Elwha River Revegetation Project

Vegetation Restoration in the Former Reservoirs: A Tale of Two Surfaces

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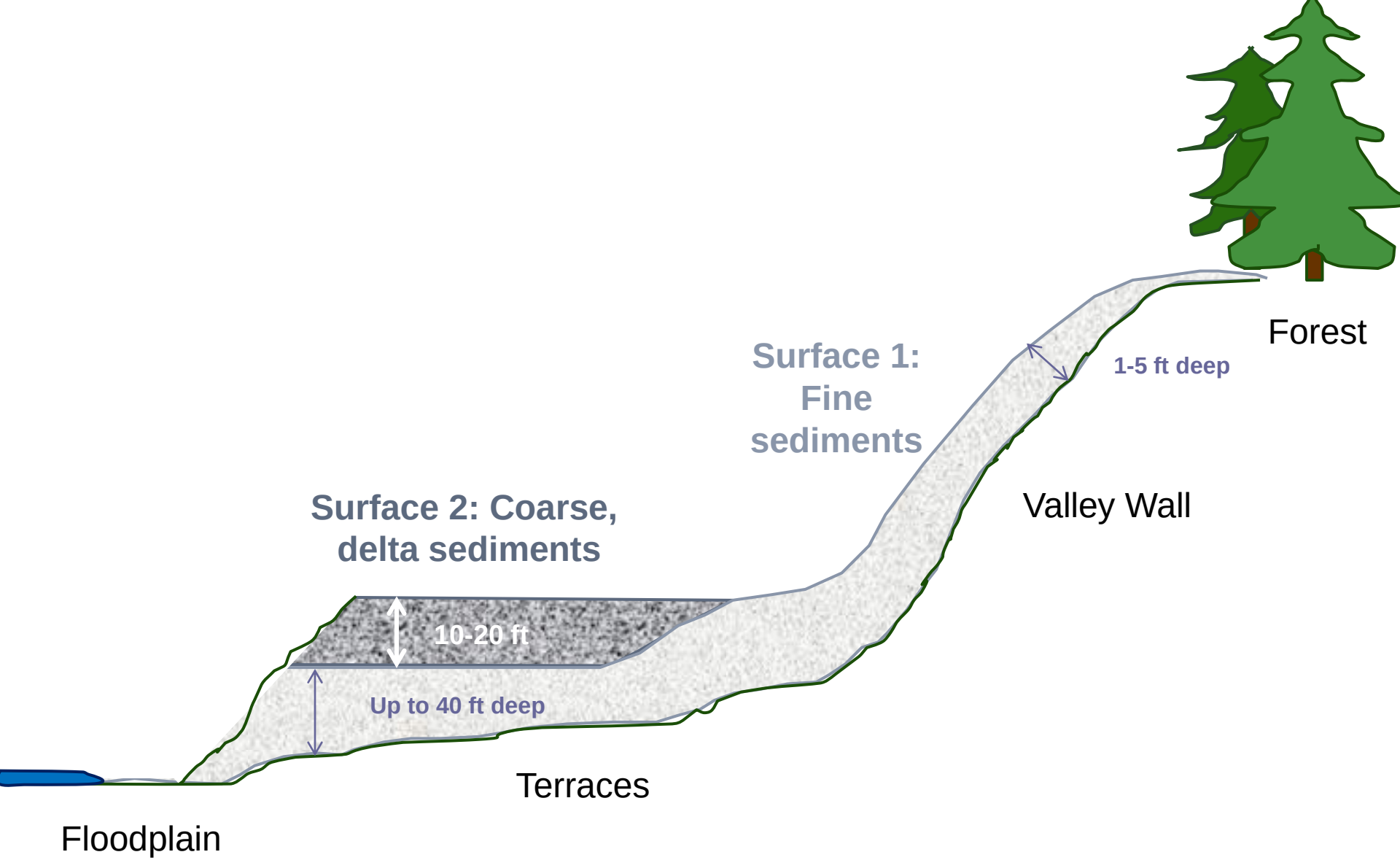
May 16, 2017

