

Restoration Basics

Post-Weed Control

Robin Forest Bay
Sr. Environmental Scientist
Habitat Management, Inc.



Restoration vs Reclamation Goals

Restoration

- Recreate original community
- Soil conservation, stabilization, & remediation
- Reconstruct original drainage system
- Maximize system's ability to retain water
- Recreate function & structure of vegetation
- Restore species composition & native genetic diversity
- Aesthetics

Reclamation

- Create functioning community for land use
- Soil conservation, stabilization, & remediation
- Construct functioning drainage system
- Maximize system's ability to retain water
- Create functional vegetation community for land use
- Create desirable species diversity
- Aesthetics

Considerations & Limitations

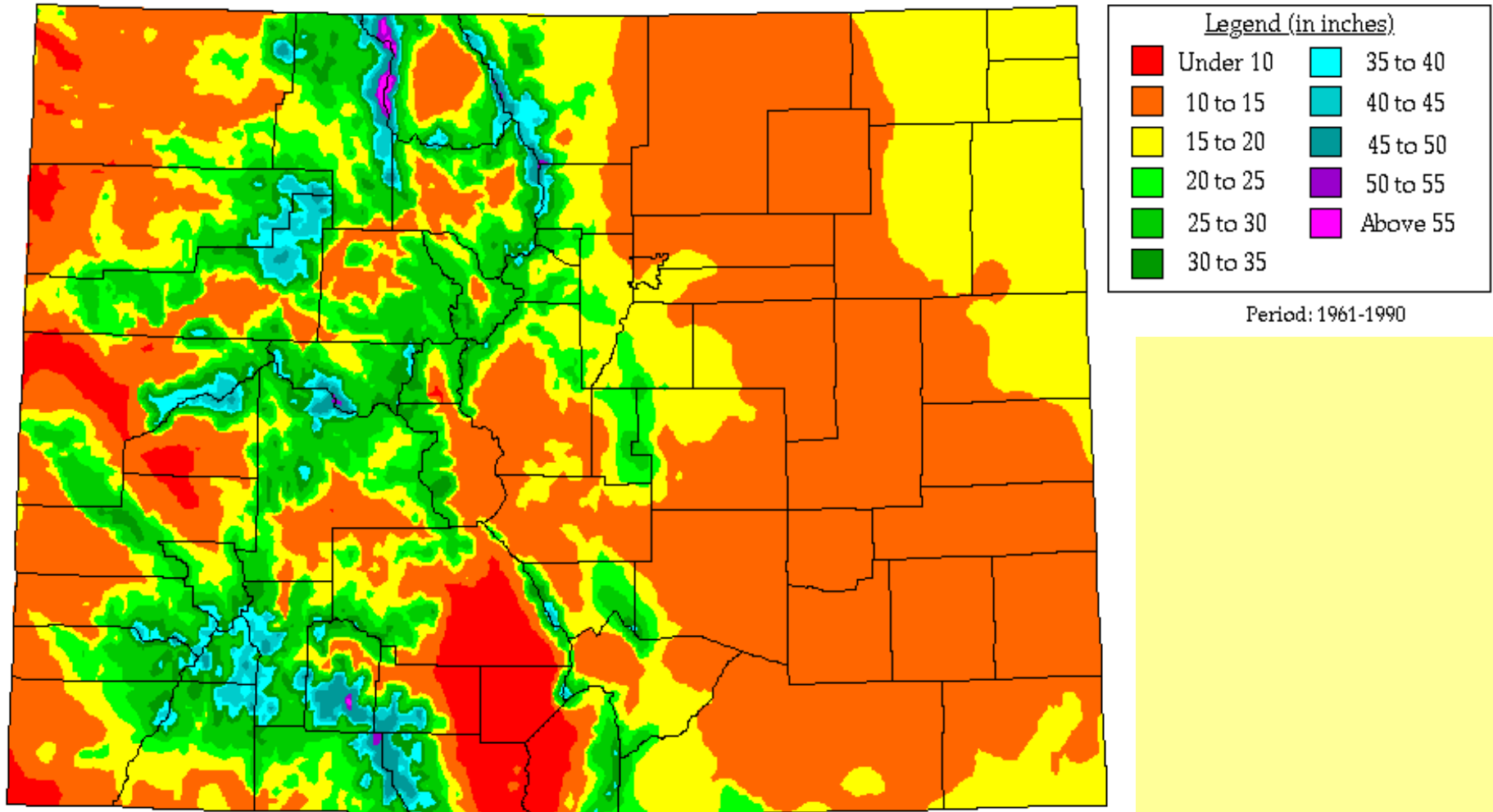
- Land Use Goals
- Climate
 - Precipitation
 - Temperature
- Soils
 - pH (Acid/Alkaline)
 - Salinity
 - Texture
 - Fertility
- Cost/Budget
- Materials
- Equipment
- Physical Effort
- Maintenance

