Prescient Revegetation: Factors Influencing Plant Establishment Period

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Topics covered

- Riparian Plant Establishment—Time Frames
- Risks during Establishment Period
- Management Strategies to Address Risks
- Factors that Drive Establishment Period
- Applications to Monitoring and Performance Measures

Riparian Plant Establishment—Time Frames

Vegetation Development—Jocko River

2005

2006

2007

2012

Vegetation Development—Milltown Site

2010

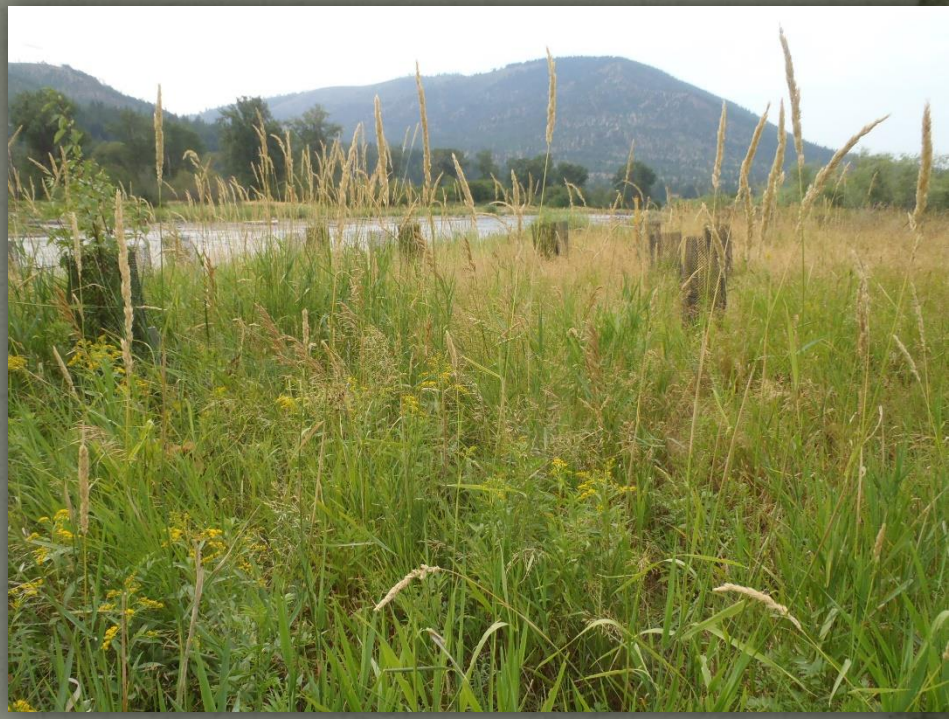
2011

2013

2014

Milltown Site—Floodplain areas seeded in 2009

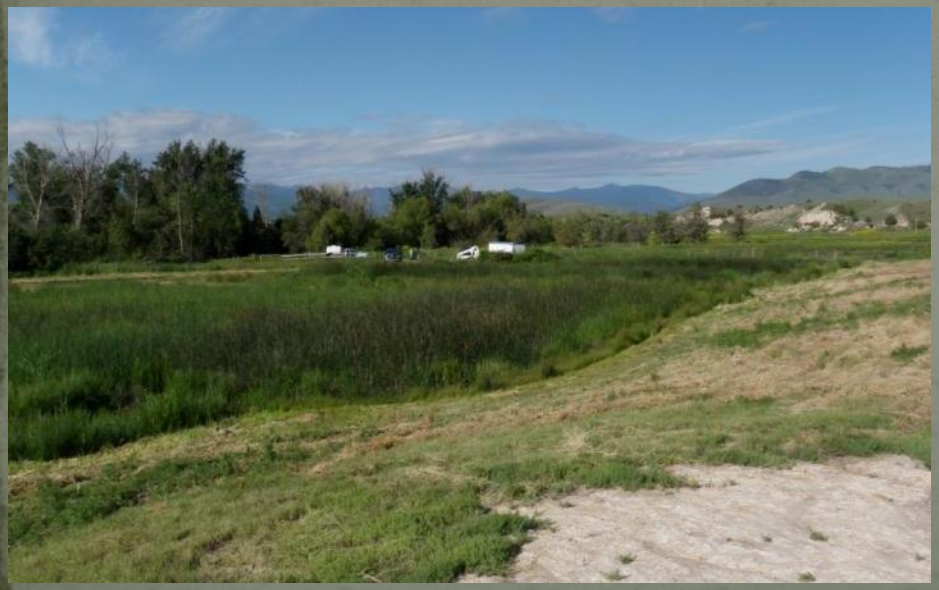
August 2010



August 2012

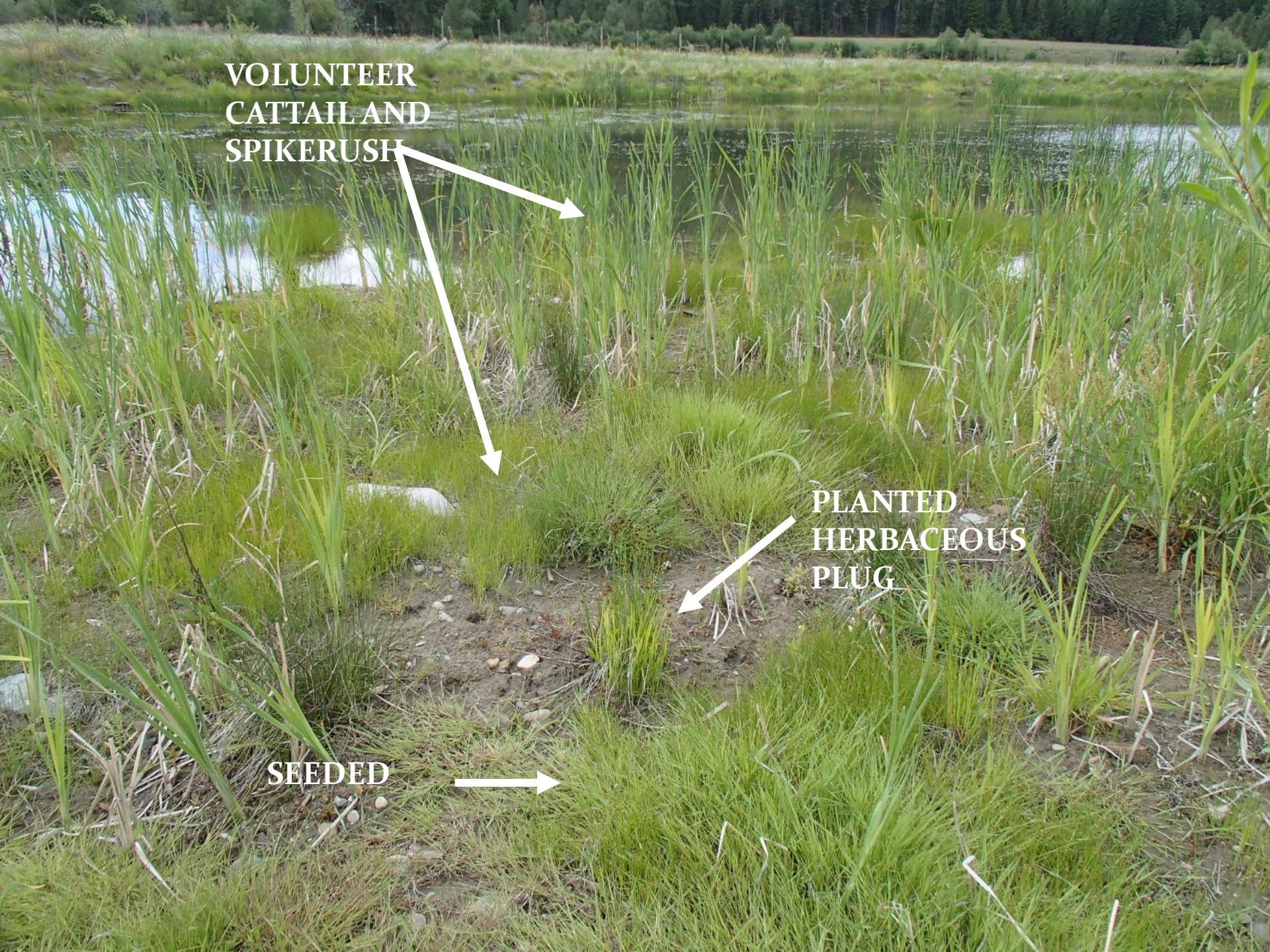
September 2008 (2 months after construction)

