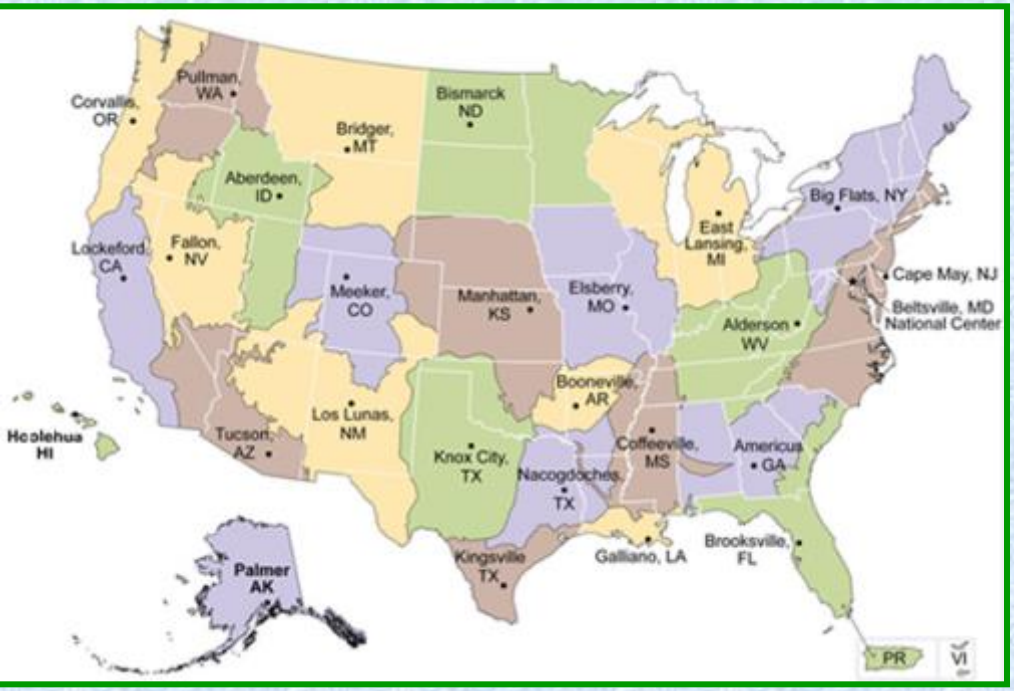
USDA Natural Resources Conservation Service Plant Materials Program



The Plant Materials Program

- Collects, selects, and uses plant breeding strategies to release grasses, legumes, wildflowers, trees and shrubs to commercial producers who sell our products to the public
- Develops technologies for establishing vegetation for the use of plants as a natural way to solve conservation issues with the ultimate goal of re-establishing ecosystem function

Deep-Planting Techniques to Establish Riparian Vegetation in the Arid and Semi-Arid Southwest

By: Greg Fenchel
Dave Dreesen
Danny Goodson
Keith White

NRCS Natural Resources Conservation Service

Plant Materials Program

Los Lunas, New Mexico

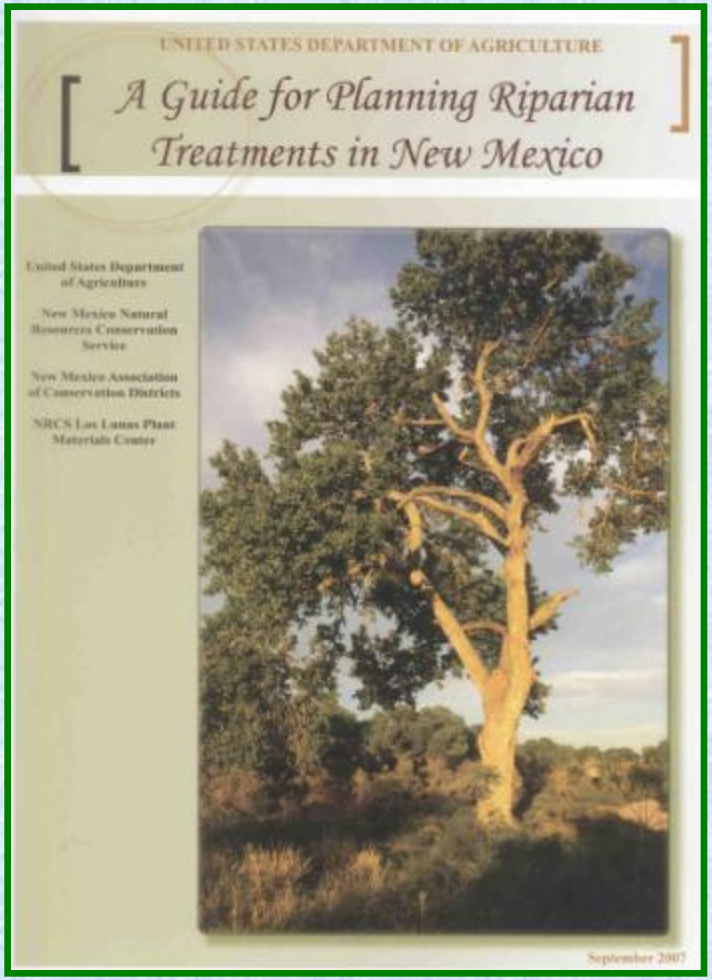
Plant Materials Center


Six Years Later

Presentation Includes

1. What, when, and where to plant (and why)
2. Effective planting methods
3. Suggested planting equipment
4. Survival results
5. Suggested publications

www.nm.nrcs.usda.gov/technical/technotes/bio/riparian.pdf



1. Step-by-step guide to obtaining resource data on the riparian site
2. An assessment tool to determine the condition of a site
3. Treatment considerations and references 40 websites where you can download free, “state- of- the-art,” NM NRCS endorsed methodologies to improve condition

Guide–Step 1: Obtaining Site Resource Data

(Pages 1-4)

- **Locate the site** - Use of aerial photography and USGS quad sheets
- **Identify ownership** - Federal, state, local, tribal, private
- **Locate utility corridors** - Get a line check from the providers for potential buried electric, oil, gas, phone lines etc.
- **Locate flood control structures** – Dikes or dams that effect natural flow
- **Site modifications** – Waste disposal, concrete, car bodies, etc
- **Public access** – Some areas may need to be excluded to protect plants
- **Rules and regulations** – Compliance with environmental laws (i.e. NEPA & ESA, 404 permit, etc.)
- **Natural site parameters** – Consider soil texture, salinity, flooding, and groundwater depth

Guide–Step 2:

Analyze Condition using a Visual Riparian Assessment Tool

a. Hydrologic Factors:

- **Hydrologic alterations** – Regular flooding?
- **Channel condition** – Natural, no down-cutting?
- **Bank stability** – Erosion, bank failure?
- **Riparian zone width** – Extends at least one active channel with?
- **Active or stable beaver dams** – Beavers present?

Visual Riparian Assessment Continued

b. Soils- Erosion and Deposition Factors:

- **Soil characteristics/rooting medium** – Considers the portion of site with sufficient soil to hold water and act as rooting medium?
- **Topographic variance or surface expression on floodplain** – Considers the degree of topographic variation with vegetation, including the overstory, shrub layer, and herbaceous; and the amount of large rocks or woody debris.
- **Streambank rock armoring** – Considers size of rock and amount
- **Point bar revegtation** – Are they well formed, desirable, mature vegetation on point bars?

Visual Riparian Assessment Continued

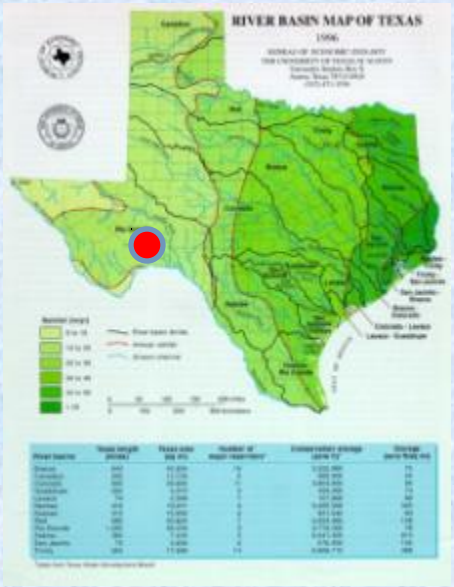
c. Vegetation Factors:

- Diverse age class distribution of trees?
- Shrub regeneration?
- Total ground cover of grasses and forbs?
- Percent of streambank with deep, binding root systems?
- Total area occupied by undesirable herbaceous and woody species?

Guide-Step 3
(Applying Treatments)

Bilogical control of saltcedar using the Tamerisk beetle (*Diorhabda elongata* or *Diorhabda sublineata*) near Big Springs, TX (2010)

Dr. Jack Deloach ARS
Temple, TX



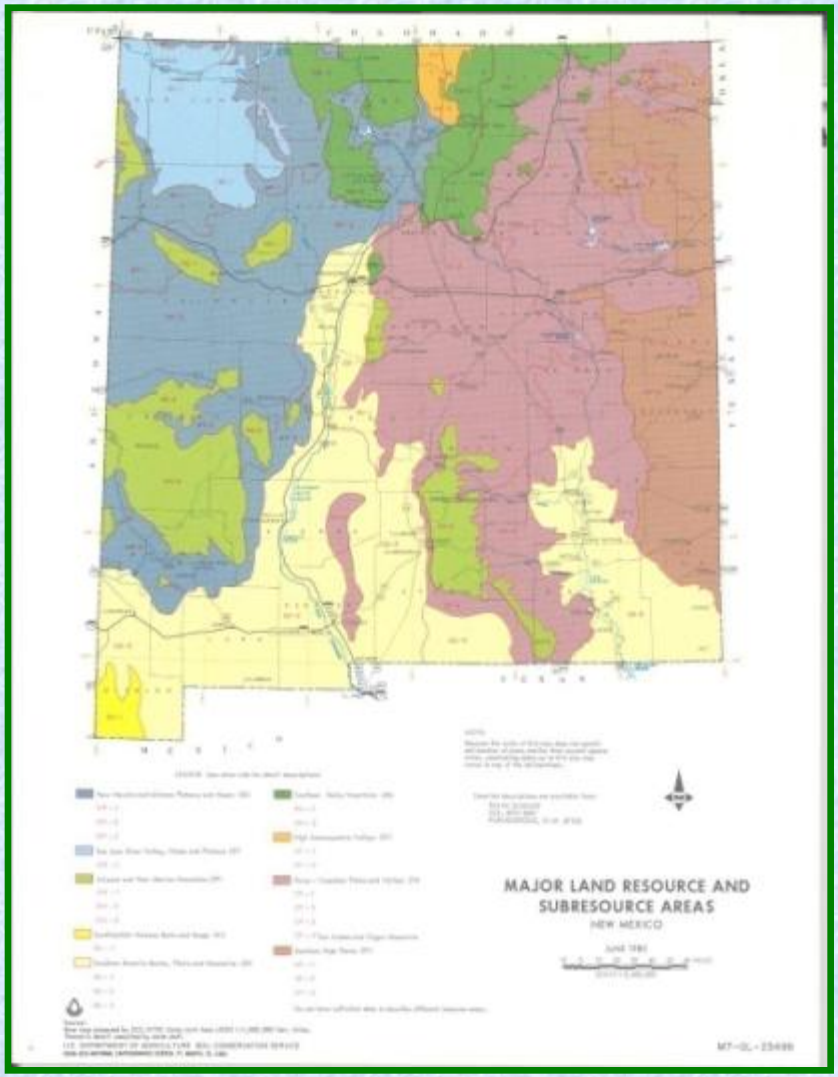
Guide–Step 3: Total Acres Treated in NM for Non-Native Phreatophyte Control (2002-2004)