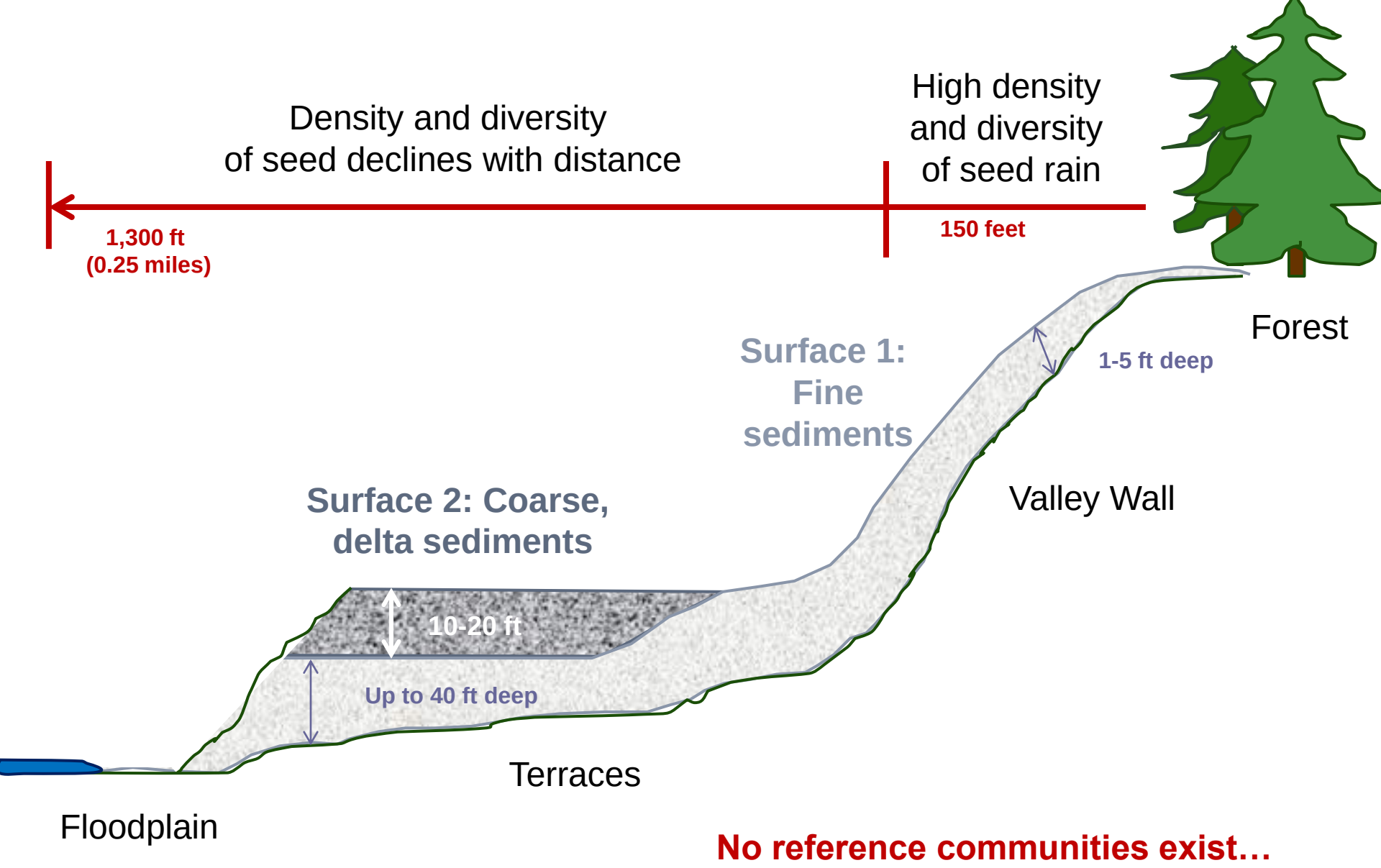

Lake Aldwell
2009
Elwha Dam


Glines Canyon
Dam
Lake Mills
2009


Lake Aldwell
2016


Lake Mills
2016


Forest
Surface 1:
Fine
sediments
1-5 ft deep
Surface 2: Coarse,
delta sediments
Valley Wall
10-20 ft
Up to 40 ft deep
Terraces
Floodplain



No reference communities exist…

Revegetation Project Overview

- Project goals:
  - Minimize invasive species populations
  - Restore ecosystem processes
  - Accelerate ***forest*** development
    - Is the cover of bare ground declining annually?
    - Are native woody species (trees in particular, planted and/or naturally occurring), increasing in cover annually?
    - Native woody species richness?