June 2009



June 2010

August 2011


VOLUNTEER
CATTAIL AND
SPIKERUSH
PLANTED
HERBACEOUS
PLUG
SEEDED

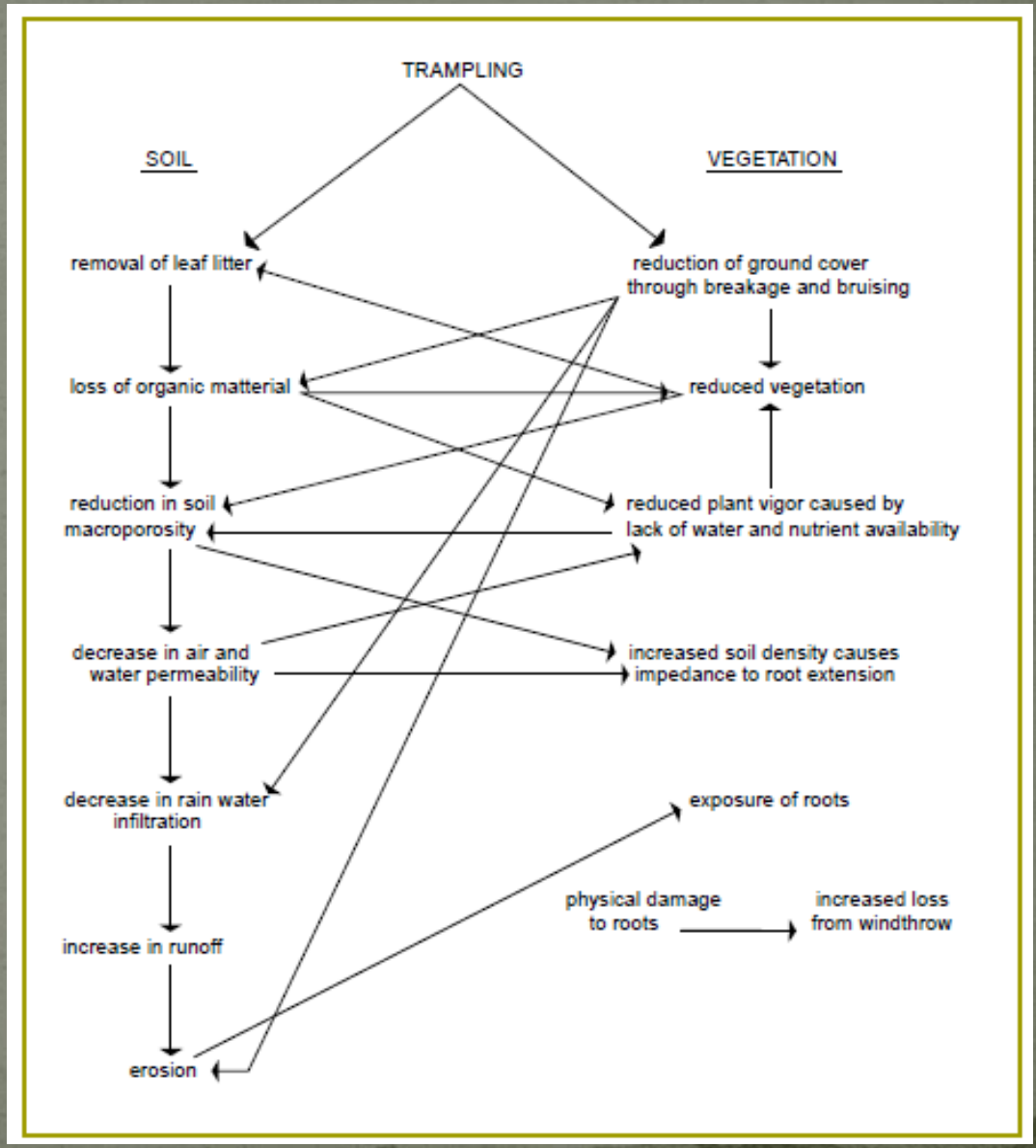
Risks During Establishment Period

Risks During Establishment Period

- Trampling
- Livestock Grazing
- Wildlife Browse
- Competition
- Contamination
- Other Disturbances

Trampling—recreation impacts

- Can reduce
  - Water infiltration
  - Vegetation cover
  - Plant germination
  - Plant growth
  - Organic matter
  - Water holding capacity
- Can Increase
  - Runoff
  - Erosion

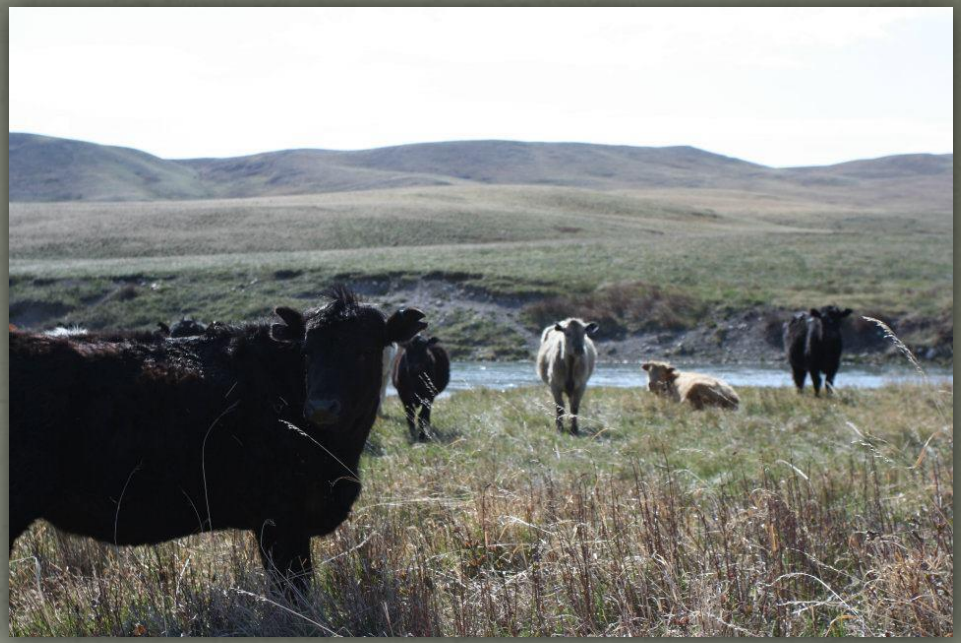


Trampling—managing risk

- At Milltown Dam, the Clark Fork River was closed for several years during and after construction to allow vegetation time to establish.
- The Upper Clark Fork Phase 1 project area is closed until Sept. 2015 to allow bank vegetation time to establish.

Livestock Grazing

- Can reduce
  - Vegetation cover
  - Water infiltration
  - Plant germination
  - Plant growth
  - Organic matter
  - Water holding capacity
- Can Increase
  - Erosion
  - Soil compaction
  - Runoff



Grazing—managing risk

- Conservation agreements associated with the Upper Clark Fork project will include a period of no grazing, and any subsequent grazing will be monitored closely and linked to specific targets.

Combination livestock/wildlife fence on the Kootenai River

Wildlife Browse

Wildlife Browse—managing risk

Competition and Invasive Species

Competition and invasives—managing risk

Contaminated soils

Management options:

- Remove and replace with clean soil
- Treat in place

Other Risks

- Floods
- Drought
- Scour
- Sedimentation

- (But these are all natural processes, so the best way to manage for these risks is to make the design accommodate the processes)

Vegetation Limited by Scour and Drought

2006
As Built

2011

So how long does it take plants to grow?

