of cuttings depends on the application. No matter where you plant cuttings, you want your willows to have their "toes" in the water and their "heads" in the clouds. In general, willow stakes should be about four to five feet tall and willow layers should be at least six feet long. Ideally, cuttings are thumb-sized or bigger (somewhere between $\frac{3}{4}$ and $1\frac{1}{2}$ inches in diameter). Small whips are unlikely to root, except under ideal conditions.

Choose Wisely

Most projects easily incorporate thousands of live willow cuttings. Healthy plants that are two to seven years old (look for smooth, not rough, bark) are ideal. Cuttings should be straight with the side branches and top several inches removed. Trimming back the ends of the cuttings reduces excessive leaf growth and encourages initial root production. To establish cuttings in the first years, the plant's stored energy needs to be invested in developing roots, not leaves.



Locally harvested plant material is preferred, as it is best adapted for local conditions.



Clean plant material greater than 0.5 inches in diameter is preferred.



Willow stakes can be planted through fabric or into soils or sod.

*REVEGETATION CONSIDERATIONS (continued)**Moisture is Key to Establishment*

Ideally at least 6 inches of the willow stem cutting is in the mid-summer water table and approximately two-thirds of the cutting is planted into the ground with approximately one-third of the stem remaining above ground.

If long periods of inundation exceeding 30 days are likely, cuttings should be long enough to extend 6 to 12 inches above the expected high water level. Temporary irrigation can help establish new cuttings.

Sunlight Counts

Willows do best in sunny locations. Establishing willows in heavily shaded areas has reduced success. If weeds or aggressive plant species are present, the willow stem cutting should be long enough to extend both above the herbaceous summer growth (to receive adequate sunlight) and below the weed root mass (to minimize competition for space and nutrients). If tall grasses such as smooth brome or timothy are present, willow cuttings should extend above the leaves of the tall grass species.

Don't Forget to Bundle and Soak

Once cuttings are harvested and pruned, bundle them into groups of 10 to 20 with twine. Ideally, cuttings should be soaked in water at least 48 hours and up to 2 weeks prior to installation. Soaking willows keeps the cuttings from drying out after being planted and encourages early root growth. Cuttings that are stored for extended periods or left in the sun have low success. Rooting hormones such as Indolebutyric acid (IBA) and naphthaleneacetic acid (NAA) and others can be used in powdered or solutions to enhance rooting in difficult sites.

Browse Protection, Cuttings, Plugs and Bareroots

An alternative to rigid fencing or browse protectors is the use of repellents such as Plantskydd or Ropel (trade names for two products) that are used to discourage browse from elk, moose, deer and beaver. Plantskydd lasts up to 6 months (including over the winter). Repellents applied twice a year for a couple of years following willow installation may prove to be a better alternative to fencing.



Base of willow cuttings should touch groundwater where possible.



Soaking willows prior to planting is important to establishment. After two weeks of soaking fragile roots will emerge and may be damaged during planting.



Cuttings should be trimmed so approximately one-third of the stem is exposed.

Dormant cuttings can be stored in a cooler or snow stash 1-1.5 months before use.

MANAGING BEAVERS

Beavers helped shape the existing landscape and play key roles in maintaining proper channel form and function. However, beavers also have the potential for damaging property by removing trees and causing localized flooding. Landowners find that the consequences of removing beavers and their dams are often worse than learning to manage the beavers and their activities.

Beaver dams are sometimes removed to:

- Reduce flooding
- Eliminate obstructions at culverts, headgates, or bridges
- Prevent new channels from forming around dam.
- Drain wetland areas
- Eliminate beaver damage to mature streambank trees
- Provide access for migratory fish spawning areas

Culvert protection

Beaver will attempt to plug a culvert because the sound and speed of water rushing through resembles that of a hole in their dam. There are different devices such as a “Beaver Deceiver” that block off the culvert entrance and divert the sound and feel of water moving into the culvert.



Beaver deceiver™ installed at upstream end of culvert to prevent beaver from damming.

Beaver dam removal more often results in:

- Channel downcutting
- Excess bank erosion
- Lowering water table
- Sediment release to downstream reaches
- Streambank instability
- Damage to riparian vegetation and fisheries
- Beavers eventually rebuilding dams

Tree protection

There are several methods for protecting trees from beavers. Fencing large clumps of trees or individual trees is common. A paint mixed with sand can also prove effective by applying to the bottom 3-4 feet of the trunk.



Sand mixed with paint to match the bark of the tree can be a discrete way to prevent beaver damage. Photo courtesy of Sierra Wildlife Coalition.