	Total Acres
Canadian River	4,018
Pecos River	17,054
Lower Rio Grande	9,961
Upper Rio Grande	3,182
Grand Total	**34,115**

Source: New Mexico Department of Agriculture (September 2005)

Most Treated Areas Receive Less Than 15-Inches of Annual Precipitation

- Non-native phreatophyte control is occurring mainly in major land resource areas: 42 (Southern Desert Basins Plains and Mountains) and 70 (Pecos and Canadian Plains and Valleys).
- MLRA's are geographical areas, usually several thousand acres in extent, that are characterized by a particular pattern of soils, climate, water relations, and land uses



Source: NRCS (2005)

MLRA 42 – Southern Desert Basins, Plains, and Mountains

- Elevation range from 4,500 – 6,000 feet
- Precipitation Averages 8 – 10 inches (May and June are usually the drier months, wetter months include July and August)
- Average annual temperature is 55 degrees F (from 105 to -5)
- Frost free season averages 185 days
- Major soil resource concerns include salinity and wind erosion on light textured soils

Attributes of Planting Riparian Vegetation After Clearing

- Accelerate succession to protect river or stream bank from erosion
- Select desirable vegetation instead of allowing perennial or annual weeds to dominate the site
- Enhance wildlife habitat with selected plant species
- Create pristine recreational areas


Recently cleared area now dominated by Russian knapweed (*Acroptilon repens*) on the Rio Grande in San Acacia, New Mexico (2010)

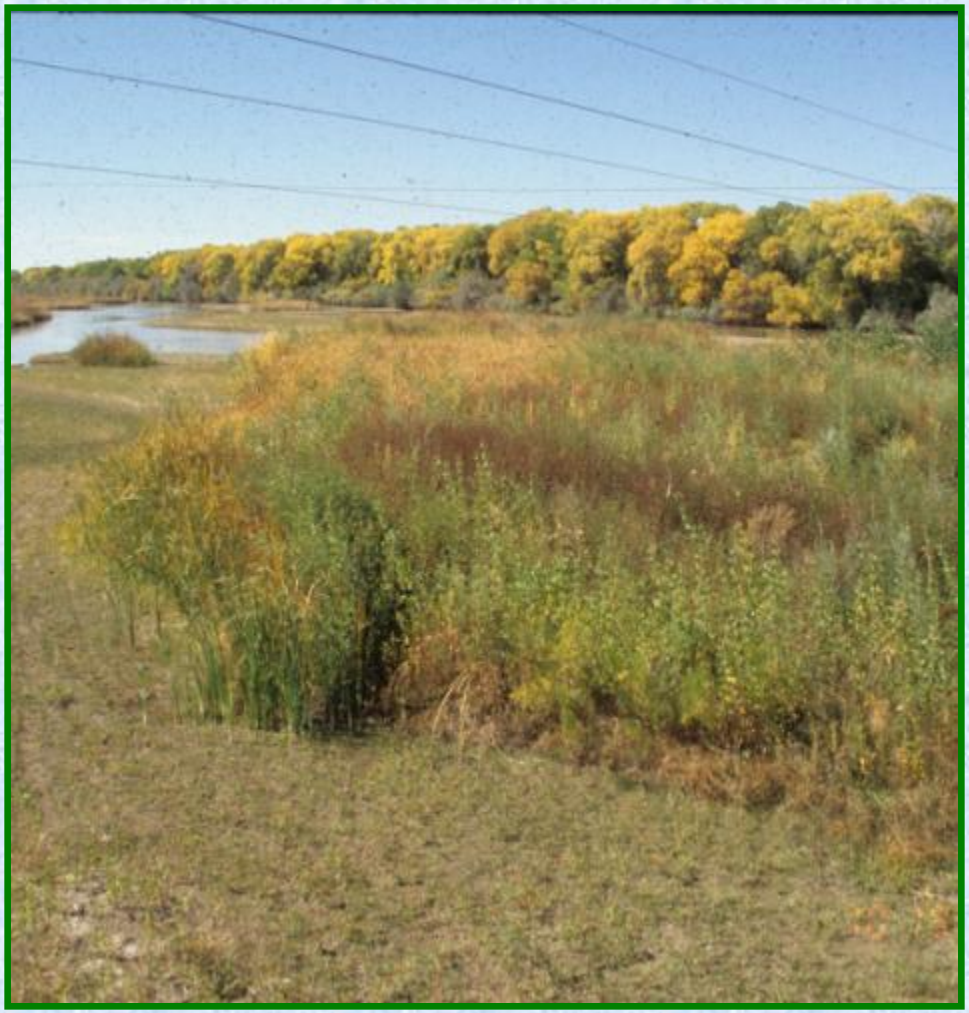
Rebecca Harms and Ron Hiebert (2006) found " that vegetation response to tamarisk removal is often negligible. Land managers should be prepared for persistent impoverished plant communities following tamarisk removal if additional restoration measures are not instigated." Their results are from an on-site review of 33 previously treated areas (from 1 – 11 years) in the Southwest.

Vegetation Response Following Invasive Tamarisk (*Tamarisk* spp.) Removal and Implication for Riparian Restoration.
September 2006. Restoration Ecology Vol. 14, No. 3, pp. 461-472

Over-Bank Flooding Provides Natural Establishment of Native Vegetation

Species includes:

- Cottonwood (*Populus deltoides var wislizeni*) seedlings
- Black willow (*Salix gooddingii*) seedlings
- Coyote willow (*Salix exigua*) seedlings



Sandbar on Rio Grande, Los Lunas, NM

Simulating Over-Bank Flooding Using Micro-Sprinklers to Establish a Riparian Plant Community

Drilling a shallow well on the west side of the Rio Grande in Albuquerque, New Mexico.

Same site–More than 12,000 cottonwood seedlings by the fall of the first year.

Same Location

Cottonwood seedlings germinated only in the wet areas.

Same planting by the 5th year. Irrigation was removed after the 2nd year.

Elevation of flood plain reduced to promote seasonal flooding to establish riparian plant species on the Rio Grande in Belen, NM

Elevation of flood plain reduced to promote seasonal flooding to establish riparian plant species on the Rio Grande in Bernalillo, NM

Water Seepage From Rivers Supports a Ribbon of Trees and Shrubs in the Desert

Methods have been developed for establishing trees and shrubs that require minimal or no irrigation by tapping into this shallow water table.

Middle Rio Grande Reach, New Mexico

Riparian Plant Materials Developed to Plant in Shallow Water Tables (Less Than Eight Feet)

- Cottonwood and willow pole cuttings
- Willow whip cuttings
- Tree and shrub transplants with long stems

Species and Ecotype Selection

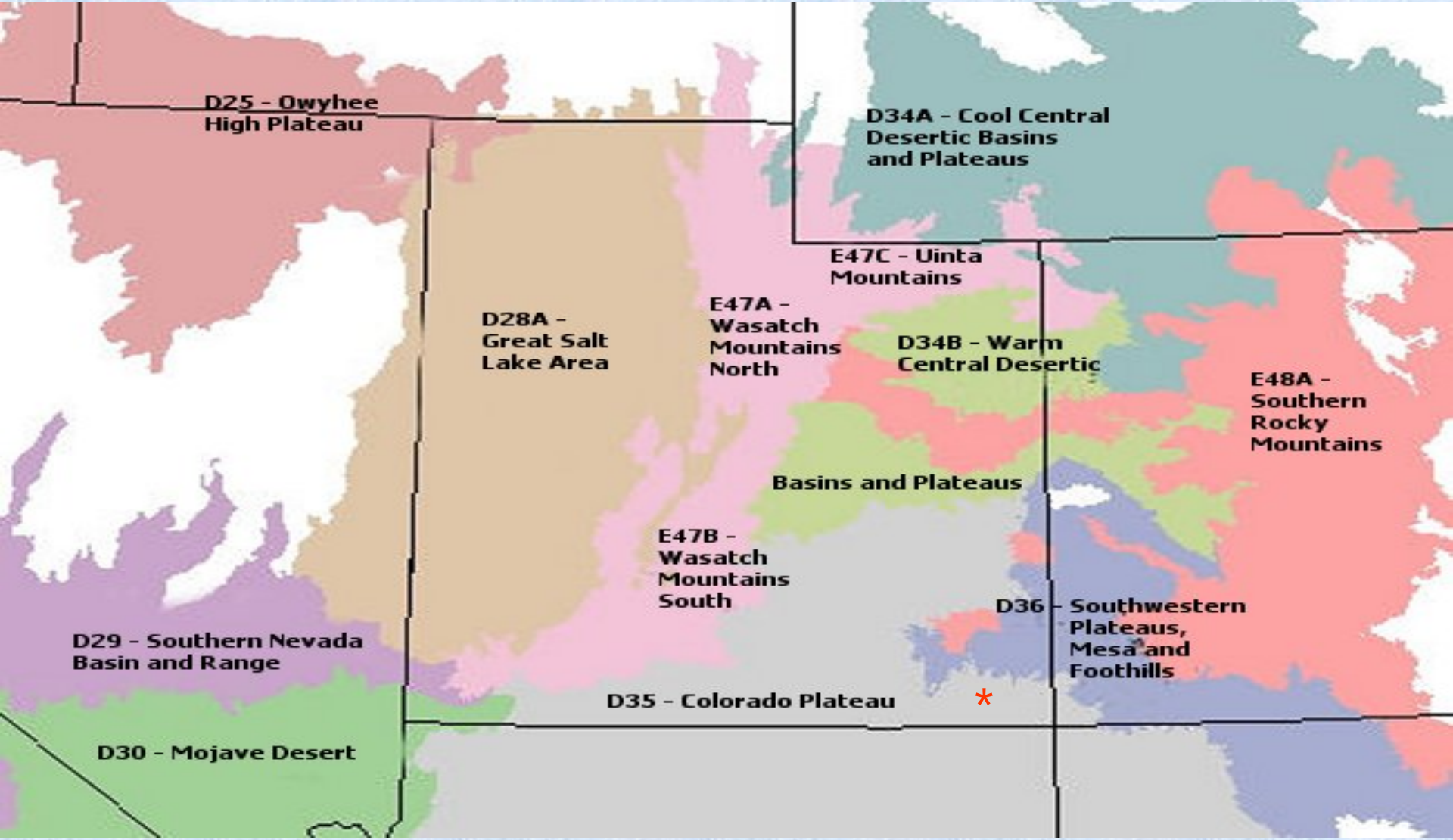
- Assess nearby proper functioning condition (PFC) riparian areas
- Use local ecotypes of common riparian species for your area
- If not available, purchase plants considering their origin:
  - Eco-region
  - Elevation
  - Environment (montane, floodplain, arroyo, closed basin-playa)
  - Soil texture and salinity
  - Soil moisture and water table depth