Land Use

- Pasture/Grazing
- Wildlife Habitat
 - Upland
 - Riparian/Wetland



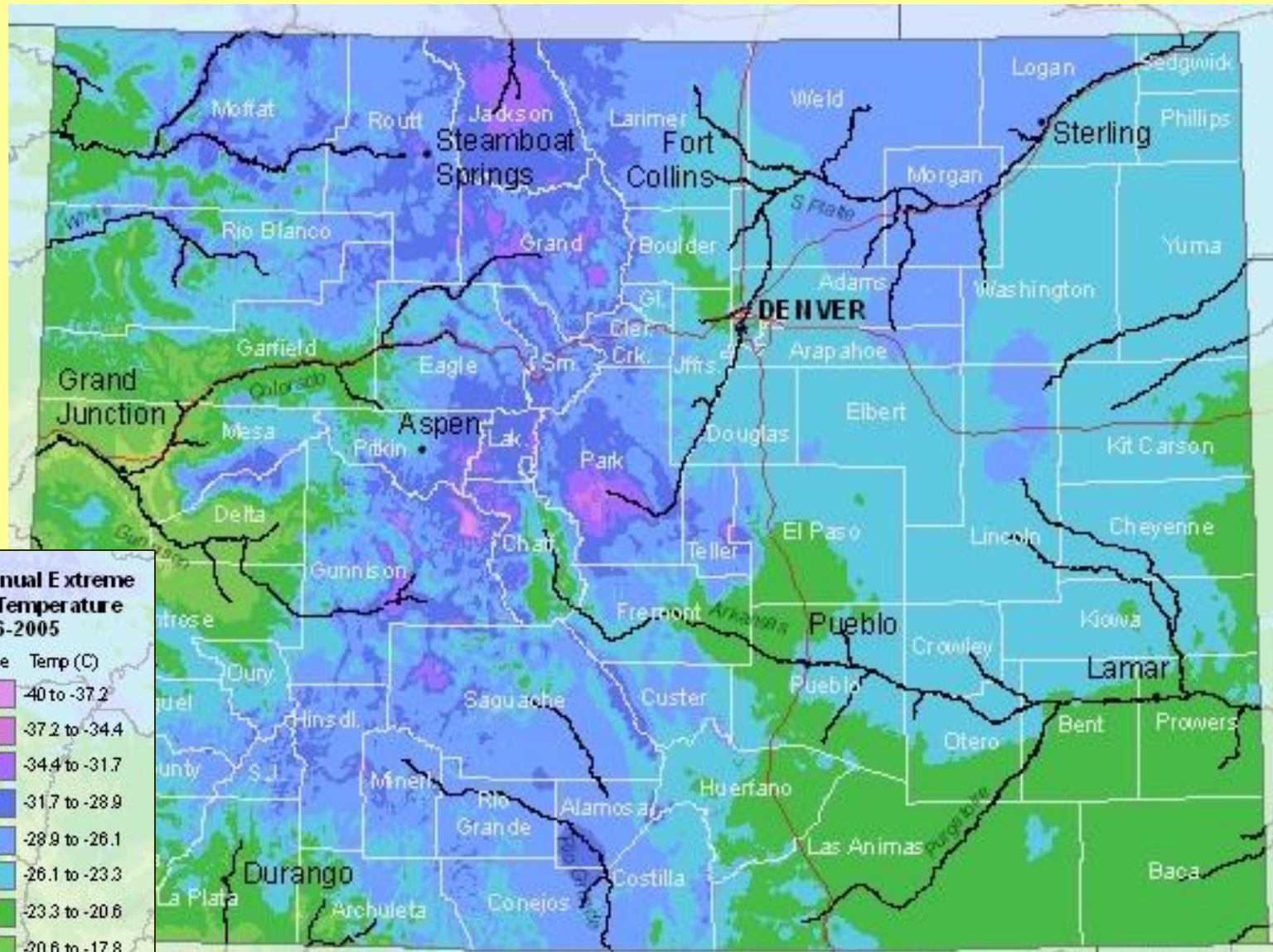
Climate – Precipitation



Western Regional Climate Center - www.wrcc.dri.edu

CoCoRaHS - www.cocorahs.org

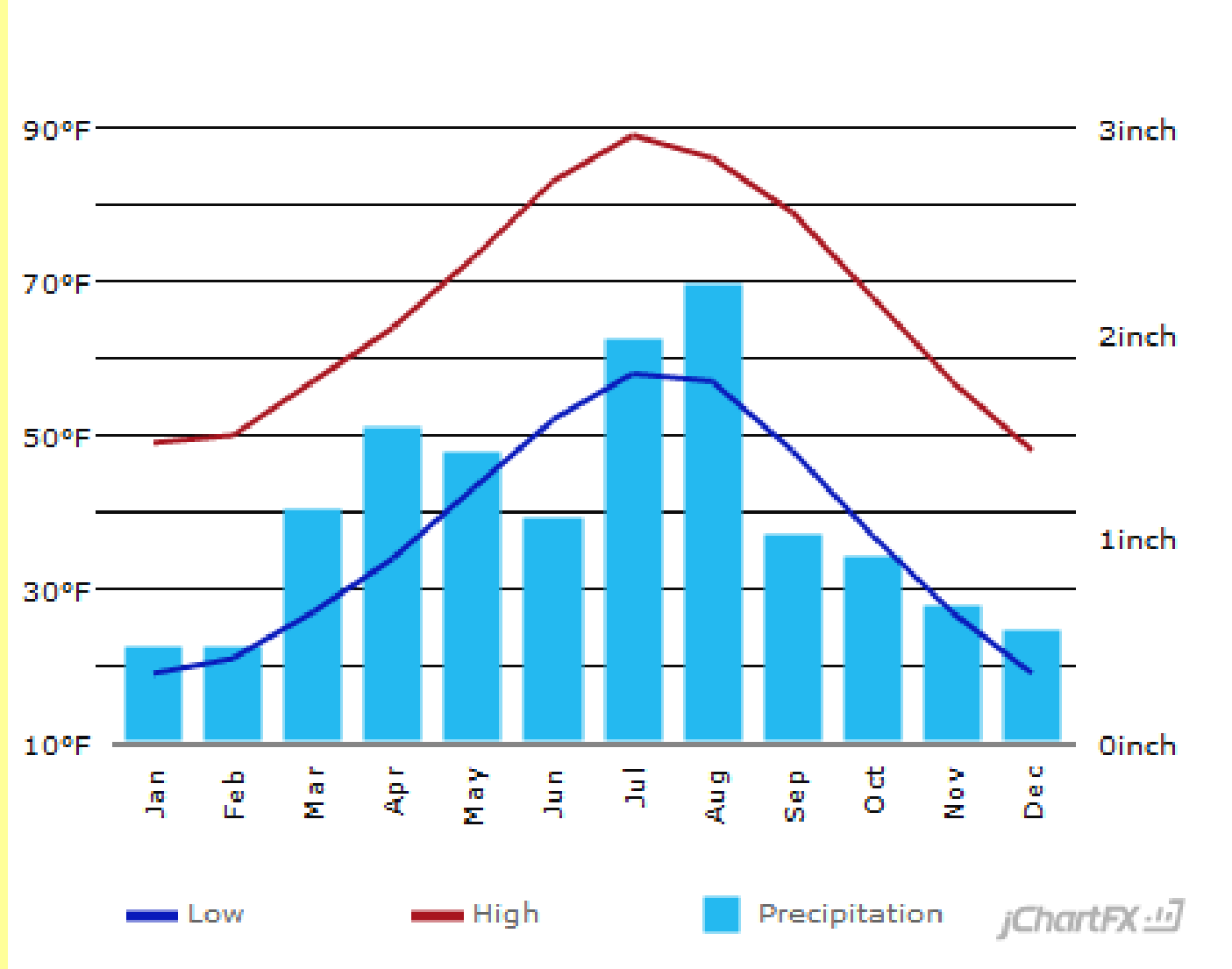
Climate – Temperature



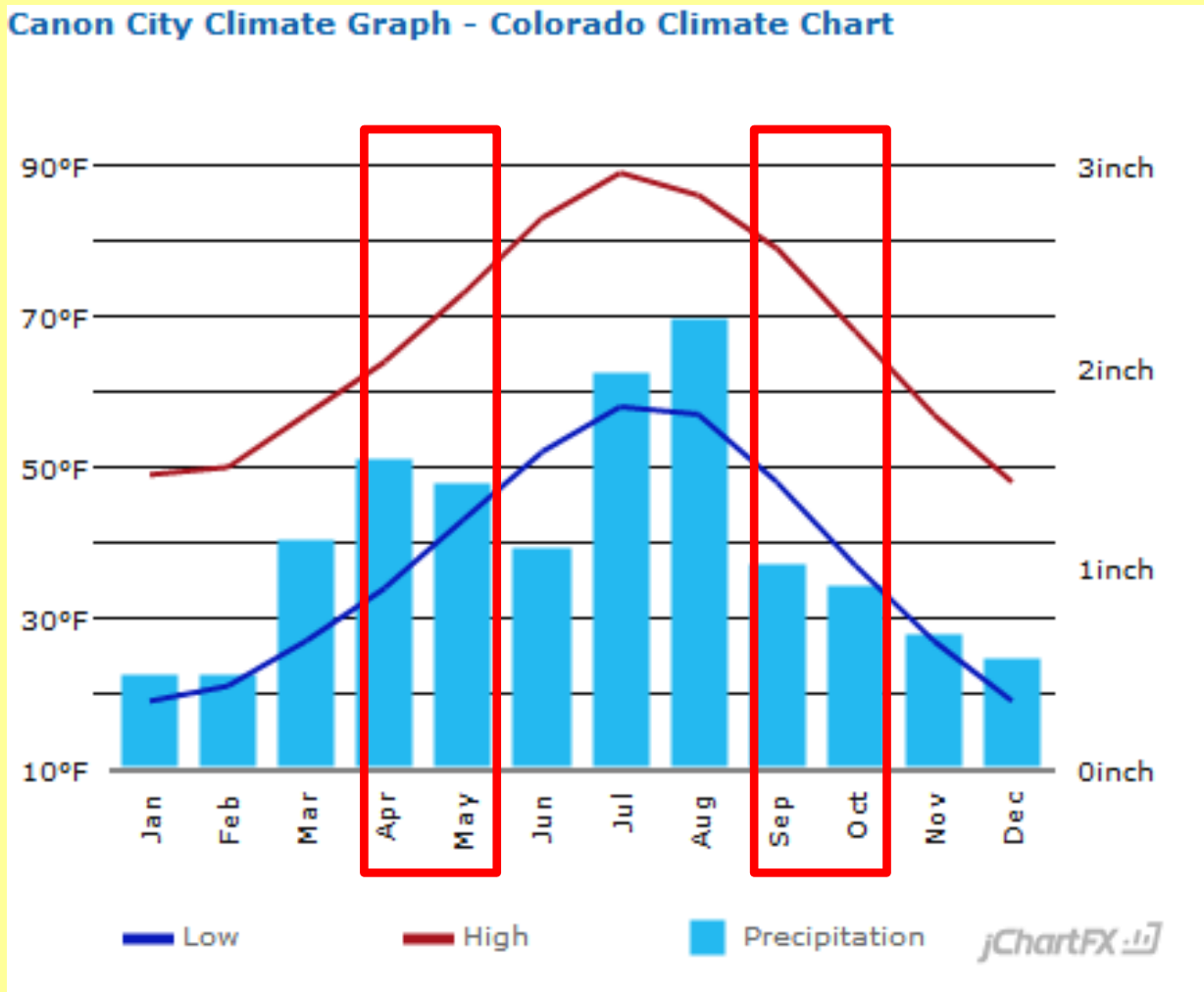
<https://planthardiness.ars.usda.gov/PHZMWeb/>

Climate – Temperature

Canon City Climate Graph - Colorado Climate Chart



Climate – Temperature



- Timing of Planting
 - Spring
 - Fall
- Elevation
- Species
- Methods

Soil Assessment

- Altered soil characteristics associated with weedy monocultures
- Soil assessments used for
 - Acid soil remediation
