Materials Plant Program

TECHNICAL NOTES

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SOIL BIOENGINEERING DEMONSTRATION PROJECT, COYOTE CREEK, LANE COUNTY, OREGON: FIRST AND SECOND YEAR RESULTS

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Introduction

Soil bioengineering is the use of woody vegetation and/or traditional engineering structures in stabilizing eroding streambanks or upland areas. It is often more economical and aesthetically pleasing than the use of traditional engineering structures alone, and it is considered a useful alternative for small, highly sensitive or relatively inaccessible sites. The following describes the first installation of Corvallis PMC-released woody cultivars in a small, simple bioengineered design to stabilize streambanks of a portion of Coyote Creek, near Lorane, Oregon.

Site Description

Coyote Creek meanders through a wooded, rolling area of Lane County, Oregon. A portion of the creek passing through private property exhibits some streambank erosion and reduced water quality, due to excessive sediment load. The streambanks under consideration are mostly vegetated with grass, sedge, and various forb species. Soil type is McAlpin silty clay loam, and streambank slopes vary from flat to 30^{o}; some moderate slippages and a vertical cut bank is present. In response to the land manager's request for technical assistance in streambank erosion control, the site was visited May 6, 1993 by Scott Lambert, Plant Materials Specialist for Oregon and Washington; Jim Hecker, Area Plant Materials Representative, Corvallis; Theresa Flessner, Conservation Agronomist, Corvallis Plant Materials Center, and Bruce Williams, former District Conservationist, Lane County, Oregon. A decision was made to 1) install live fascines or wattles on a moderately sloping, bare portion of the streambank, and 2) install live stakes in flat areas or small slippages to encourage plant diversity and further slope stabilization.

Installation

In early February, 1994, two live fascines or wattles were constructed; construction involved cutting six-foot whips of willow (*Salix* spp.), redosier dogwood (*Cornus stolonifera*), and Douglas spirea (*Spirea douglasii*); whips were dormant and did not generally exceed 0.5" in

diameter. Woody cultivars used included 'Clatsop' hooker willow (*Salix hookeriana*), 'Placer' erect willow (*Salix eriocephala* ssp. *ligulifolia*), 'Plumas' sitka willow (*Salix sitchensis*), 'Rogue' arroyo willow (*Salix lasiolepis*), 'Nehalem' Pacific willow (*Salix lasiandra*), 'Multnomah' Columbia River willow (*Salix fluviatilis*), 'Mason' redosier dogwood, and 'Bashaw' Douglas spirea. Twelve whips per cultivar or a total of 96 whips were bundled and tied with twine; bundle diameter was approximately 8". A total of 132 live willow, redosier dogwood, and Douglas spirea stakes, 2'-3' in length, were also prepared. Wattles and stakes were stored in a walk-in cooler for 24-48 hours prior to installation. Cutting, bundling, labeling, and storing plant materials required 20 labor hours, and the cutting crew consisted of three people.

On February 9, 1994, the live fascine bundles, or wattles, and all stakes were installed by a crew of seven people in two hours. The wattles were placed in a shallow trench about midway up the streambank in the designated, moderately sloping, bare area, that is frequently flooded during winter months. Live willow stakes were inserted through the center of the bundles, approximately every 30", and below the bundles, approximately every 24". Wattles were covered with moist soil until just 10% of the bundle surface was visible.

A short piece of rebar iron was used to prepare a hole for installation of stakes in a steep, but vegetated portion of the bank, a flat area along the creek, and selected moderate to vertical slopes. Stakes were installed by hand or with a mallet as deeply as possible (12"-18"); Ideally, one to two buds of the stake should be located above the soil surface and 2/3 to 3/4 of the length of the stake should be below the soil surface. However, soil type, hardpan layers, and soil compaction hindered stake installation, and proper installation of stakes was difficult at this site.