NRCS Ecological Site Descriptions

Includes information about:

- Precipitation zone
- Elevation
- Soil (physical and some chemical characteristics)
- Animal community
- Forage preferences by livestock
- Transition models
- Plant composition

Major Land Resource Areas (MLRA's)



MLRA D34B – Warm Central Desertic Basins and Plateaus

- Elevation 4,600 – 8,000 ft
- Average precipitation 6 – 24 inches (much occurs in July – September; May and June are usually the drier months)
- Frost free days 110 – 235
- Average annual Temperature ranges from 41 to 54 degrees F.
- Major soil resource concerns include salinity and wind erosion on light textured soils

Ecological Site Descriptions

www.ut.nrcs.usda.gov (Utah NRCS website)

- Click: eFOTG (Utah)
- Click: State of Utah on map
- Click: San Juan county on map
- Click: Section II
- Click: Ecological Site Descriptions
- Click: Utah Ecological Site Descriptions
- Click: Warm Central Desert Basins, Mountains, and Plateaus
- Click: Site name that best describes your site (River Floodplain)
- Scroll down: to plant community composition

MLRA 34 B: Warm Central Desert Basins, Mountains, and Plateaus

Ecological Site Name: River Floodplain (Fremont cottonwood)

Common Name	National Symbol	Group	Pounds per Acre		% by Weight of Total Composition	
			Low	High	Low	High
Coyote willow	SAEX		140	210	10	15
Rubber rabbitbrush	CHNA2		70	140	5	10
Basin big sagebrush	ARTRT		70	140	5	10
Greasewood	SAVE4	3	14	42	1	3
Low rabbitbrush	CHVI8	3	14	42	1	3
Golden currant	RIAU	3	14	42	1	3
Salt cedar	TARA	3	14	42	1	3
Scented Sumac	RHTRT	3	14	42	1	3
Other shrubs	SSSS	10	70	140	5	10

MLRA 48 A: Southern Rocky Mountains

Ecological Site Name: Semiwet Fresh Streambank (Water birch)

Common Name	National Symbol	Group	Pounds per Acre		% by Weight of Total Composition	
			Low	High	Low	High
Drummond willow	SADR		100	200	5	10
Water birch	BEOC2		60	100	3	5
Chokecherry	PRVI		60	100	3	5
Speckled alder	ALIN2	3	20	60	1	3
Redosier	COSE16	3	20	60	1	3
Saskatoon serviceberry	AMAL2	3	20	60	1	3
Silver buffaloberry	SHAR	3	20	60	1	3
Blue elder	SACE3	3	20	60	1	3
Fourline honeysuckle	LOIN5	3	20	60	1	3
Mountain snowberry	SYOR2	3	20	60	1	3
Creeping Oregon grape	MARE11	3	20	60	1	3
Deciduous travelersjoy	CLLI2	3	20	60	1	3
Threadleaf rubber rabbitbrush	CHNAC2	3	20	60	1	3
Woods rose	ROWO	3	20	60	1	3
Wax currant	RICE	3	20	60	1	3
Basin big sagebrush	ARTRT	3	20	60	1	3
Other shrubs	SSSS	3	200	300	10	

Other Useful USDA Websites

www.plants.usda.gov (PLANTS database)

Provides information on individual plant species

http://plant-materials.nrcs.gov (National Plant Materials website)

On Tool Bar (top of page), Click: **Plant Materials Centers**

On Map, Click: **Los Lunas, NM**

On Map, Click: **Meeker, CO**

Winter Harvesting of Farm Grown Cottonwood and Willow Pole Cuttings

Some Local Retail Production Nurseries

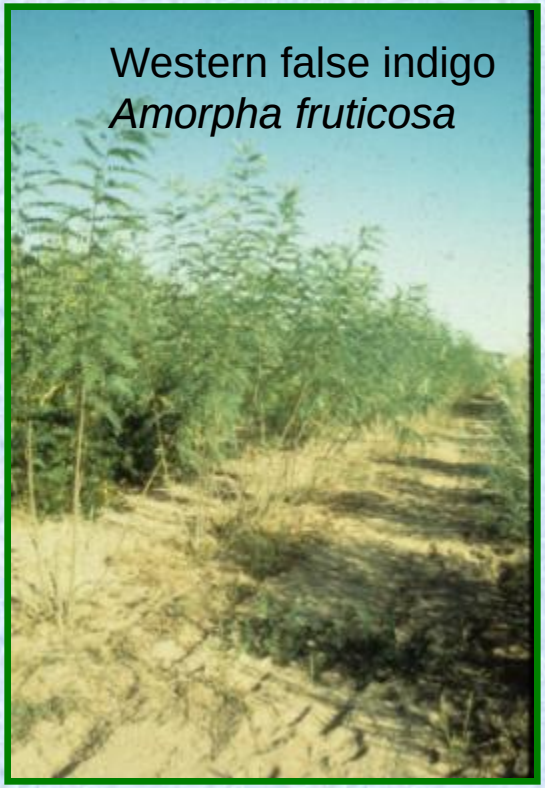
Bosque Tree Farm	505-865-5991
Crooked Wood Farm	505-861-0027
Hydra	505-281-5740
Santa Anna Garden Center	505-867-1322

Storage and Transporting Poles

Pole cuttings are kept hydrated in tanks by placing the cut ends in water.

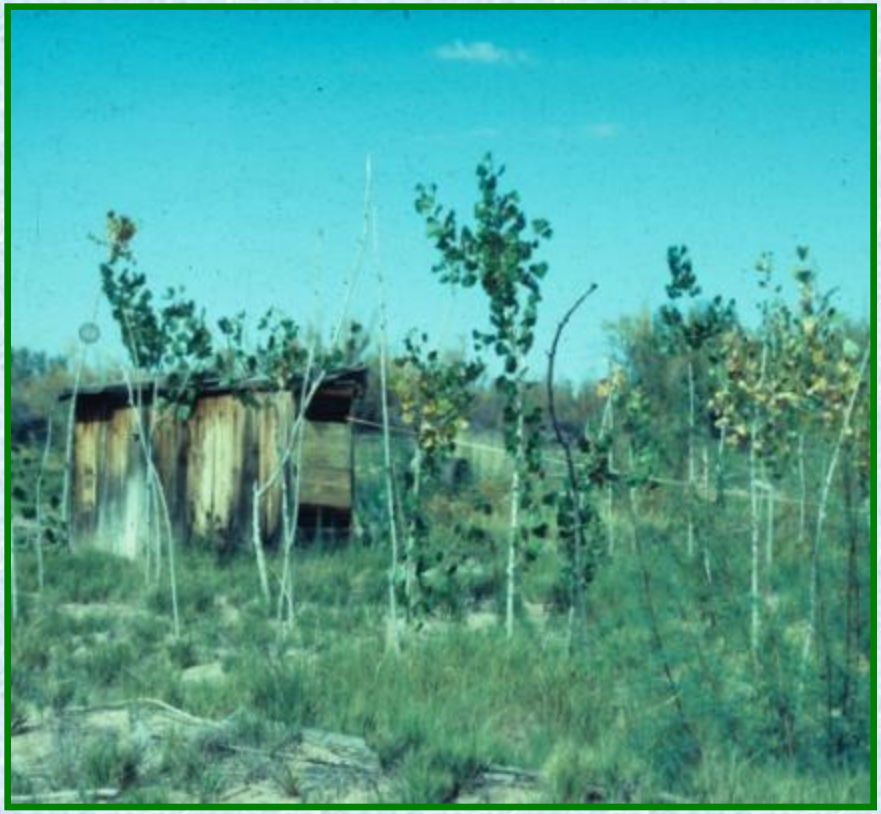
Pole cuttings can be transported dry for several hours and still maintain excellent vigor for planting.

Other Plant Species Grown as Pole Cuttings

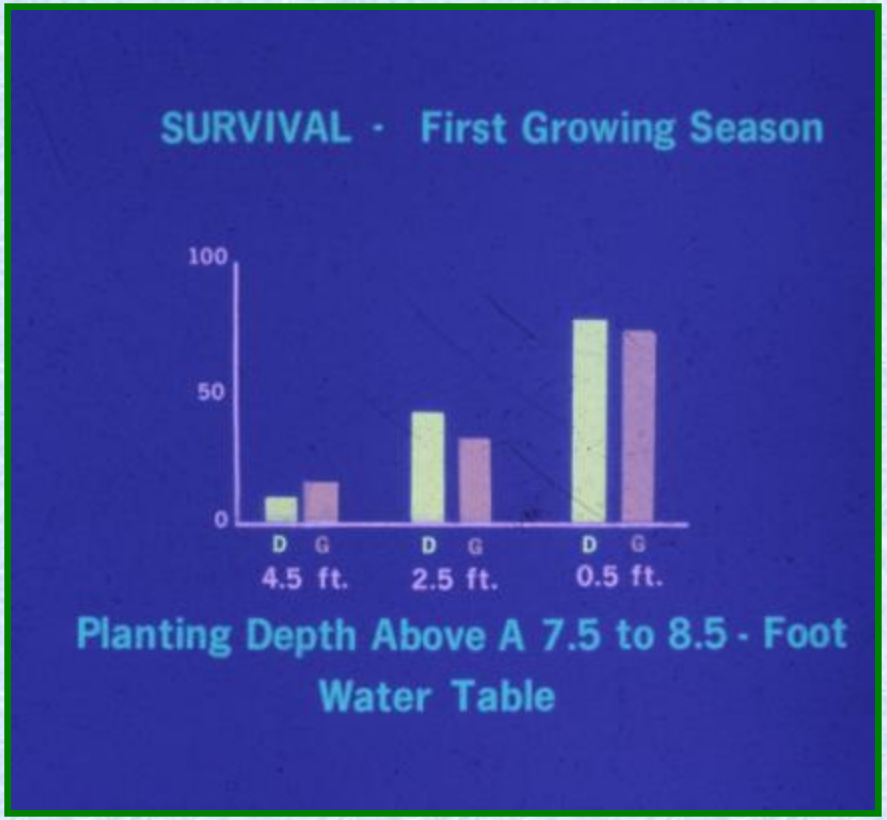


Study to Determine Depth Above the Water Table to Plant Pole Cuttings

(Swenson, 1983)



Cottonwood pole cuttings planted in soil lysimeter.