 - Saline/sodic soil remediation
 - Species selection
 - Fertility amendments

Importance of Soil Assessment



Soil Sampling

- Separate surface characteristics
- 1 sample / 5 acres (3-5 sub-samples)
- Sample top 12 inches



Hand Auger



Machine Auger



Shovel

Soil Sampling – Analyses

Chemistry

- pH
- Electroconductivity (EC)
- Sodium absorption ratio (SAR)

Texture

- % Sand
- % Silt
- % Clay
- Texture Class

Fertility

- Nitrate Nitrogen
- Phosphorous
- Available Potassium
- Organic matter (%)

Mycorrhiza

- Presence
- Endo vs. Ecto

Soil Analyses - Chemistry

Analysis	Good	Fair
pH	6.0 – 8.0	8.0 – 8.5 5.5 – 6.0
Electroconductivity (EC) mS/cm or mmhos/cm	< 4	4 – 8
Sodium Absorption Ratio (SAR)	< 6	6 – 10

- Most native species have a low tolerance for saline, sodic, and/or alkaline soils

Soil Analyses - Chemistry

- Remediation of Saline/Sodic Soils
 - Flooding
 - Harrowing
 - Mulching
 - Gypsum
 - Sulfur
- Remediation of Acid Soils
 - Lime

Soil Analyses - Texture

Analysis	Good	Fair
% Sand	40% – 70%	20% – 80%
Texture Class	Loam, Sandy loam, Silty loam, Sandy clay loam	Clay loam, Silty clay loam, Sandy clay

Linked to:

- Soil moisture & water holding capacity
- Soil salinity
- Nutrient availability and cycling
- Soil aeration
- Competitive interactions of species

Soil Analyses - Texture

- Addition of organic matter can mitigate some of the problems caused by overly sandy or clayey soils.