First and Second Year Results

Survival and growth of wattles and stakes was recorded in June and October, 1994, and July and October, 1995:

June (1994) - 100% of the redosier dogwood and Douglas spirea stakes placed in the steep, vegetated bank had sprouted (Table 1.) In the flat portion along the creek, 100% of the redosier dogwood, 75% of the Douglas spirea, and 94% of the willow stakes had sprouted (Table 1.) The wattles also exhibited excellent sprouting; growth consisted mostly of willow and a few spirea shoots and ranged in height from 2"-30". No additional slumping or soil erosion was noted in the area the wattles were installed. All willow stakes placed through or underneath bundles and stakes inserted in moderate to vertical slopes had sprouted.

October (1994) - 38% and 75% of the redosier dogwood and Douglas spirea stakes placed in the steep, vegetated bank had survived, respectively (Table 1.) Redosier dogwood appeared to have suffered moderate drought stress; shoot growth averaged 7". Douglas spirea shoot growth averaged 16". In the flat area, 100% of the redosier dogwood, 75% of the Douglas spirea, and 83% of the willow stakes had survived (Table 1.) Redosier dogwood and Douglas spirea stakes exhibited vigorous shoot growth averaging 13" and 24", respectively. The 'Rogue' and 'Multnomah' willow cultivars exhibited 63% and 38% survival, respectively; all other willow cultivars survived to 100%. Willow shoot growth was moderate to vigorous and ranged from 7" to 33". The live fascines exhibited moderate to severe rodent or mammal damage. Surviving shoots consisted of willows and averaged 12" in length. Willow stakes inserted in moderate to vertical slopes exhibited 55% survival.

July (1995) - 0% and 63% of the redosier dogwood and Douglas spirea stakes placed in the steep bank had survived, respectively (Table 1.) Both species suffered heat/drought stress. In the flat area, 100% of the redosier dogwood, 75% of the Douglas spirea, and 63% of the willow stakes had survived (Table 1.) Survival of specific willow cultivars is also noted in Table 1. Willow shoot growth of surviving species was moderate and ranged from 21" to 58". The wattles

exhibited fair sprouting of three willow species ('Placer', 'Plumas', and 'Nehalem'); only five of the wattle stakes exhibited sprouting. Shoots ranged in height from 11" to 40" and exhibited fair to good vigor. No new slumping or soil erosion was noted in this area. Willow stakes inserted in moderate to vertical slopes exhibited 27% survival.

October (1995) - None of the redosier dogwood and 38% of the Douglas spirea stakes placed in the steep bank survived (Table 1.) In the flat area, only willow stake survival declined (to 52%) (Table 1). Willow shoot growth of surviving species was moderate and ranged from 21" to 58". The live fascine exhibited fair sprouting of three willow species ('Placer', 'Plumas', and 'Nehalem'); shoot growth ranged from 11" to 40".

Table 1. Survival (%) of stakes of eight woody species used in different locations or microsites as a part of Coyote Creek soil bioengineering project.

Species	Location	Survival (%)			
		06/94	10/94	07/95	10/95
Douglas spirea	Steep bank	100	75	63	38
	Flat area	75	75	75	75
Redosier dogwood	Steep bank	100	38	0	0
	Flat area	100	100	100	100
Willow	Flat area	94	83	63	52
'Plumas'	" "			100	
'Placer'	" "			88	
'Nehalem'	" "			88	
'Clatsop'	" "			63	
'Rogue'	" "			25	
'Multnomah'	" "			0	

Summary

Species, microsite, and rodent or mammal damage affected survival and vigor of wattles and stakes. The wattles have remained in place and curtailed soil erosion, and although the stakes have not reduced erosion in the short run, the addition of these woody species has increased diversity. However, the potential for live stakes to reduce soil erosion increases with time. Willow stake survival percentages in the flat area are consistent with that observed in field plantings in the Pacific Northwest under similar conditions. Redosier dogwood preferred moist or saturated (not flooded) soil conditions during establishment (as illustrated in this project) and should be utilized in areas with access to the water table or irrigation during dry summer months. Douglas spirea tolerated the dry soil conditions of the steep bank, but performed best in moist or saturated soil conditions of the flat area. The overall effectiveness of these techniques in terms of stabilizing eroding streambanks will continue to be evaluated periodically over the next three to five years. Rodent and mammal activity will also be monitored and use of protective measures, such as fencing and repellants, must be considered in addition to other site characteristics when designing appropriate streambank stabilization measures.