Cottonwood pole cuttings rooted best when planted closest to water table.

Monitor the Water Table to Determine Planting Depth

A portable well drilling rig that can be loaded in the bed of a pickup. Drills down to about 12 feet.

Perforated 2-inch diameter PVC pipe provides for an inexpensive well casing.

Rooted Cutting

Cottonwood pole cutting rooted near the soil surface and at the capillary fringe of the water table.

Measure Soil for Salts

Soil too salty for pole establishment (1987).

Cuttings soaked in solutions of NaCl (1989).

Six weeks after room temperature soak.

Soils with TDS of more than 2000 ppm, or EC greater than 3 ds/m, may reduce the survival of cottonwood pole cuttings.

Salinity Tolerance of Common Floodplain Species

Most Tolerant

Four wing saltbush (*Atriplex canescens*)

Moderately Tolerant

Wolfberry (*Lycium torreyi*)

Screwbean mesquite (*Prosopis pubescens*)

Willow baccharis (*Baccharis salicina*)

Somewhat Tolerant

Goodding's willow (*Salix gooddingii*)

Not Tolerant

Rio Grande cottonwood (*Populus deltoides*)

Source: Taylor and McDaniel 1998

Soil Salinity Tolerance of Common Riparian Woody Species in Colorado

Table 4-1. Soil salinity tolerance of typical woody plants in the Rio Grande Bosque. Information compiled from Scianna 2003, Miyomoto et al 2004, and CSU 2009

Common Name	Scientific Name	Salinity tolerance (dS/m)	Native Status
Fourwing saltbush	*Atriplex canescens*	60	Native
Saltcedar	*Tamarix ramosissima*	10	non-native
Silver buffaloberry	*Shepherdia argentea*	8	Native
Russian olive	*Elaeagnus angustifolium*	8	non-native
Tree of heaven	*Ailanthus altissima*	8	non-native
Honeylocust	*Gleditsia triacanthos*	6-8	Native/non-native
Wolfberry	*Lycium torreyi*	6-8	Native
Black locust	*Robinia pseudoacacia*	6-8	Native/non-native
Skunkbush sumac	*Rhus trilobata*	6-8	Native
New Mexico olive	*Forestiera neomexicana*	6	Native
Baccharis	*Baccharis salicifolia*	6	Native
Rubber rabbitbrush	*Ericameria nauseosa*	6	Native
Siberian elm	*Ulmus pumila*	6	non-native
Big sagebrush	*Artemisia tridentata*	6	Native
Plains cottonwood	*Populus deltoides*	4	Native
Goodings willow	*Salix gooddingii*	4	Native
Northern Catalpa	*Catalpa speciosa*	4	Native/non-native
Coyote willow	*Salix exigua*	4	Native
Golden currant	*Ribes aureum*	4	Native
Wood's rose	*Rosa woodsii*	4	Native

Source: Scanna 2003, Miyomoto et al 2004 and CSU 2009

Attributes of Shrubs

(Allows for use of trees and shrub species other than cottonwood and willows without providing irrigation)

- Tolerance of soil salts by several species allows for the establishment where cottonwoods cannot
- Increases species diversity which improves habitat sustainability
- Improves habitat structure (from 2 tier–4 tier) for neo-tropical birds
- Increases browse production for livestock and wildlife
- Increase cover for wildlife
- Increase vegetation density and cover which reduces the potential of surface erosion
- Production of fruit by several species which provides food for wildlife

Traditional Transplants

New Mexico olive grown
in 14-inch treepots
(2:1 shoot-to-root ratio)

3.8.2.1 Watering Plant Material

All planted shrubs (willow baccharis, New Mexico olive, golden currant, sumac, silver buffaloberry, and false indigo bush) shall be watered as follows:

Water for November Planting:
TOTAL OF 18 WATER APPLICATIONS. Watering shall be conducted by using a steel rod hose that can be pushed down into the soil to the level of the root system. Water should then be injected (at a slow rate so that soil or root disturbance does not occur) into the root zone of the plant. The volume of water applied to individual plants at each watering period will be 2-3 gallons. The need for some flexibility in the watering schedule is anticipated, depending upon site conditions (soil texture, depth to groundwater) and seasonal climatic factors (snowmelt runoff volume, precipitation, temperatures). However, the contractor shall assume that the watering schedule listed below will be followed unless advised otherwise by the COTR:

- Immediately after installation (1 watering)
- 1 x per month December through end of March (4 waterings)
- 2 x per month April through end of June (6 waterings)
- 1 x per month July through end of November (5 waterings)
- 1 x per every 6 weeks December through March (3 waterings)

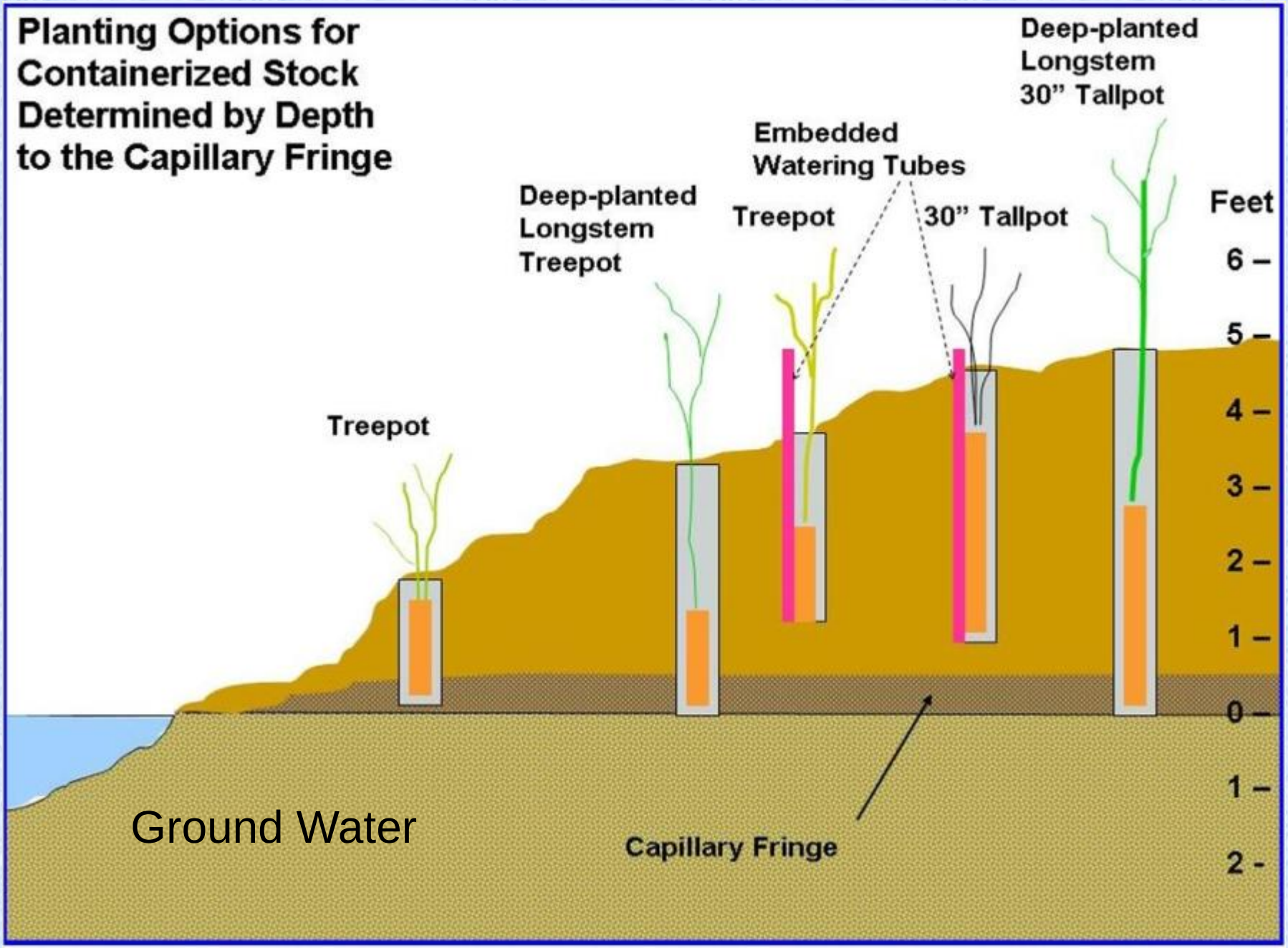
Longstem Transplants (2 – 4 year Stock)

New Mexico olive grown in 2x2 x 14-inch treebands (7:1 shoot-to-root ratio)

New Mexico olive grown in 14-inch treepots (7:1 shoot-to-root ratio)