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Soil Analyses - Fertility

Analysis	Good	Fair
Nitrate Nitrogen (NO ₃)	> 15 ppm	10 – 15 ppm
Phosphorous	> 20 ppm	15 – 20 ppm
Available Potassium	> 300 ppm	140 – 300 ppm
Organic Matter	> 1.5%	0.5% – 1.5%

Organic Matter critical for:

- Nutrient availability and cycling
- Soil moisture & water holding capacity
- Erosion control

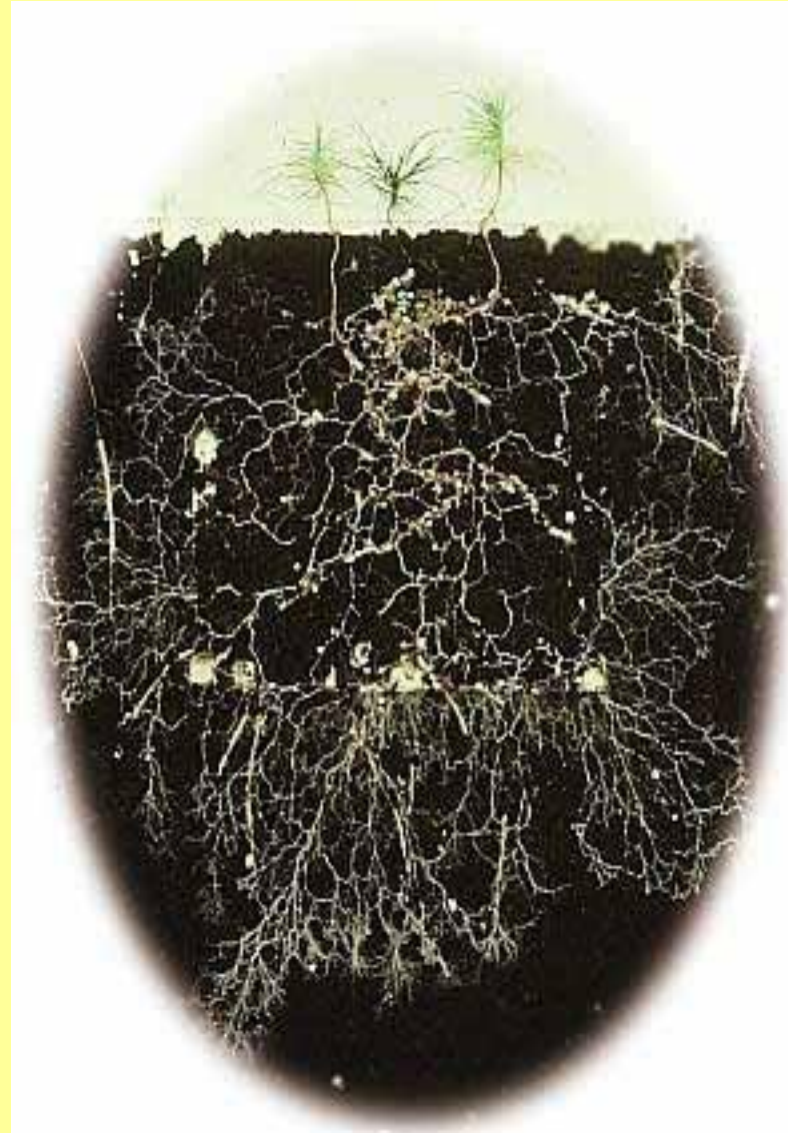
Soil Analyses - Mycorrhiza

Glomus

- *intraradices*
- *mosseae*
- *Aggregatum*

Enhance capture of:

- *Soil moisture*
- *Phosphorous*
- *NH₄⁺*



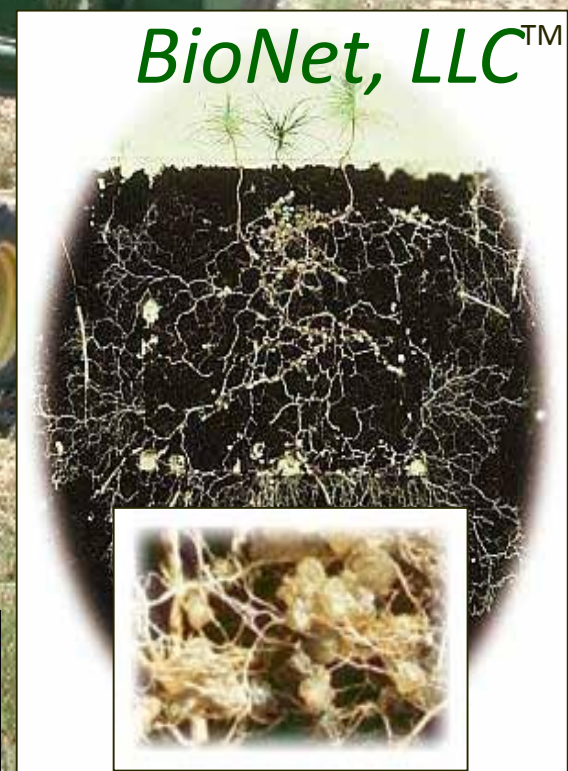


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Species Selection

NRCS Plants Database – plants.usda.gov

- Distribution
 - state/county
- Ecology
 - life form/duration/origin
- Morphology/Physiology
- Growth Requirements
 - soil/water/temperature
- Reproduction
 - propagation/commercial availability
- Uses
 - palatability/commercial uses

NRCS Species Fact Sheet



Plant Guide

BLUE GRAMA

***Bouteloua gracilis* (Willd. ex
Kunth.) Lag. ex Griffiths**

Plant Symbol = BOGR2

*Contributed by: USDA NRCS Plant Materials
Center, Manhattan, Kansas.*



phenotypic plasticity since in the southern states it grows normally as a bunch grass, but in the northern states and in the mountains, or in areas under heavy grazing pressure it is a sod former. Phenotypic plasticity is the ability of an organism to alter its physiology or morphology in response to changes in environmental conditions (Schlichting, 1986). Blue grama possesses the C-4 photosynthetic pathway for carbon fixation (Waller and Lewis, 1979).