- We can predict this based on successful projects, but those growth rates cannot be achieved passively.

- Need to be aware of risks and follow riparian revegetation best practices…

Riparian Revegetation Best Practices

- Hydrologically connected floodplain
- Roots in contact with seasonal low water table
- Protection from deer, livestock, beavers, other rodents and birds
- Space to grow (protection from competition and access to light)
- Water in dry years or on high surfaces
- Exercise patience

Factors that Drive Plant Establishment Period

Fredric Clements

- Climate is the main force that influences biological communities
- Seres highly predictable and deterministic always progressing towards a climax community
- Monoclimax
- A plant community is a distinct organism, not an assemblage of interacting components

Photo Courtesy of The Campbell Ranch Research Project

Succession

- Change of biological community structure leading to different species composition over time, ultimately leading towards a climax community (until disturbance resets or dials back the system)
- Driven by
  - Abiotic components such as
    - Light intensity
    - Soil conditions
    - Hydrology
    - Climate
  - Biotic components such as
    - Competition

Sir Arthur Tansley

- Environmental factors influence biological communities within a region that will create different climax formations
- Multiple possible climax states
- A community is a group of species that occur in the same location for independent reasons

including soils, available water, and other components of the ecosystem.

Photo Courtesy of The Register, UK

Jared Diamond

- First proposed Assembly Rules in the 1970s
- Competition, not random migration, is responsible for determining changes in community structure
- Multiple Different climax states
- Driven by competition

Photo Courtesy of Radio Live, New Zealand

Assembly Rules (one newer interpretation)

- Communities are assembled as a product of chance based on how species arrive, how they survive, and how they interact with other species.

- How is an ecosystem assembled?
  - How do the species arrive?
    - Migration
    - Chance (e.g., non-native species)
  - How do they survive?
    - Soil conditions
    - Hydrology
    - Climate
  - How to they interact with other species?
    - Competition
    - Mutualism

Selecting Plants for Revegetation

Biogeographic Attributes	Distribution Habitat Elevation
C-Value	Relative Tolerance to Disturbance
Management Attributes	• Risks • Advantages • Requires intensive management • Potential for natural recruitment • Availability • Plant material • Functional group • Phenology • Successional status • Shade tolerance • Cultural significance • Metal tolerance

