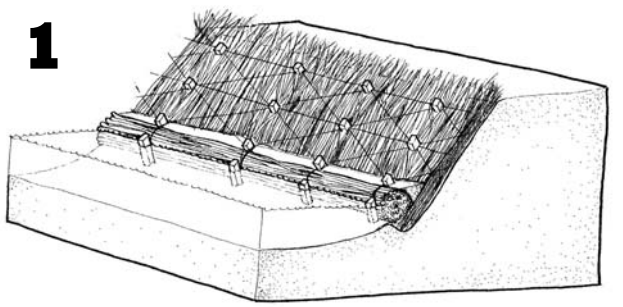


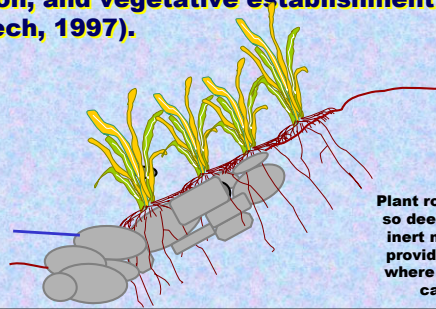
Streambank Soil Bioengineering Treatments

1



Streambank Soil Bioengineering

- Streambank soil bioengineering is defined as the use of live and dead plant materials in combination with natural and synthetic support materials for slope stabilization, erosion reduction, and vegetative establishment (Allen and Leech, 1997).



Plant roots only go so deep! Use the inert material to provide strength where the plants can not.

Streambank Soil Bioengineering

- Streambank soil bioengineering uses plants as the main structural components to stabilize and reduce erosion on streambanks rather than just for aesthetics.

- **Successful establishment of the plants, both herbaceous and woody, is extremely important.**



Streambank Soil Bioengineering

Inert material is often used in combination with the plants to:

- Take pressure off the bank which in turn allows the plants to establish
- Provide permanent strength where plants can't
- Provide temporary strength where the plants can't
- Induce sediment deposition
 - Provides an improved planting bed for the plants.
 - Deposits fine soil in areas that have little soil to start with which in turn allows plants to establish where they couldn't before – Phase II of a planting plan

Terminology

- Bioengineering
- Biotechnical Erosion Control
- Biotechnical Slope Stabilization
- Soil Bioengineering
- Ground Bioengineering
- Water Bioengineering
- Biotechnical Soil Stabilization

Advantages Soil Bioengineering

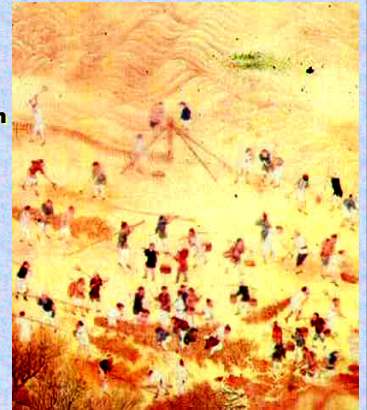
- Reinforces the streambank by roots
- Provides roughness to the streambank to reduce velocities from the above ground biomass
- Gets stronger with time as the plants grow
- Self repairing
- Provides a buffer between the river and the upland
- Provides habitat for aquatic and terrestrial species
- Filters pollutants
- Improves aesthetics
- Cost effective
- Local natural materials
- Easy to install by Landowner/Volunteers without large equipment (bulldozer, excavator, dump trucks, etc.)
- Minimal site disturbance
- Shields inert material and reduces maintenance needs
- Can increase the water uptake in areas where the riverbank is saturated

Limitations of Soil Bioengineering

- Bioengineering has various degrees of flexibility so there must be a tolerance for movement.
- Treatments are plant materials intensive and labor intensive.
- Not all areas are suitable for sustained plant growth?
- Roots go only so deep, so they will not stop deep failures.
- Plants can fail to grow
- Plants may be uprooted by freezing and thawing
- Plants may be damaged by ice and debris
- Wildlife and livestock can feed on the plants
- Increased roughness (resistance) from the mature plants can increase flood levels.
- Maintenance

Bioengineering History

- Tapestries from 28 BC Chinese emperor's tomb show Chinese peasants installing Willow Wattles for riverbank stabilization on the Yellow River.
- Early western visitors to China told of riverbanks and dikes stabilized with large baskets woven of willow, hemp, or bamboo and filled with rocks.