Revegetation Project Overview

- Adaptively manage the project.
  - Allow natural regeneration wherever possible!
- Phase the project to allow adaptive management
  - Planting phased over 7 years
  - Experimental plantings 2012-2013

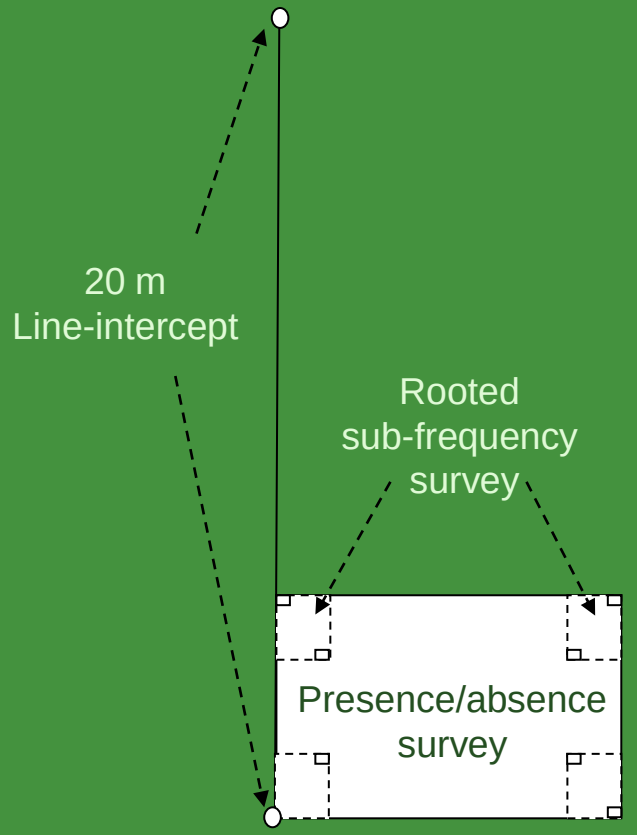
Project accomplishments

(2011- 2017)

- Began planting in November 2011
- 325 acres planted/seeded
  - **62% of the 525 acres *proposed for planting***
  - **43% of the exposed land**
- ~320,000 native trees, shrubs and herbaceous plants
  - 63 native species
  - High diversity!
- ~6,000 lbs of seed sown
- 95 permanent plots surveyed since 2012