Distribution: For current distribution, please consult the Plant Profile page for this species on the PLANTS Web site. Blue grama is a major species of the western Great Plains and southwestern United States. It is also found growing in Mexico and the Canadian Provinces of Alberta, Saskatchewan and Manitoba.

Habitat: Blue grama is most effective when grown in the dryer parts of the northern and southern Great Plains and southwestern region of the U.S. It naturally grows in mixed stands, primarily with buffalograss (*Bouteloua dactyloides*), needle-and-thread (*Hesperostina comata*), western wheatgrass

Species Selection

Local NRCS Office-<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/contact/local/>

The screenshot displays the USDA Natural Resources Conservation Service website. The header includes the USDA logo, the text "Natural Resources Conservation Service", and "United States Department of Agriculture". Navigation links for "About NRCS", "Careers", "National Centers", and "State Websites" are present. A search bar and a "Browse By Audience" link are also visible. The main content area is titled "Local Service Centers Directory" and includes a description of USDA Service Centers and a link to the "Service Center Locator Web site". A map of the United States is shown, with states color-coded to represent different service center regions. A sidebar on the left lists various directories, including "Local Service Centers Directory".

USDA
Natural Resources Conservation Service
United States Department of Agriculture

Topics | Programs | Newsroom | Contact Us

About NRCS | Careers | National Centers | State Websites

Browse By Audience | A-Z Index | Advanced Search | Help

You are Here: Home / Contact Us / Local Service Centers Directory

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Contact Us

- Office of the Chief Directory
Regional Conservationists
- Associate Chief for Operations
- Associate Chief for Conservation
- National Centers Directory
State Offices Directory
Plant Materials Centers Directory
MLRA Soil Survey Regional Offices Directory
Technical & Program Specialists Directory
Local Service Centers Directory
- Special Emphasis Programs Directory
- Media Contacts Directory
FOIA Directory
- Feedback Forms

Local Service Centers Directory

USDA Service Centers are designed to be a single location where customers can access the services provided by the Farm Service Agency, Natural Resources Conservation Service, and the Rural Development agencies.

This [Service Center Locator Web site](#) will provide the address of a USDA Service Center and other Agency offices serving your area along with information on how to contact them.

[View Service Center Locator](#)

The map shows the United States with states color-coded into several regions. The colors used are light blue, dark blue, and light green. The states are labeled with their two-letter abbreviations. The map includes Alaska (AK), Hawaii (HI), Puerto Rico (PR), and the Virgin Islands (VI).

Species Selection/Sources

Commercial Seed Suppliers

- Pawnee Buttes – www.pawneebutteseed.com
- Granite Seed – www.graniteseed.com
- Arkansas Valley Seed – www.avseeds.com
- Western Native Seed – www.westernnativeseed.com
- Southwest Seed – www.southwestseed.com
- Wind River Seed – www.windriverseed.com

Species Selection/Sources

NRCS Plant Materials Centers

- **Upper Colorado Environmental Plant Center – Meeker, CO**
- **Los Lunas Plant Materials Center – Los Lunas, NM**

Species Selection/Sources

Colorado State Forest Service Seedling Tree Nursery – Ft Collins, CO

- <http://csfs.colostate.edu/seedling-tree-nursery/>
- Native and ornamental species
- Planting guides
- The only requirement to purchase seedlings and other plant materials from the CSFS Nursery is that they are used solely for conservation purposes.

Species Selection/Sources

Commercial Nurseries

- **Alpine-Eco Nursery** – Denver, CO
- **Aquatic & Wetland Nursery** – Ft. Lupton, CO
- **North Fork Native Plants** – Rexford, ID

Revegetation Methods

- Seeding
- Containers
- Cuttings



Seeding

Broadcast



Drill



Alternative Material Sources

Native Hay

Alternative Material Sources

Hand Collection



Container Stock

Standard Containers

- Rooted plant materials of various sizes
- Generally requires supplemental irrigation



Long Stem Containers

- Planted in capillary fringe
- Minimal need for supplemental irrigation
- Form adventitious roots along buried stems