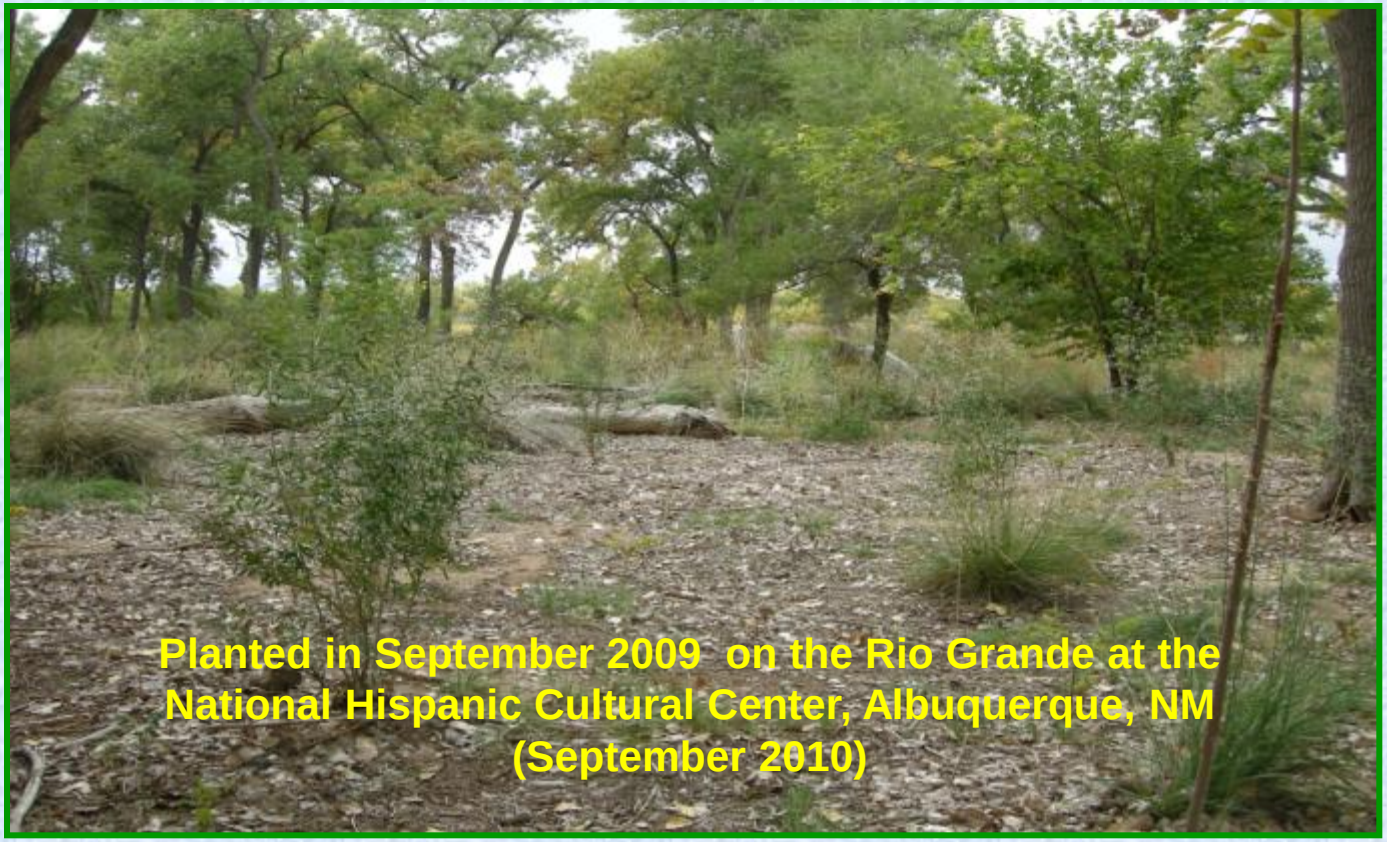
Skunkbush sumac grown in 30-inch tallpots (3:1 shoot-to-root ratio).

Some Longstem Shrubs Available at the LLPMC


Planting Options for Containerized Stock Determined by Depth to the Capillary Fringe
Deep-planted Longstem 30" Tallpot
Embedded Watering Tubes
Deep-planted Longstem Treepot
Treepot
30" Tallpot
Feet
6 –
5 –
4 –
3 –
2 –
1 –
0 –
1 –
2 -
Treepot
Ground Water
Capillary Fringe

Best Time to Plant in the Southern Desert

Pole or whip Cuttings	December – March
Longstem Transplants	~~November~~ – March? September



Some Useful Planting Equipment

Google: soil power auger = 1,380,000 hits

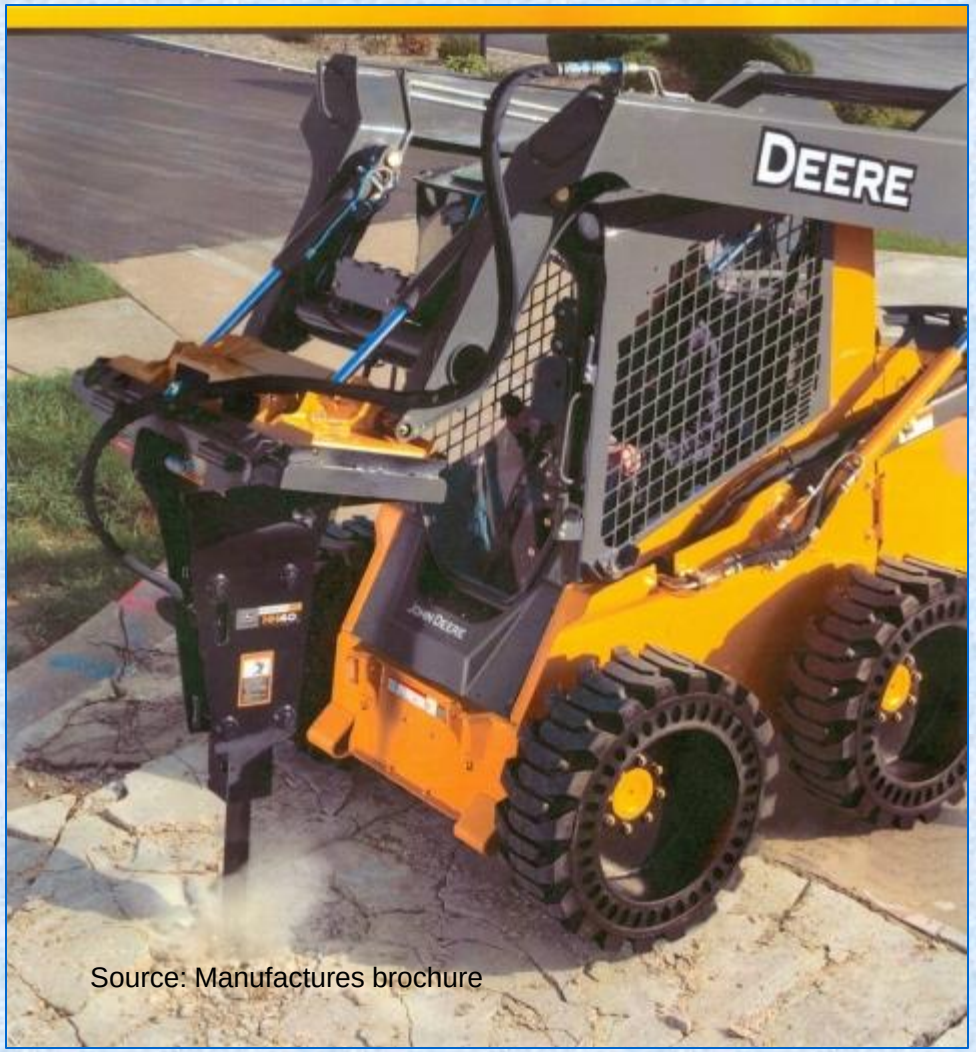
More Equipment

Stinger bar attached to an excavator.

® Bobcat is a registered trademark of the Bobcat Company – a unit of Ingersoll-Rand

New Equipment for Loose Sand, Gravel, and Cobble

Hydraulic compactor with stinger (3.5-inch diameter) attached to the loader of a 65-hp farm tractor



Source: Manufactures brochure

Hydraulic hammer with chisel mounted on a skid tractor

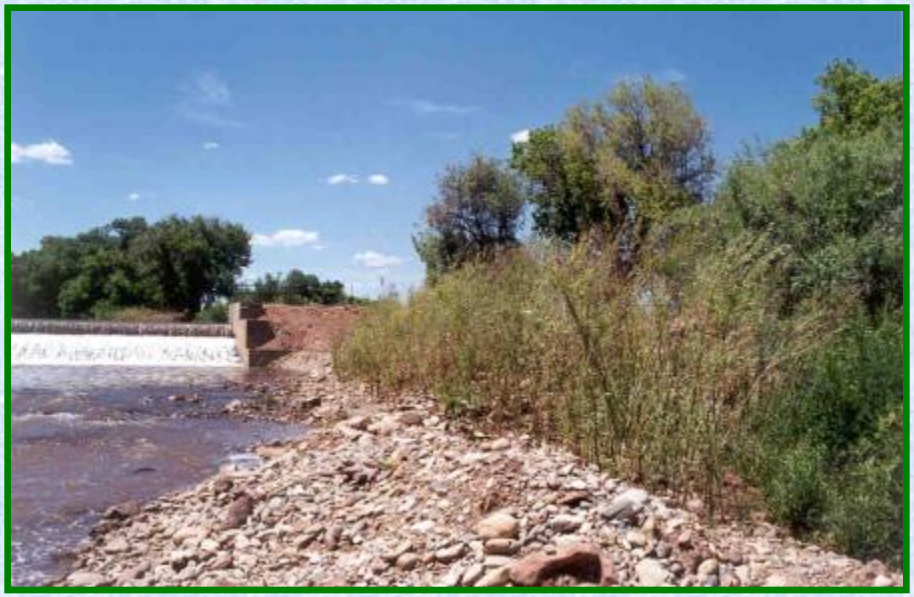
Electric Rotary Hammer Drills are an Excellent Tool for Planting Willows

On the Rio Chama north of Espanola, New Mexico.

On the Rio Grande near Pilar, New Mexico.

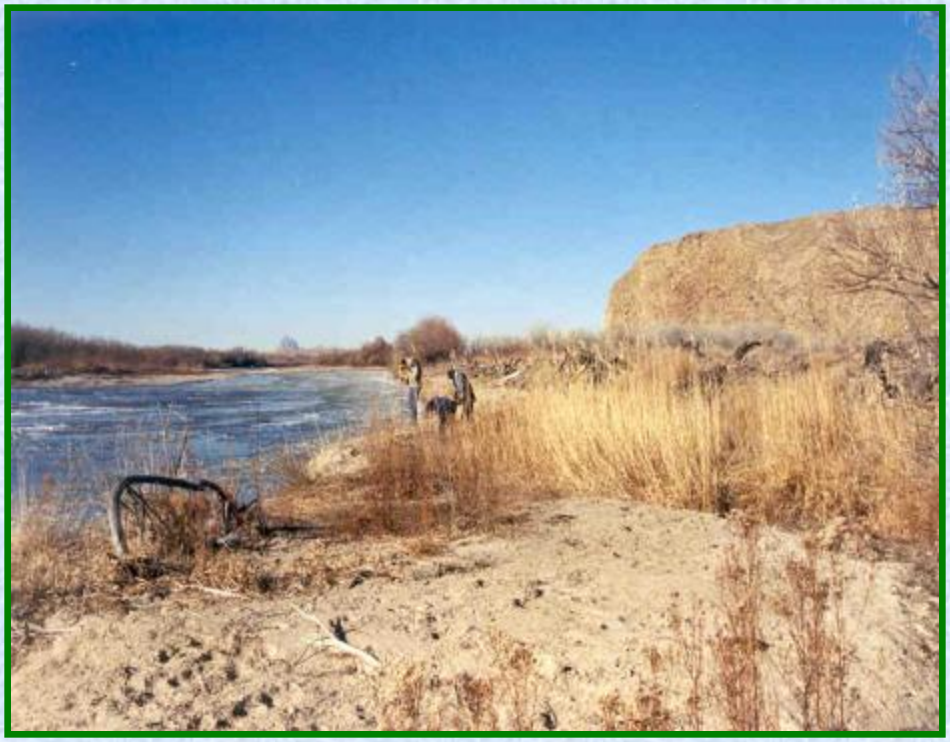
Willows Planted With Hammer Drills

On the Rio Pecos near Pueblo, New Mexico.