Vegetation Survey Methods

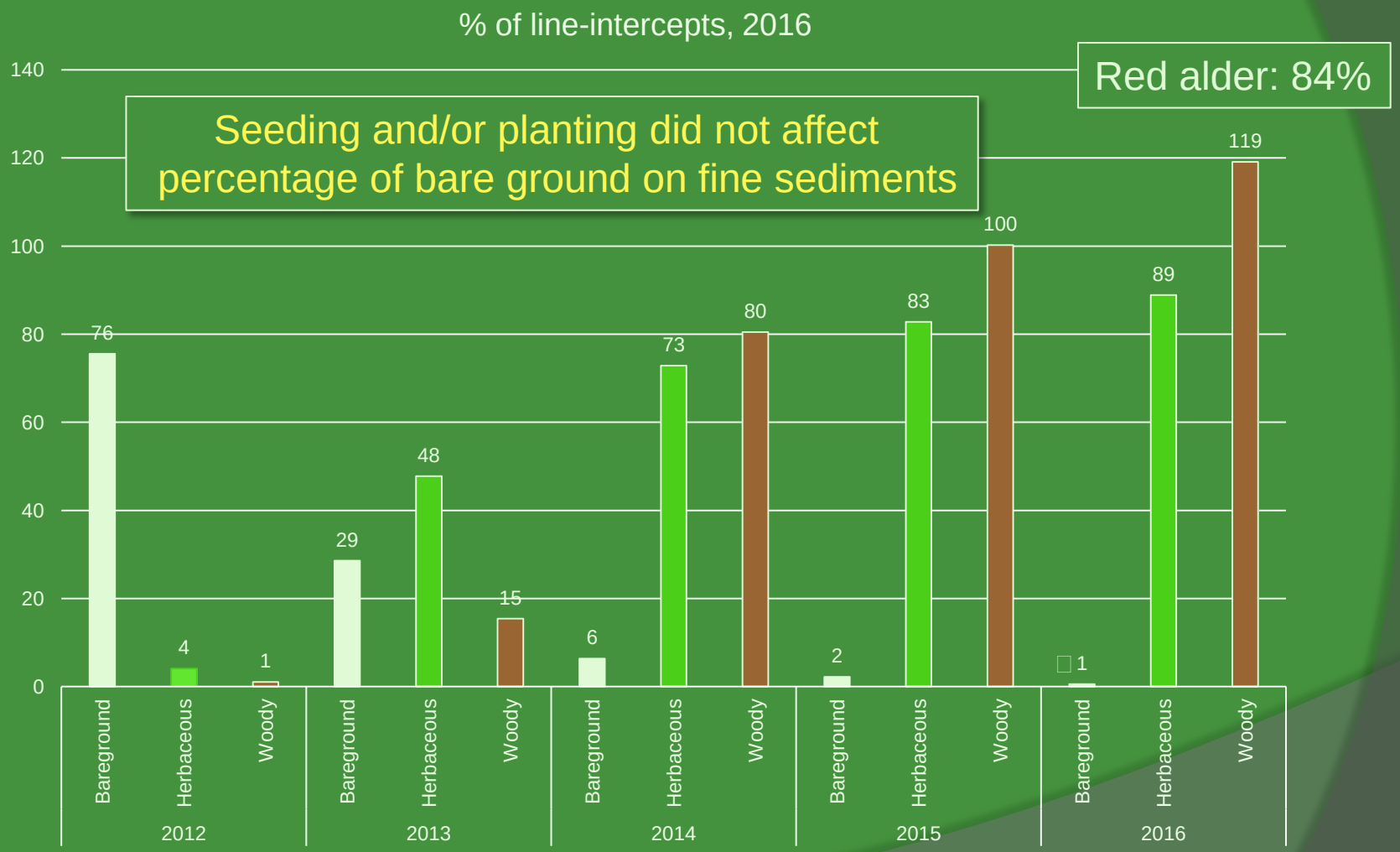
- Cover of vegetation and bare ground:
  - 20 meter line intercept
- Native/non-native abundance:
  - Rooted sub-frequency survey
- Vegetation community structure:
  - Presence/absence in a 50m^2 plot