Bioengineering History

- A bioengineering manual was published in 1791 by Woltmann that illustrated live stake techniques.
- About 1800, Bioengineers in Austria were using brush trenches to trap silt and reshape channels.
- In the 1900's, European bioengineers were using many of the treatments that we use today.
- In the 1930's, pre-war Germany used the treatments in to save money.



Bioengineering History

After WW II, moved streambank protection away from plants and into harder structures.

- Availability of surplus bulldozers, excavators, dump trucks and other heavy equipment
- Increased understanding of engineering and construction using concrete and rock
- Only recently have we started to move back to plants and soil bioengineering

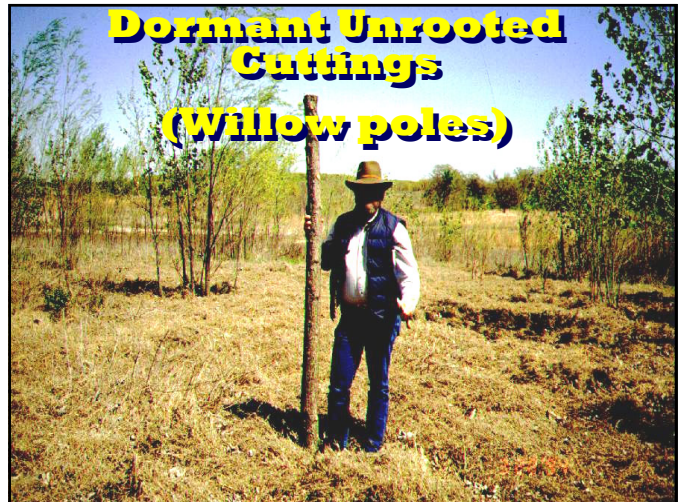


RIPARIAN RESTORATION

Riparian restoration is similar to riparian management

It takes an INTERDISCIPLINARY Approach

Dormant Unrooted Cuttings (Willow poles)





Trout Creek, NV - Planted 6/1992

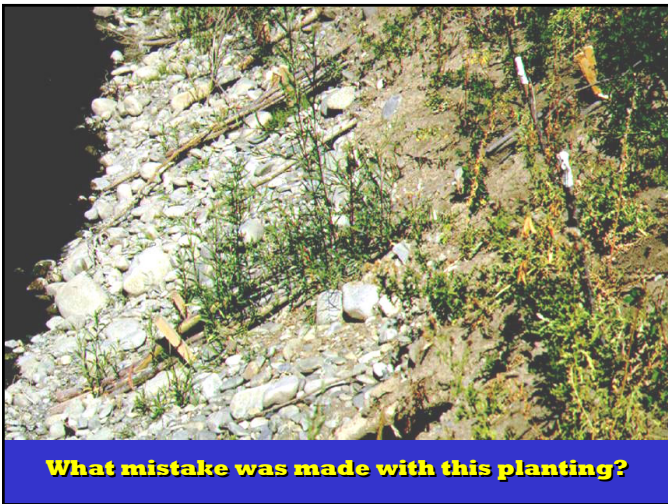


Trout Creek, NV - 9/1992



Trout Creek, NV - Aug, 2000

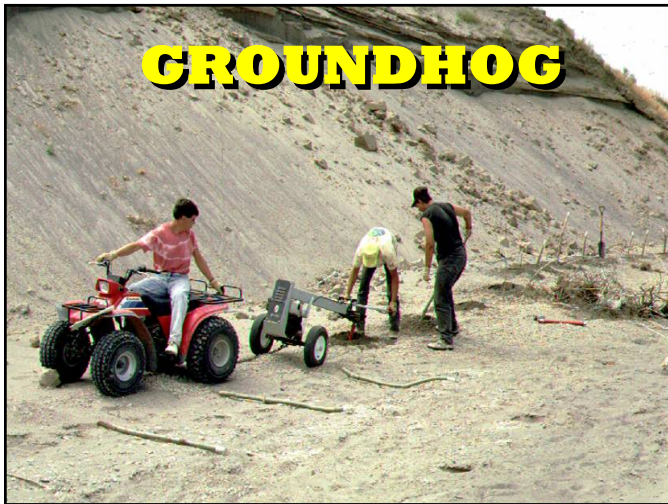




**Dormant
Unrooted Cutting
Planting Methods**



POWER AUGER



GROUNDHOG



Tractor Mounted Auger



WATERJET STINGER:

A tool to plant dormant unrooted cuttings



Waterjet Stinger Trailer



Force of the water liquefies the soil so a cutting can be pushed into it.