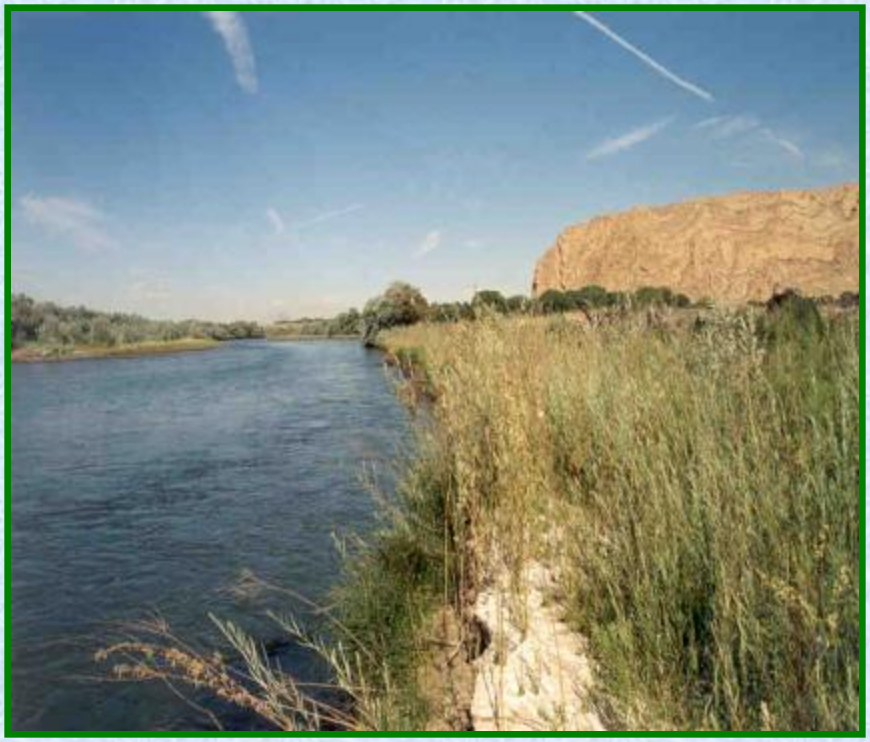


Same site 7 months after planting.

More Willows Planted With Hammer Drills



On the San Juan River near Waterflow, New Mexico.



Same site 7 months after planting willows.

Damaged But Still Healthy

Beaver damage to a newly planted coyote willow stand. Willows are resprouting in the spring after predation.

Farm Tractor With a Front-End Loader Mounted Auger (8-Foot)

Planting cottonwood pole cuttings in an arroyo near Lamy, New Mexico.

Planting longstem tallpot transplants above a shallow water table in deep holes near Lemitar, New Mexico.

Established Shrub Pole Cuttings

New Mexico olive
Forestiera pubescens

Willow baccharis
Baccharis salicina

False indigo bush
Amorpha fruticosa

Established Cottonwood Pole Cuttings on the Arkansas River: Pueblo, Colorado

Seven months after planting.

Same site at the conclusion of the 3rd growing season.

On the Rio Santa Fe at Cochiti Pueblo, New Mexico

Before treatment winter of 1993

Same location summer of 2000

On the Rio Santa Fe at Cochiti Pueblo New Mexico

Before planting in February 1994.

Same site 6 years later.

Same Site Under Canopy

Natural log jam creating pool and riffle

Natural overbank flooding allows for new cottonwood seedling establishment

Burying the Root Crowns of Tallpot Transplants by Planting in Deep Holes to Reach Capillary Water

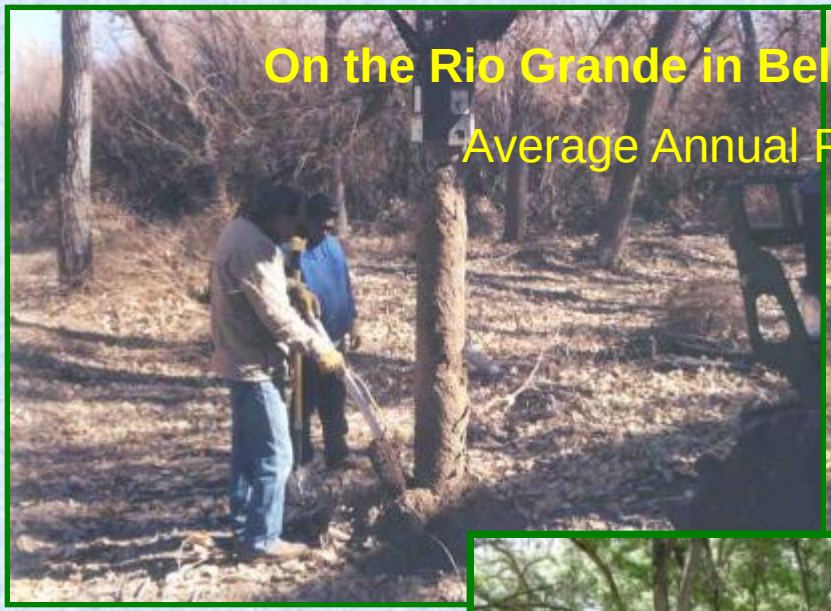
On the Rio Grande in Bernalillo, NM (Dec. 2006)

Same site by the 3rd growing season

Funded by Bureau of Reclamation


Same site by the 4th growing season

Burying the Root Crowns of Treepot Transplants by Planting in Deep Holes to Reach Capillary Water



On the Rio Grande in Belen, New Mexico (Feb. 2006)

Average Annual Precipitation 19 cm

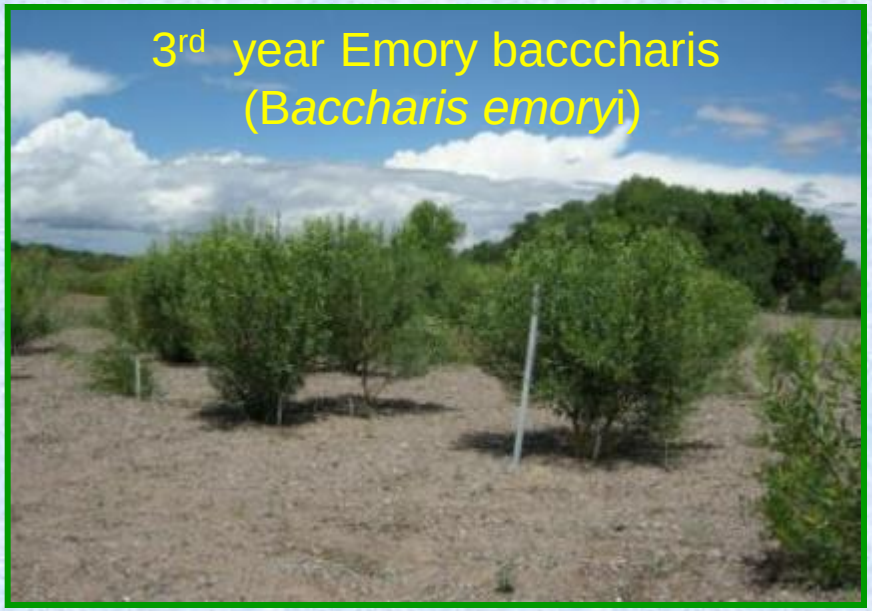
Same Location 2008

3rd growing season


Same Location After 5 Years
17 acre site

Established Longstem Transplant Shrub Species

Established Longstem Transplants, Continued



Successfully Deep-Planted Shrub Species

- Golden currant — *Ribes aureum*
- Stretchberry — *Forestiera pubescens*
- Netleaf hackberry — *Celtis reticulata*
- Boxelder — *Acer negundo*
- Skunkbush sumac — *Rhus trilobata*
- Silver buffaloberry — *Shepardia argentea*
- Wolfberry — *Lycium torreyi*
- False indigo — *Amorpha fruiticosa*
- Screwbean mesquite — *Prosopis pubescens*
- Emory baccharis — *Baccharis emoryii)*
- Rio Grande cottonwood — *Populus deltoides*
- Sandbar (coyote) willow — *Salix exigua*

Adventitious Root Growth on Main Stem of Buried Plants

Skunkbush sumac after one growing season.

Emory baccharis after one growing season.

False indigo after two growing seasons.

Adventitious Roots Continued

Irrigation of Shrubs During Drought

Shrubs are irrigated monthly if ground capillary water becomes absent

Common Survival Ranges Among Planting Methods

Cottonwood and Willow Pole Plantings

- 50 to 90 percent
- Sample size of more than 10,000 during a 20-year period

Shrub Pole Plantings

- 10 to 40 percent
- Sample size of more than 4,000 during a 10-year period

Shrub and tree ‘Longstem’ Deep Plantings

- 70 to 97 percent
- Sample size of more than 7,000 during an 8-year period

COST COMPARISON
Field Planting Traditional Transplants versus ‘Longstem’ Transplants

Traditional Transplant (2:1 shoot-to-root ratio)
(18 irrigations x $2.00 per irrigation) + $6.00 for a one-gallon traditional ‘treepot’ + $6.00 for installation = **$48.00/plant**