Surface 1: Fine Sediments

Former Lake Mills
November 2012

Valley Wall (fine sediments), former Lake Mills Reservoir



Cover of red alder: 0%

Former Lake Mills
Fine sediments
Untreated Site

July 2012

bareground: 69%

cover of red alder: 38%

Former Lake Mills
Fine sediments
Untreated Site

July 2013

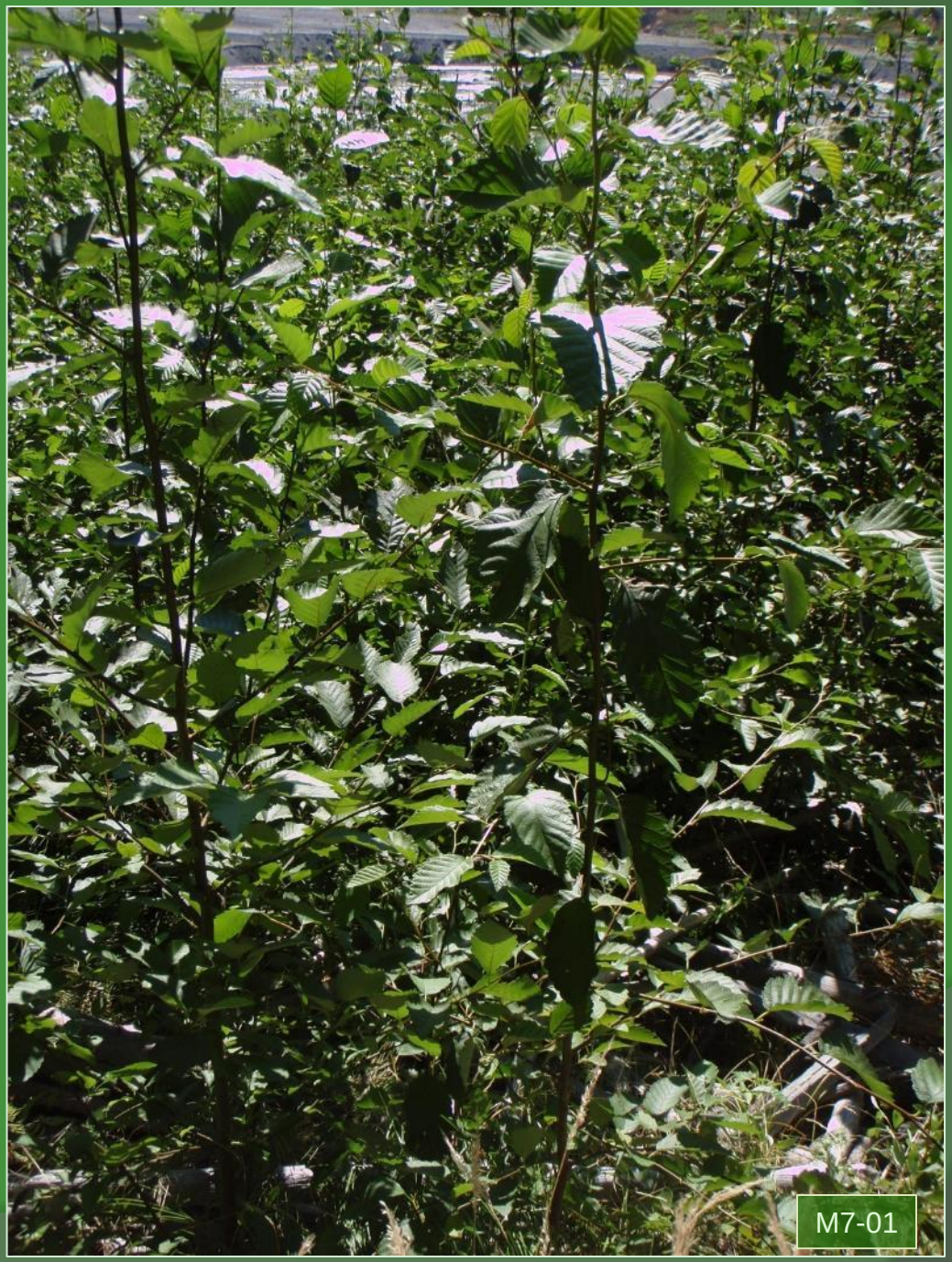
bareground: 4%

cover of red alder: 86%

Former Lake Mills
Fine sediments
Untreated Site

July 2014

bareground: 0.3%



cover of red alder: 100%

Former Lake Mills
Fine sediments
Untreated Site

July 2015

bareground: 0%

cover of red alder: 100%

Former Lake Mills
Fine sediments
Untreated Site

July 2016

Average canopy height: **20ft!**

Stem density: **11,940 per acre**