Container sizes



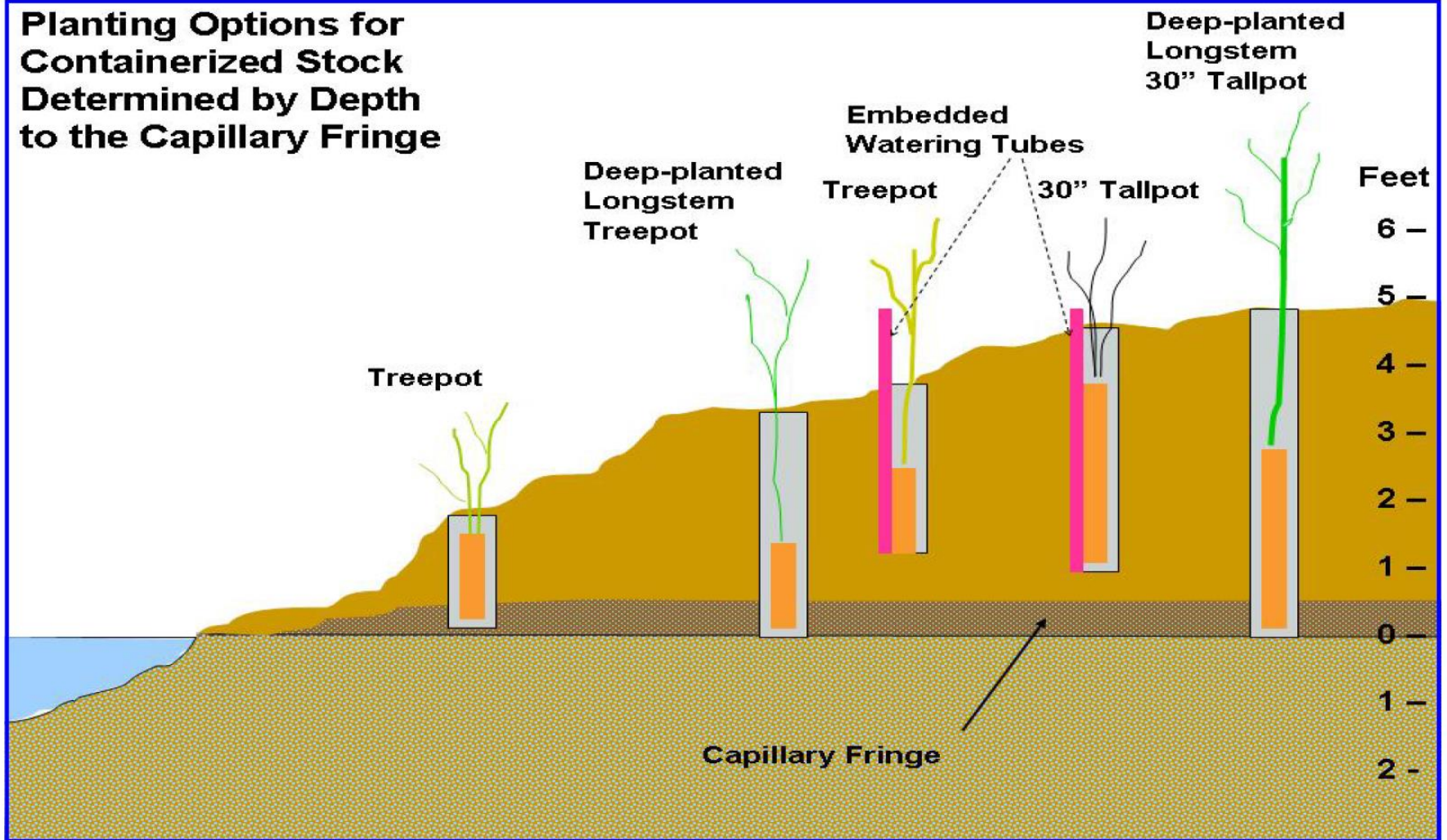
Tall Pots/Deep Pots

- Promote extensive root development
- Up to 7:1 root to shoot ratio

Standard Containers

- May require supplemental irrigation

**Planting Options for
Containerized Stock
Determined by Depth
to the Capillary Fringe**



[Guidelines for Planting Longstem Transplants for Riparian Restoration in the Southwest: Deep Planting-The Ground Water Connection](#) Los Lunas Plant Materials Center 2007. Los Lunas PMC. Los Lunas, NM. 2007. 2p. (ID# 7106).