Or **$48,000 for 1,000** plants installed

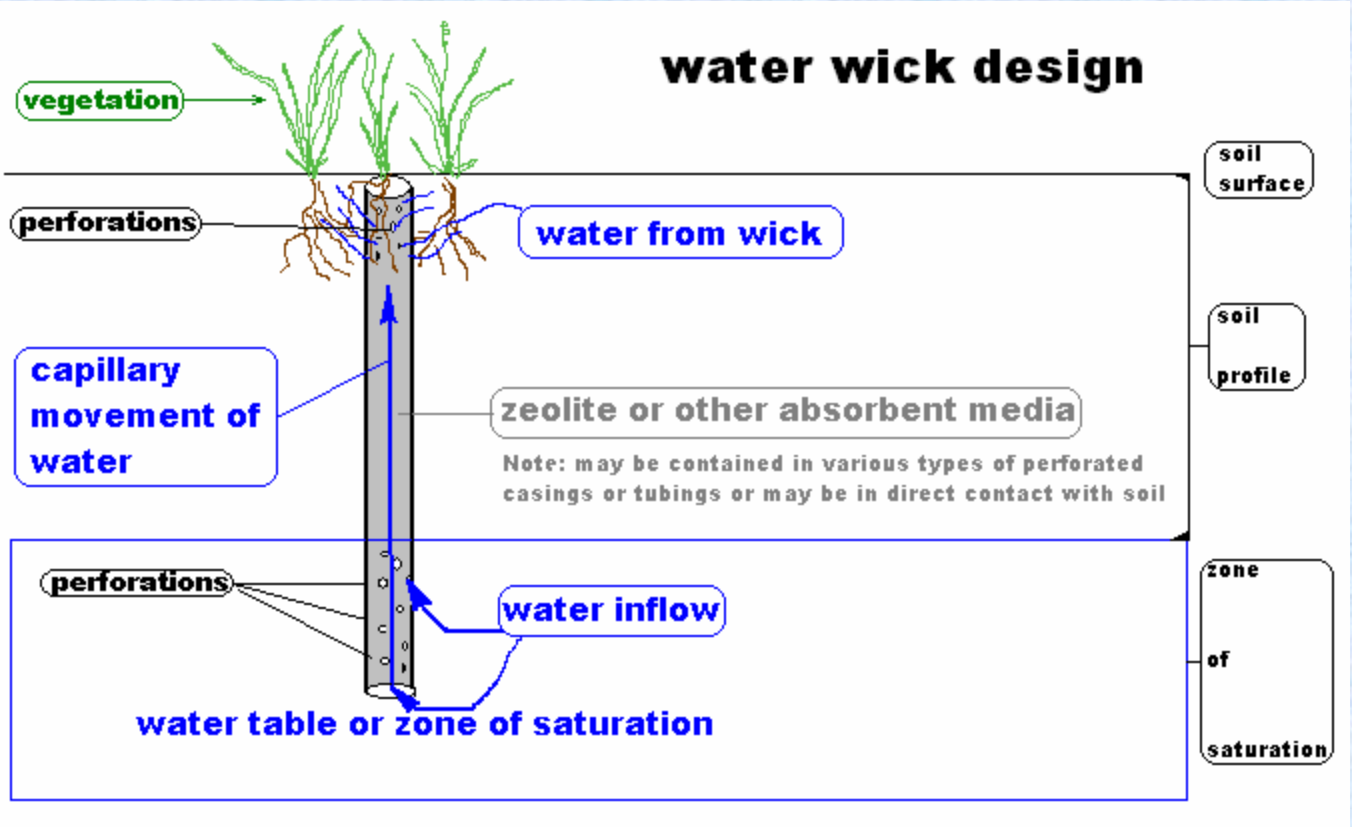
‘Longstem’ Transplant (7:1 shoot-to-root ratio)
$15.00 for a one-gallon ‘treepot’ ‘longstem +
$10.00 for installation = **$25.00/plant**

Or **$25,000 for 1,000** plants installed

Zeolite Planting Method

Zeolite is a volcanogenic sedimentary mineral of aluminosilicates

Zeolite Planting Method Continued

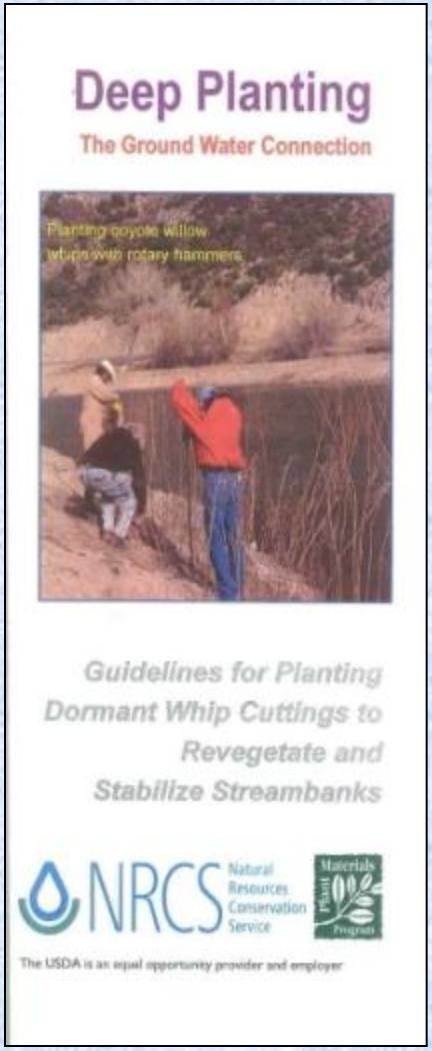


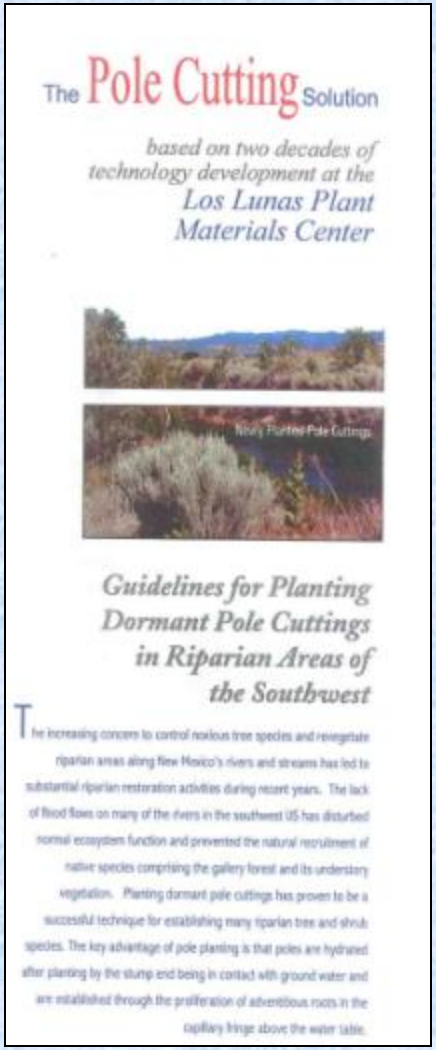
Source: Brent Tanzy, Eugene Adkins and etal (white paper)

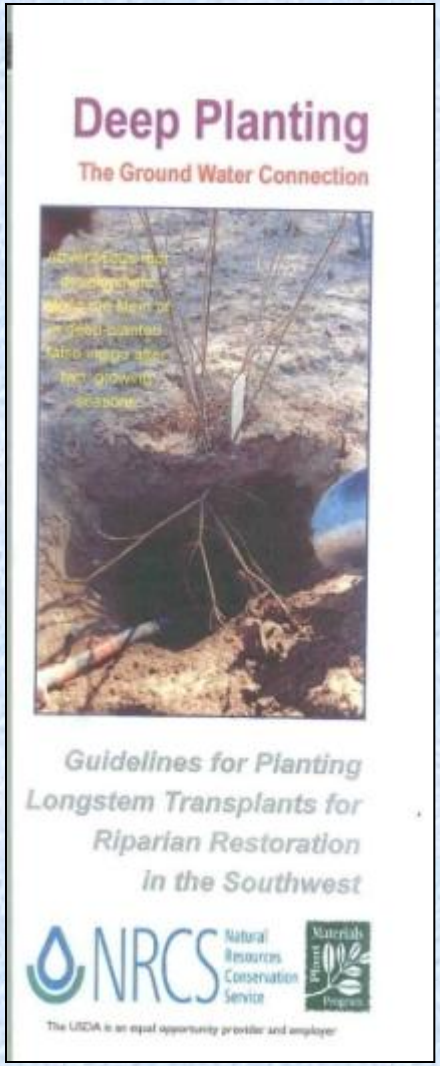
Established grass transplant using the zeolite planting method

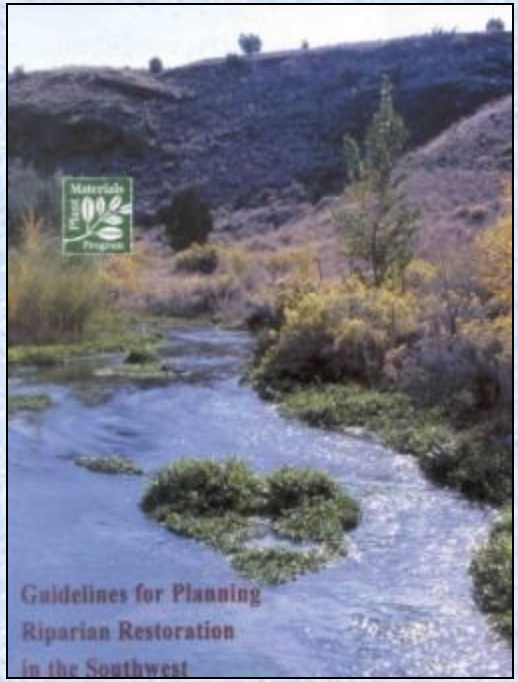
Available Planting Guides

www.nm.nrcs.usda.gov/plants









Publications Continued

Journal of Soil and Water Conservation (July/August 2008)

Published in the *Journal of Soil and Water Conservation, July/August 2008, Volume 63, Number 4*

Deep-planting methods that require minimal or no irrigation to establish riparian trees and shrubs in the Southwest

David R. Dreesen and Gregory A. Fenchel

During the past 20 years, the Los Lunas Plant Materials Center (LLPMC), USDA Natural Resources Conservation Service, has developed deep-planting techniques that require minimal or no follow-up irrigation to establish woody vegetation on disturbed riparian sites in the semiarid Southwest. The use of these techniques results in minimal maintenance and high survival rates, which will reduce ultimate revegetation costs. Invasive exotic woody species, primarily saltcedar (*Tamarix* sp. L.) and Russian olive (*Elaeagnus angustifolia* L.), have been controlled on floodplain tracts totaling more than 13,750 ha (34,000 ac) along New Mexico's major rivers during the past five years by mechanical extraction or herbicide application (New Mexico Department of Agriculture 2005). Principal motives for these efforts include conserving groundwater, reducing wildfire potential, restoring wildlife habitat, and providing grazing or other beneficial uses. The alteration of surface and groundwater hydrology by flood control structures and flow regulation has encouraged the spread of invasive woody species (Stromberg et al. 2007) and has resulted in relatively deep water tables on many sites. The lack of overbank flood events on these rivers has perturbed normal ecosystem function and prevented the natural recruitment of native species comprising the gallery forest and its understory vegetation. The establishment of planted obligate riparian woody plants (i.e., phreatophytic overstory trees and understory shrubs) requires either prolonged irrigation until the transplants' root systems can extend into the permanent unsaturated soil moisture above the water table (i.e., the capillary fringe) or deep- planting techniques that allow immediate root contact or rapid root extension into this moisture supply.

David R. Dreesen is a horticultural/agronomist and Gregory A. Fenchel is the manager of the Los Lunas Plant Materials Center, USDA Natural Resources Conservation Service, Los Lunas, New Mexico.

