Lessons from Floodplain and Riparian Revegetation

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Why revegetation fails (the short list)

- Low fall and/or spring rainfall
- Flooding in seeding areas
- Herbivory
- Seasonal inundation in planting areas
- High flood velocity/scouring
- Early fall hard freeze
- Frost-heave

- Poor/no site prep weed control
- Poor/no weed control post-planting or post-seeding
- Deep water table
- Sandy/low nutrient soils
- Plant material not placed in moist soil, and no irrigation
- Plant materials freeze/dry out before planting
- Plant materials not adapted for site conditions
- Site prep and establishment work are not budgeted
- Planting method doesn’t work in soil conditions
Overview

• Lessons learned in revegetation
• Floodplain revegetation approach
• Techniques for planting on elevated banks/floodplains
LESSONS LEARNED

- Plan!
- Sites and projects are variable
- Try new things!
Understand Your Project

• What is your functional goal?

• Timing of:
  – Funding?
  – In-water work windows?
  – Precip and stream flows
  – Plant installation windows

• Budget:
  – Irrigation
  – Weed suppression
  – “Natural” aesthetics vs. costs

• Planting method
Understand Your Site

- Site history – what happened before?
- Soils
- Hydrology
  - Water surface elevations
  - Timing, duration, velocities, extent of high/low flows
- Existing vegetation
- What are key threats?
Understand Your Species

- What function do you want from your plants?
- Locally adapted material
- Consider the ecology of reveg species
  - Do they establish easily?
  - Are they vigorous sprouters?
  - Are they adapted to site hydrology, soils, etc?

→ Historically-occurring species are not necessarily the best choice
FLOODPLAIN RESTORATION

Understand site, species
Site prep
Weed control – site prep AND post-planting
Acquire plant materials
Seed native grasses
Plant trees, shrubs, forbs
Monitoring
Goals:
1) Reduce seed bank
2) Eliminate perennial species

1-3 years chem fallow as site prep

3) Reduce competition after seeding

1-2 years post-seeding

3 years after seeding
FLOODPLAIN RESTORATION

Weed control

2005 prior to chem fallow
FLOODPLAIN RESTORATION

Weed control

2006 First spring chem fallow
FLOODPLAIN RESTORATION

Weed control

2008 after 3 years chem fallow; seeded fall 2008
Weed control

2011, 3 yrs after seeding
Propagate plant materials

Grass seed increase
- For new genotype, 3-4 years from seed collection to harvest
- For orders, place spring/summer before planting date

Native riparian woody species
- For locally collected, min. 18 months for collection and propagation
- For other orders, 1 year before planting date
Factors affecting seed establishment:

- Seed-soil contact
- Soil depth $\frac{1}{8}'' - \frac{1}{2}''$
- Soil moisture
- Low residuals
- Fall prior to rain/soil freeze

Methods:

- No-till drill
- Broadcast-harrow
- Handseed and rake
- Hydroseed
FLOODPLAIN RESTORATION

Results – What to expect?

Examples: 3 sites
- Seeded fall after 1-2 yrs site prep
- Floodplain grass mixes
- Different soils

Seedlings in Year 1

Germination Rate
Examples: 3 sites

- Seeded fall after 1-2 yrs
- Site prep
- Floodplain grass mixes
- Different soils

Results – What to expect?

**Seedlings in Year 1**

<table>
<thead>
<tr>
<th>Site</th>
<th>Seedlings/m²</th>
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<tbody>
<tr>
<td>Site 1</td>
<td>60 ± 5</td>
</tr>
<tr>
<td>Site 2</td>
<td>15 ± 2</td>
</tr>
<tr>
<td>Site 3</td>
<td>45 ± 3</td>
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**Germination Rate**

<table>
<thead>
<tr>
<th>Site</th>
<th>Percent Germination</th>
</tr>
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<tbody>
<tr>
<td>Site 1</td>
<td>12 ± 1</td>
</tr>
<tr>
<td>Site 2</td>
<td>2 ± 0.5</td>
</tr>
<tr>
<td>Site 3</td>
<td>8 ± 0.7</td>
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Results – What to expect?

Cover of Seeded Grasses

Percent Cover

Year 1
Year 2

Site 1
Site 2
Site 3
FLOODPLAIN RESTORATION

Results – What to expect?
Results – What to expect?

FLOODPLAIN RESTORATION
FLOODPLAIN RESTORATION

Results – What to expect?
Results – What to expect?

Cover of Seeded Grasses

Introduce shrubs/trees 2+ yrs after seeding
Getting plants to moist soil

Challenge: Low water table (3-8 ft below soil surface)

Examples:
1) Cle Elum River
   - Inverted flow regime
     • Highest flows during maximum growth period
     • Banks well out of moist soil zone during spring, fall
     • Changes in flow are rapid
   - High flows scour banks
2) Yakima floodplain
   - Variable depths to water (1-6 ft)
Tall container plants

Methods

– Tall treepot material
– Species with vigorous vegetative reproduction
– Excavator bucket holes
– 3-10 plants per hole, placed by crew
Goal
– Install plant roots into moist soil

Plant material
– 6 ft tops, tall treepots

Results
– 95% survival across sites, Yrs 1 and 2

Lessons learned
– Expensive (machinery and handwork) but good returns on investment

CLE ELUM RIVER

Tall container plants
(high elevation)

2 yrs after planting
Tall container plants
(high elevation)

Goal
– Install plant roots into moist soil

Plant material
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Results
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Deep Planting Survival

<table>
<thead>
<tr>
<th></th>
<th>ALIN</th>
<th>COST</th>
<th>POTR</th>
<th>SAME</th>
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<tr>
<td>2015</td>
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<td>2016</td>
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Tall container plants
(low elevation)

Goal
  – Protect plants from scour
Plant material
  – 3 ft tops, 40 cu in
Results
  – 55% survival Year 1
  – 10% survival Year 2
Lessons learned
  – Total inundation during long-duration high flows
  – Taller material may have worked?
Vertical bundles

Goals

– Increase plant cover along steep banks
– Live stake installation into cobble soil
– Allow for large changes in water elevation

Methods

– 6-ft live stakes bundled together
– Staked into shallow trench and covered, upper foot exposed
– Bottom end secured at low water line
Vertical bundles

Year 1:
- 62% average bundle survival among sites

Lessons learned
- Large loss to scour
Vertical bundles

Year 2

- 10% average bundle survival
- Strong spring flood flows

Lessons learned

- High flow velocities, duration, and timing are too extreme for method
- Use tall plants, top of bank
- Bundle cost = tall treepot
Goal
• Install plant roots into moist soil (elevated banks)

Plant material
– 6 ft tops, tall treepots

Method
– Hydraulic stinger
Reecer Creek floodplain, 5 yrs after planting