TECHNICAL NOTE

Revegetating Riparian Areas in the Southwest "Lessons Learned"

LLPMC Technical Note No. 70
January 2009

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The efforts to control invasive tree species and revegetate riparian areas along New Mexico's rivers and streams have led to important "lessons learned" based on both successful and failed projects. The information in this technical note is intended to concisely address the concerns that you should consider when planning and developing riparian revegetation projects.

These considerations can be lumped into several broad categories:

- Treatment and planning – Controlling invasive species, removal of dead biomass, land use/landscape objectives, advanced planning for plant materials.
- Hydrologic considerations – Wet meadow sites, depth to ground water, soil characteristics, scouring potential, and inundation potential.
- Site factors – Annual weed infestations, connecting new plantings to the capillary fringe, and planting concerns.
- Maintenance and monitoring of the planting **–** Irrigation, herbivores, and pest control.

Naturally diverse riparian plant community in the Middle Rio Grande Valley including giant sacaton, baccharis, New Mexico olive, and cottonwood.

Controlling Invasive Woody Species on Floodplain Sites

The proliferation of invasive woody species on low-elevation floodplain sites has required intensive and long-term control efforts to allow the revegetation of native riparian plant communities. The methodology for initial control of invasive woody species has been well established. A long-term commitment for spot spraying of resprouts must be part of any control program. Monitoring of the site will reveal resprouting invasive woody plants (including saltcedar, Russian olive, Siberian elm, and tree of heaven) and should prompt the application of herbicide before the sprouts become too large. The same is true for recurring noxious perennial weeds.

Removing Dead Biomass from Treated Stands

The dead biomass can be burned in slash piles for interspersed invasive woody plants or by crown fires in monoculture stands. The removal of large diameter biomass as firewood is another alternative. Mulching biomass is expensive, but the benefits of the wood chips may make it worthwhile. Mulch will reduce wind and water erosion, will reduce moisture loss to aid reseeding efforts, and may provide enhanced salt leaching by reducing evaporation and increasing infiltration. A mulch layer will also retard the growth of weeds that commonly occurs after clearing operations. An existing layer of mulch can interfere with seeding by preventing seed contact with mineral soil.

Desired Landscape Objectives after Controlling Invasive Woody Species

On river floodplain sites that no longer experience flooding, the self-perpetuation of cottonwoods and tree willows cannot be assumed due to the lack of natural recruitment. Riparian forest communities that have been established through intensive planting approaches will evolve towards xeric shrublands/grasslands if flooding is not re-established. These types of sites will require perpetual planting and management if the landscape goal is a park-like setting with groves or stands of riparian trees. Other landscape objectives to be considered include the fuel load that will be acceptable from the re-established plant community, and the need for firebreaks and emergency access within the restored area. Wildfire concerns may necessitate a landscape goal more comparable to a savannah than of a gallery forest.

Planning in Advance for Plant Materials and Stock Types

Many riparian restoration projects, whether in low elevation floodplains or montane riparian sites, will require unconventional native species and/or stock sizes. To achieve a suitably diverse native plant community, growers of native plant materials will need to be identified well in advance to produce the amount of plant materials required for a large restoration project. Those planning revegetation projects need to consider the costs versus the benefits of different stock sizes. The calculation of advantages of large versus small stock will be influenced by the availability and cost of labor and equipment used for planting and long-term irrigation/maintenance.

Woody Riparian Plant Communities versus Wet Meadow Communities

Due consideration is required to evaluate whether a site is truly a wet meadow environment and not appropriate for woody vegetation. Shallow depth to ground water, fine-textured organic-rich or anaerobic soils, and low stream gradients are some of the factors consistent with wet meadow environments. On low elevation floodplains, saltgrass or alkali muhly meadows are inappropriate for revegetation with woody species because of shallow groundwater as well as generally high levels of soil salinity.

Depth to Ground Water and Water Table Fluctuation

For revegetation projects, seasonal measurement of depth to ground water is highly recommended to determine appropriate species, planting depth, and the most effective stock type regarding stem length, container depth, or pole length. Inexpensive shallow monitoring wells will confirm the depth and seasonal fluctuation of the water table. Extreme depths to groundwater (for example, greater than eight feet) may indicate the only practical restoration goal is revegetation with xeric shrubs and grasses rather than riparian species.

Revegetation Limitations Due to Soil Chemistry and/or Soil Texture Extremes

Salinity or sodicity of floodplain soils can profoundly influence species suitable for revegetation. Restrictive soil layers can be important factors that constrain the selection of species and stock type for revegetation. Soils with high percentages of cobble can be impossible to auger; whereas augered holes in dry sands and gravels will often collapse before planting.