PLANTING DORMANT POLE CUTTINGS

The LLPMC began investigating deep- planting methods over two decades ago to improve establishment of cottonwood (*Populus deltoides* Bartr. ex Marsh. and *P fremontii* S. Wats) and Goodding's willow (*Salix gooddingii* Ball) dormant pole cuttings (LLPMC 2006a).

Figure 1

Traditional pole cuttings are harvested from plantation-grown young stems of tree-type cottonwood or willow species and used to establish the overstory structure of riparian forests (figure 1). The key survival advantages of using pole cuttings are the water uptake through the stump end set in groundwater and the proliferation of adventitious roots in the capillary fringe. To maximize survival, 3- to 4-year-old, large-diameter, dormant, vigorous pole cuttings are harvested, trimmed of all lower branches, kept hydrated, and planted in early winter to early spring.

Native Plants Journal (Spring 2010)

Deep-planting techniques to establish riparian vegetation in arid and semiarid regions

David R Dreesen and Gregory A Fenchel

ABSTRACT

Invasion by exotic woody species and disruption of natural hydrologic conditions require the restoration of native riparian plant communities along rivers and streams in the Southwest. Successful establishment of phreatophytic riparian plant species has been accomplished using deep planting techniques that involve the immediate exploitation of capillary fringe moisture by the existing root system of nursery stock or the adventitious root system of a cutting. These techniques, which require minimal or no post-planting irrigation in arid and semiarid regions, include the planting of dormant pole cuttings, dormant whip cuttings, tallpots with long root systems, as well as long-stem nursery stock whose root crowns are deeply buried.

Dreesen DR, Fenchel GA. 2010. Deep-planting techniques to establish riparian vegetation in arid and semiarid regions. Native Plants Journal 11(1):

A diverse riparian community established by natural regeneration along the Rio Grande near Socorro, New Mexico, comprising Rio Grande cottonwood, New Mexico olive, Emory's baccharis, and giant sacaton (*Sporobolus wrightii* Munro ex Scribn. [Poaceae]). Photo by

KEY WORDS

root crown, dormant pole cuttings, dormant whip cuttings, long-stem, capillary fringe, groundwater, phreatophyte, tallpot

NOMENCLATURE

USDA NRCS (2008a)

Monitor Plantings
Hazards That May Impact Survival

Cottonwood leaf beetle
(*Chrysomela scripta* fabricius)

Removal of tree guards

Planting Hazards Continued

Long-term inundation (more than 30 days).

Annual and perennial weed control.


Kochia Loosing Dominance to Native Perennial Herbaceous Species Five Years After Disturbance

Planting Hazards Continued

Fire

Livestock browsing and trampling

Improper backfilling

Wildlife browsing

What and Where to Plant?

Grass Seeding With Longstem and Pole Cutting Planting

Volunteers planting longstems in winter

Hydro mulching a broadcast grass seeding in summer

Thank You

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The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

Warm Season Grass Seeding in Belen, NM

- Average precipitation - 8 inches
- **Soil surface texture - a sandy loam**
- **Weed control - mechanical (pond bank was reshaped)**
- **Seeding method - hand-broadcasted and hand-raked with volunteers**
- **Seeding rate - 60 pls/sq. ft**
- **Time of seeding - July**
- **Species seeded - mainly warm-season grasses**
- **Seeding depth - ½-inch (shallow)**
- **Post treatment - wood fiber hydro-mulch**

Control Weeds Before Seeding

Since they compete for water, light, and nutrients

Available Tools Include

- Application of pre-emergence or post-emergent herbicides
- Mowing or burning.

Adapted LLPMC Plant Material Releases (plant populations from service area)

Common Name	Species	Cultivar	Drought Tolerance
Indian ricegrass*	*Achnatherum hymenoides*	Paloma	High
Blue grama	*Bouteloua gracilis*	Hachita	High
Galleta	*Pleuraphis jamesii*	Viva	High
Alkali sacaton	*Sporobolus airoides*	Salado	High
Sideoats grama	*Bouteloua curtipendula*	Vaughn	Medium
Alkali muhly	*Muhlenbergia asperifolia*	Westwater	----------

- Seeded at 60 pls/sq ft.
- (included 20 pls/sq ft. of Indian ricegrass with 79 % dormant seed)

http://plants.usda.gov

“Inverse Texture Effect”

- The storage capacity is 4 to 9% for sands, 11 to 15% for sandy loams, and 17 to 23% for fine-textured soils
- A one inch infiltration event might penetrate 12” in a sand (rapid), 8” in a sandy loam, and 5” in a silty-loam (very slow)
- **Coarse-textured soils hold less water per unit depth but much of the water is sufficiently deep to avoid evaporation whereas in a fine-textured most of the water can be lost to evaporation**
- **Therefore, sandy soils often have more useable soil moisture in arid environments than fine textured soils.**

Soil Moisture Distribution in Arid Environments

- Upper 2–4-inches of soil dries out rapidly by evaporation following a precipitation event (little water available for plant uptake)
- Soil moisture in the top 4–12-inches can persist for several weeks
- Moisture under unsaturated conditions at depths below 12-inches is primarily lost by plant transpiration (no evaporation and no drainage)

Time of Seeding

During a Period of Adequate Moisture

- This requires a series of precipitation events (pulse) that produce sufficient soil moisture to allow germination and enough root extension to survive succeeding dry periods (at this seeding location, a minimum of 20 days)

- Warm-season grasses (C4) –Growth optimum near 90° F with minimal growth below 60° F, (T.A. Jones, 1997)

Thirty Year Average Precipitation at Los luans, NM

(12 miles northwest form the grass seeding)

	Precip. Min. (in)	Precip Max (in)	Mean (in)	Actual Precip (2004)
January	0.31	0.44	0.38	Establishment Year 2004
February	0.31	0.46	0.38	
March	0.33	0.54	0.44	
April	0.34	0.52	0.43	
May	0.46	0.50	0.48	
June	1.18	0.70	0.94	1.54
July	1.64	2.35	**2.00**	**1.98**
August	0.89	2.47	1.68	0.92
September	0.36	1.56	0.96	0.94
October	0.44	1.25	0.84	0.73
November	0	0.54	0.27	1.05
December	0	0.57	0.27	0.46
Total	6.26	11.9	6.96	7.62

Fall killing frost = 10/28

Last spring killing frost = 4/15

Source: NMSU LL

Mulching is a Required Post-Seeding Technique for the Southern Desert

- Reduces soil surface evaporation and seedling evapotranspiration
- Lowers soil temperatures
- Protects soil surface and seedlings from raindrop impact
- Protects seedlings from desiccation by wind and sandblast damage
- Reduces surface erosion
- Improves Infiltration

Currently Evaluating Products with Potential to Increase Available Surface Soil Moisture for Seedling Establishment

- Wood straw® Mulch Trial – Resistance to movement by wind and water and persists longer than hay
  $514/Ton

- Granular hydrogels (starch-based) deposited (dry) into the furrow during seed drilling at a rate of 10, 20, and 30 Lbs/acre in replicated studies

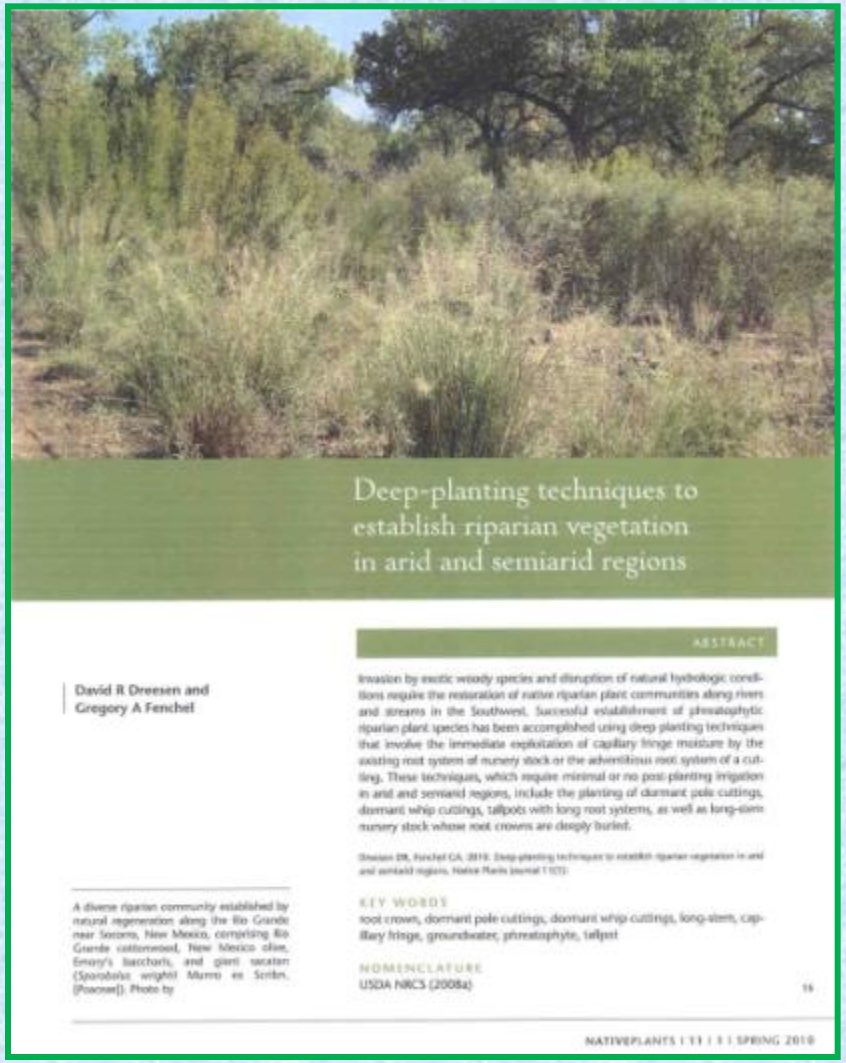
Open furrow for demonstration

An Alternative to Large-Scale Seeding
Seed Source Islands

- Because of the expense of most native seed, the cost of seed dispersal operations, and the limited success of such seeding in arid regions often makes large scale seeding difficult to justify.

Publications

Native Plants Journal (Spring 2010)



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NATIVEPLANTS | 11 | 1 | SPRING 2010

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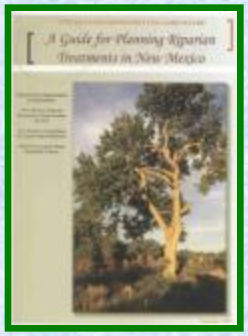

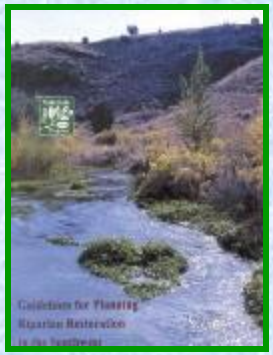

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