Example Planting

**Willow Poles -
4 feet deep,
2 rows,
2 feet apart,
2 feet between rows,
section 100 ft long,
with 5 people -
TOOK 16 MIN.**



NO WATER SOURCE AVAILABLE:

- 1000 gal water trailer
- planted 400 ft
- double row of willows
- 3-4 ft deep
- 3x3 spacing
- 6 people
- 1 hour
- 300 gal water left

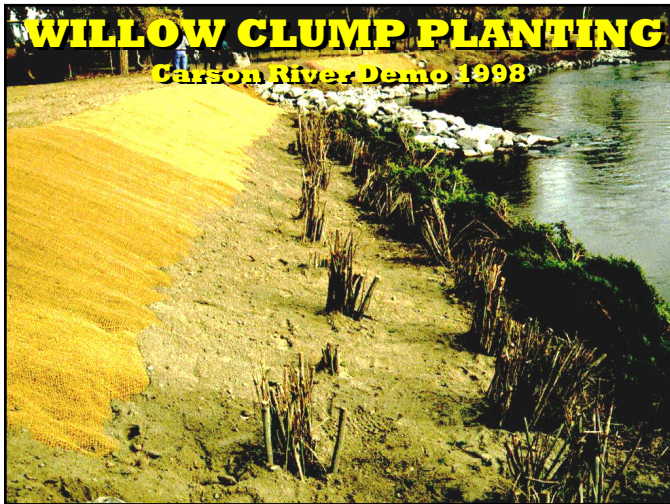


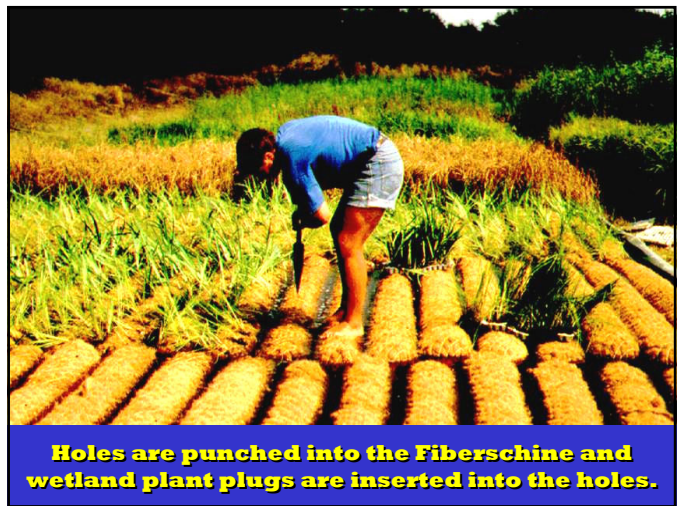
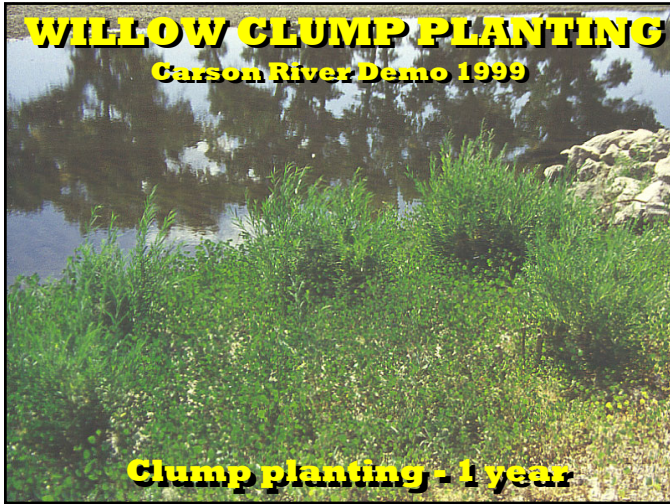
Waterjet Stinger on a raft and a canoe in an area with limited accessibility.



WILLOW CLUMP PLANTING









**Fiberschine
Installation**



Natural Channel Design, Little Colorado River

**Fiberschines
used as toe
protection**



EROSION CONTROL FABRIC