Loss of Planting Stock from the Scouring Action of High Flood Flows

High flow flood events can easily erode shallowly planted containerized and cutting stock. In arroyo systems, this can often be a more limiting factor to revegetation than the ephemeral nature of surface flow in these drainages. Extreme channel instability coupled with either severe sediment aggradation or degradation should preclude revegetation attempts until some semblance of channel stability can be achieved through natural geomorphological processes or human intervention. Dormant pole and whip cuttings planted to substantial depths can resist the extractive forces of flood flows. Willow whips with their inherent flexibility are more appropriate for higher flow regimes and less stable channel systems. Many riparian species grown with long stems can be deep planted for anchorage and contact with the capillary fringe; many riparian species are adapted to this planting method which is comparable to natural burial by sediment deposits.

Inundation of Low Floodplain Areas

High flows, particularly in the spring, can inundate low floodplain areas and if flows persist and surface and subsurface drainage is impaired these sites can remain underwater for many weeks. Anaerobic soils resulting from saturated conditions will be lethal to newly planted poles and transplants. More established plants may survive this inundation if not too lengthy. Riparian plant species are adapted to short-term inundation, a common occurrence in proper functioning riparian systems.

The Effect of Weed Competition on Revegetation

Annual weeds should be prevented from going to seed at the end of the first growing season after treatment of invasive woody plants. If annual weeds have invaded the site and have been allowed to disperse new seed, it is vital to the revegetation project to reduce weed seed in the soil seed bank before reseeding native grasses. Large dense weed stands that shade seedlings and deplete soil moisture can overwhelm the seeding of native grasses and forbs as well as the survival and growth of small containerized stock. For severe weed infestations on disturbed sites, several years of herbicidal control may be appropriate before reseeding to maximize the revegetation success.

Connecting Transplants to the Capillary Fringe

Obligate riparian plants are phreatophytes which subsist on soil moisture in the capillary fringe resulting from the capillary rise of water above the water table. Establishing phreatophytes requires immediate connection to the capillary fringe or frequent watering until the roots reach the capillary fringe. The application of water can be a prolonged endeavor depending on the depth of the capillary fringe, the depth of planting, soil texture, and soil compaction. Immediate connection can be attained using dormant pole cuttings, dormant whip cuttings, and by deep-planting longstem transplants.

Planting Methods

Planting containerized woody plants in the fall offers the benefits of lower evapotranspiration and of continuing root growth while soil temperatures remain moderate. Dormant pole and whip cuttings need to be planted before budbreak; therefore, a late winter to early spring planting window is required. Reseeding low elevation floodplain sites should be timed to take advantage of anticipated summer rains. The stock type will greatly influence the planting equipment required. Sites with deep water tables may require long augers to access ground water for pole plantings. Willow whip cuttings can be effectively planted in most stream bank soils with three-foot long, one-inch diameter rotary hammer drill bits. Large equipment requires site access which can be restricted by ditches, arroyos, levees, soft sand, or steep slopes. One unanticipated problem with equipment access, which has been identified with the recent upsurge in saltcedar clearing, is the ubiquitous presence of cut stumps which can easily flatten the equipment's tires if they are not foam-filled.

Watering Planted Containerized Stock

With the exception of poles and whips which are planted into the water table, containerized plants should be watered at the time of installation. Establishment of containerized stock could require from one-to-many water applications depending on initial contact with the capillary fringe as determined by stock size, soil moisture conditions, and watering method. Conventional water basins can be used, but high evaporation losses, difficulty in getting the moisture deep into the soil profile, and promotion of weed growth are problems with this irrigation method. The use of embedded watering tubes can aid in getting the water around and below the root ball and in recharging deep-soil moisture. Watering tubes are usually perforated at root ball depth to allow rapid and thorough distribution of water and are fabricated from PVC pipe. Larger diameter pipes (3" – 4") are helpful if starch-based hydrogels are going to be applied. The hydrogel is costly and more difficult to apply than water because of its viscosity, but the slow release of moisture will probably reduce the number of water applications required for plant establishment. You also must consider the ease of vehicle access to the site for watering operations as well as planting and seeding.

Protecting and Maintaining Revegetated Sites

A number of other considerations will require post-planting attention: resprouting of invasive woody species, protection from grazing and browsing animals, and controlling defoliating insects. The continued spot spraying of invasive woody sprouts and any other invasive weeds will be required for an indefinite period. Protection from cattle will require adequate fencing and periodic monitoring of fence integrity. The presence of beaver necessitates poultry-wire tree guards around individual pole plants as well as protection of unplanted poles and whips placed in streams or ditches for hydration. Controlling defoliating insects is crucial for pole plantings during the initial growing seasons; cottonwood leaf beetle occasionally will require control. The destruction of plantings by vandals should also be considered when planning revegetation projects

Conclusion

Cost effective and successful riparian revegetation can be achieved through diligent efforts during the planning stage. Although there is not a precise recipe that will guarantee success in riparian revegetation, understanding site limitations and the potential methods of resolving them is the most important step in the planning process.