Applications to Monitoring and Performance Measures

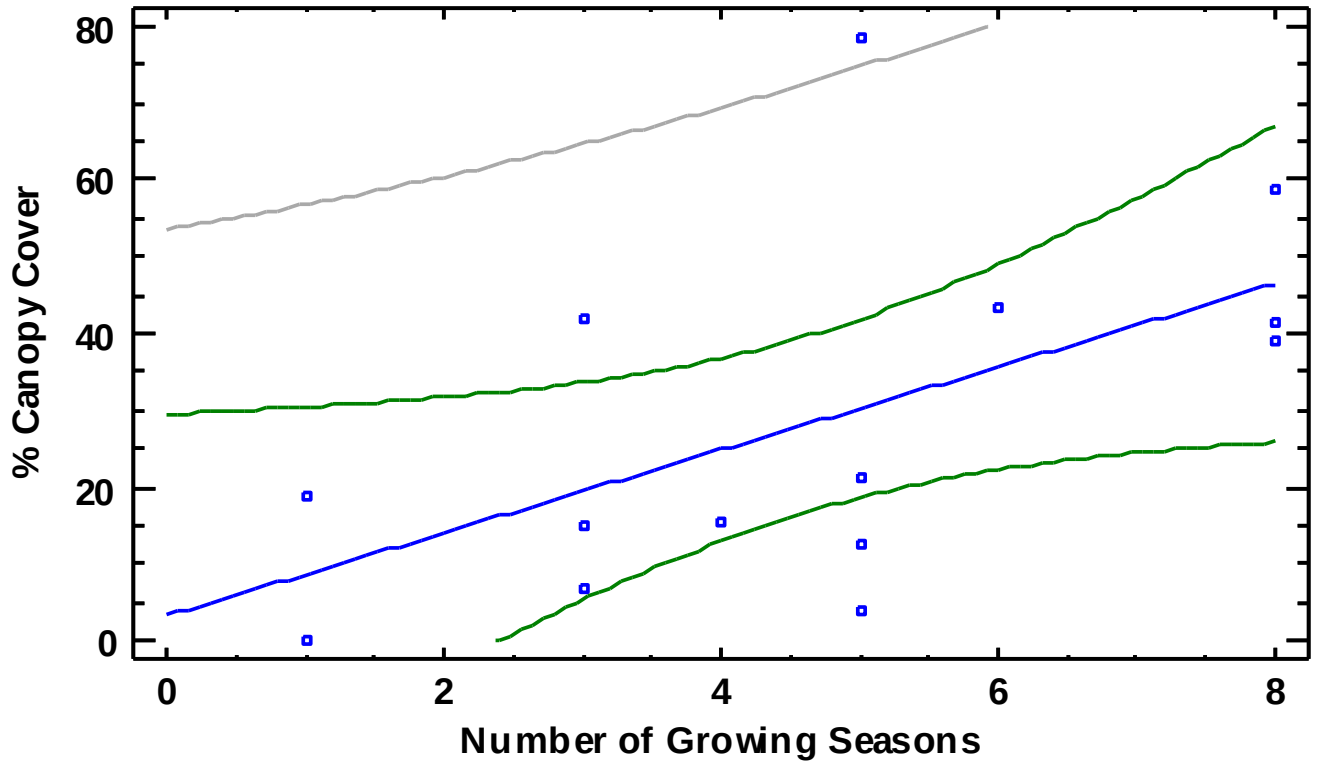
Observed Streambank Vegetation—Completed Projects and Natural Banks

Age	Sample Size (n=169)	Mean Canopy Cover (%)	Canopy Cover Min-Max (%)	95% Confidence Interval around Mean (%)
1-5 years	148	25.1	0-86.7	+/-3.2
5-15 years	14	44.2	8.9-79.9	+/-13.3
>15 years	7	87.7	82.2-93.3	+/-3.6

Observed Floodplain Vegetation—Completed Projects

Growing Season after installation	Number of plots sampled	Survival (%)	95% Confidence Interval around mean
1	72	89.3	+/- 3%
2	32	72.9	+/- 8%
3	29	69	+/- 11%
4	19	52.9	+/- 11%
5	15	75.8	+/- 9%
6	10	78	+/- 5%

Observed Floodplain Vegetation—Completed Projects



Upper Clark Fork Performance Targets for Revegetation

Growing Season after installation	Survival (%)	Total Native Canopy Cover (%)	Woody Plants Canopy Cover (%)	Streambank Woody Canopy Cover (%)
1	80	20		
3		50		
5		80	30	40
10			50	60
15				80

Selected Vegetation Resources

Plant Resources-Online Databases

- MTNHP Plant Field Guides
  - http://fieldguide.mt.gov/displayClasses.aspx?Kingdom=Plantae
- USDA/NRCS Plants
  - http://plants.usda.gov/java/
- FEIS Database
  - http://www.feis-crs.org/beta/

Photo courtesy of Ariel Rademaker

Plant Resources-Published

- Goodwin and Sheley (2003)
  - Revegetation Guidelines for Western Montana

Species	Growth form	Preferred Soil Type	Erosion Control	Notes
Idaho fescue *(Festuca idahoensis)*	Bunchgrass	Silty-loamy	Good	Moderately drought tolerant. Slow establishment. Poor seedling vigor. Mature stands are strongly competitive. Good palatability to wildlife and livestock

- Hoag et al. (2001)
  - Users guide to the description, propagation and establishment of wetland plant species and grasses or riparian areas in the intermountain west.

Species	Rate of Spread	Acidity tolerance	Salinity Tolerance	Wildlife Value
Sloughgrass *(Beckmannia syzigachne)*	Rapid	unknown	unknown	Waterfowl and small mammal food

Questions?