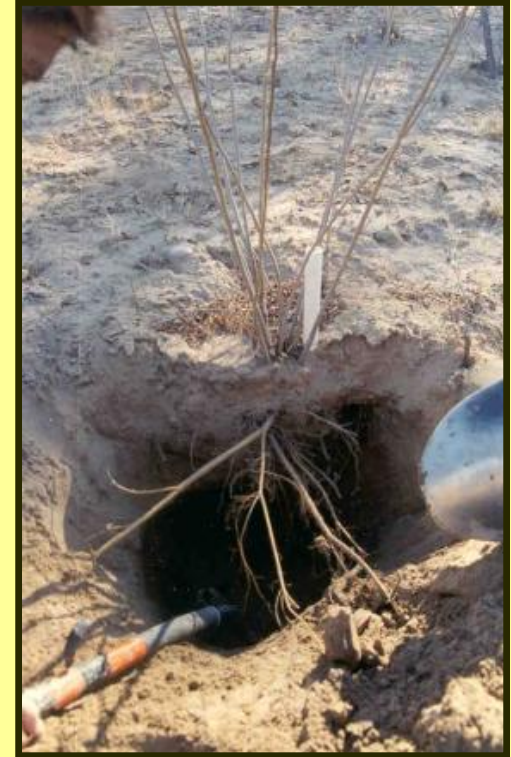
Adventitious Root Growth

Successful Species

- Golden currant
- Stretchberry
- Netleaf hackberry
- Boxelder
- Skunkbush sumac
- Silver buffaloberry
- Wolfberry
- False indigo
- Screwbean mesquite
- Emory baccharis
- Cottonwood .
- Sandbar (coyote) willow



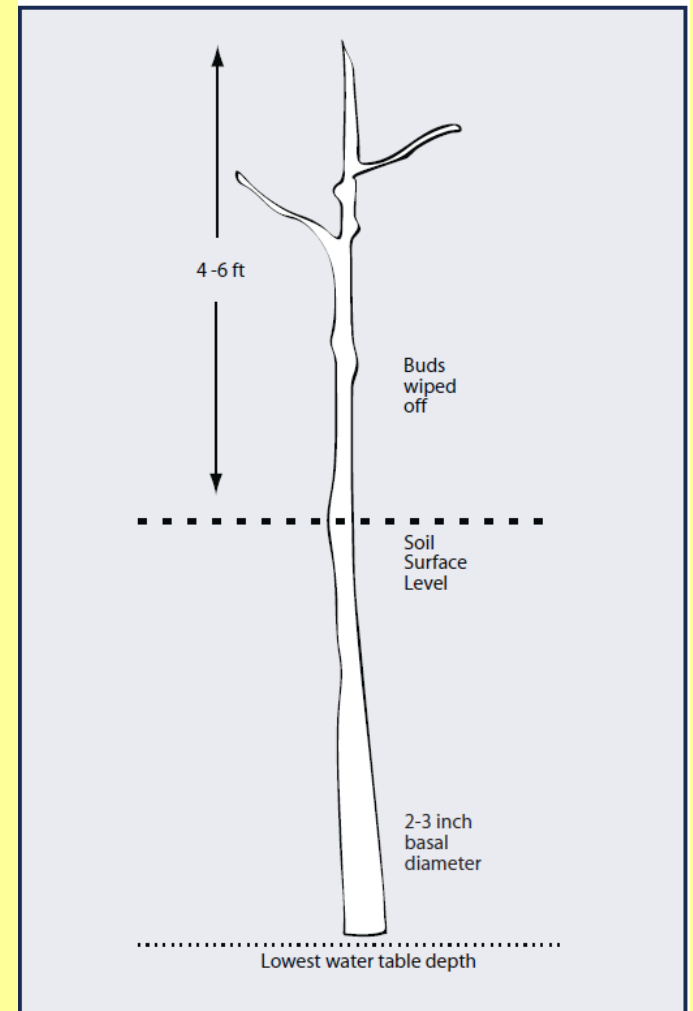
Skunkbush sumac after one growing season.



False indigo after two growing seasons.

Pole Planting

- Woody riparian species that form adventitious roots
- Dormant, un-rooted stem
- Direct contact with the water table
- 2-3 ft aerated soil above capillary fringe
- Limits need for supplemental irrigation



Pole Planting Species

- Best success with:
 - Cottonwood
 - Various willow species (coyote, Goodding's, peachleaf)
 - Redosier dogwood
 - Alder
- Lesser success with:
 - New Mexico olive
 - False willow (*Baccharis* spp.)
 - False indigo (*Amorpha fruticosa*)



Planting Poles

- Dormant season
- Right side up!
- Soil/stem contact



Willow Wattles & Stakes



Seed Bed Preparation

- Alleviate compaction
- Incorporate amendments
- Improve seed-soil contact
- Improve water infiltration



Seed Bed Preparation

- Alleviate compaction
- Incorporate amendments
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- Improve water infiltration



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Mulch

- Retain soil moisture
- Moderate temperature fluctuation
- Add organic matter/nutrients
- Straw
- Native Hay
- WoodStraw



Mulch – Straw/Hay

Pros:

- Inexpensive
- Easy to Apply



Cons:

- Wind
- Secondary weeds

Mulch – WoodStraw

Pros:

- Won't blow
- Weed free
- Long-lasting



Cons:

- Cost
- Labor intensive

Soil Stabilization/Erosion Control

- Mulch
- Check Dams
- Geotextile blanket



Soil Stabilization/Erosion Control



Soil Stabilization/Erosion Control



Soil Stabilization/Erosion Control



Monitoring - Qualitative



Monitoring - Quantitative



Weed Maintenance



Weed Maintenance

- 3-5 years
- Spot treatment
- Reduce competition
- Annual nuisance weeds drop out over time



Thank You!