bareground: 0%

Cover of Douglas-fir: 0%

Former Lake Mills
Fine sediments
Planted Site

July 2012

bare ground: 89%

Cover of Douglas-fir: 0.4%

Former Lake Mills
Fine sediments
Planted Site

July 2013

bare ground: 41%

Cover of Douglas-fir: 3%

Former Lake Mills
Fine sediments
Planted Site

July 2014

bare ground: 14%

Cover of Douglas-fir: 10%

Former Lake Mills
Fine sediments
Planted Site

July 2015

bare ground: 0%

Cover of Douglas-fir: 16%

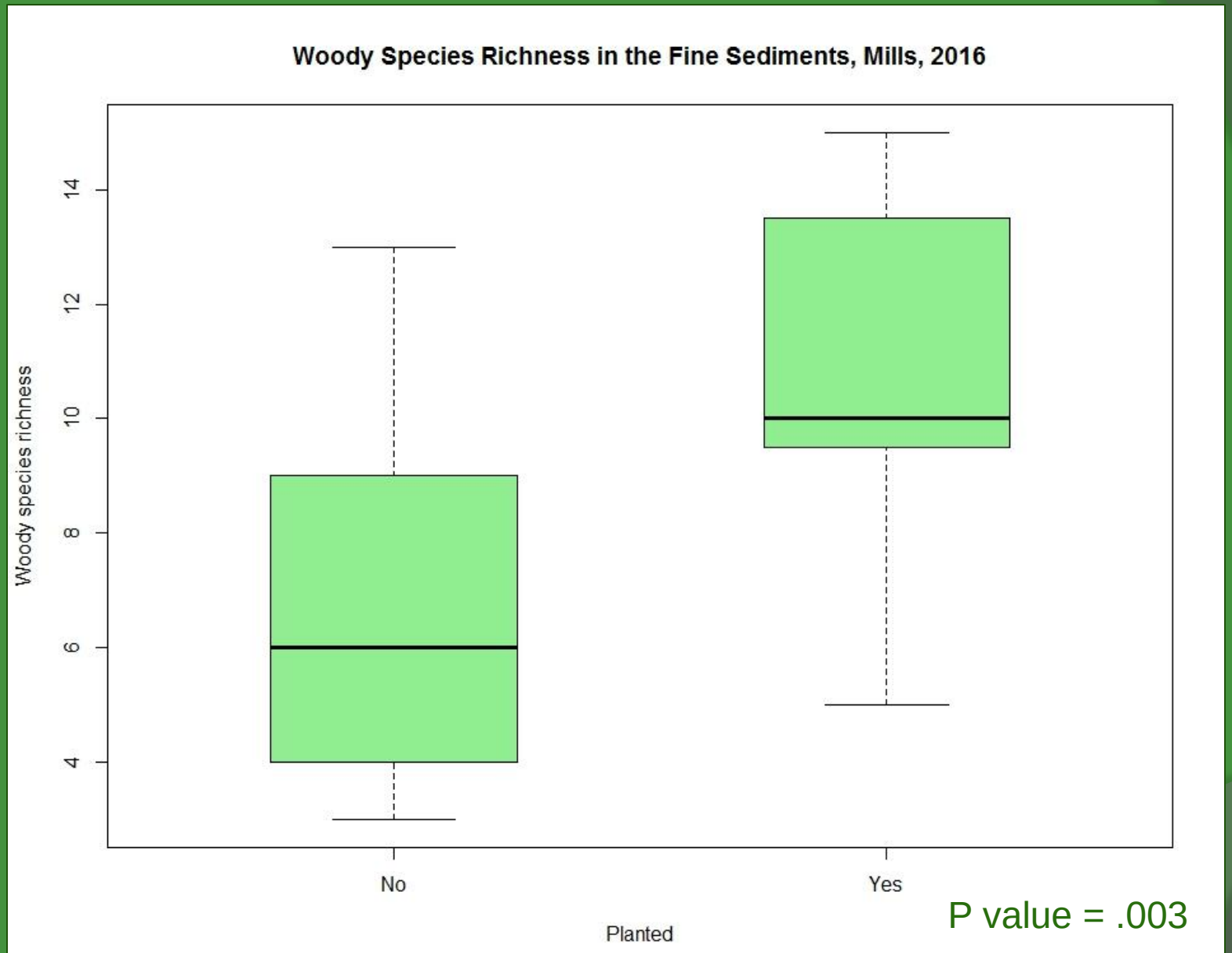
Former Lake Mills
Fine sediments
Planted Site

July 2016

bare ground: 0%

Untreated: 2016

Planted: 2016


Woody Species Richness in the Fine Sediments, Mills, 2016
Woody species richness
4
6
8
10
12
14
No
Yes
Planted

P value = .003

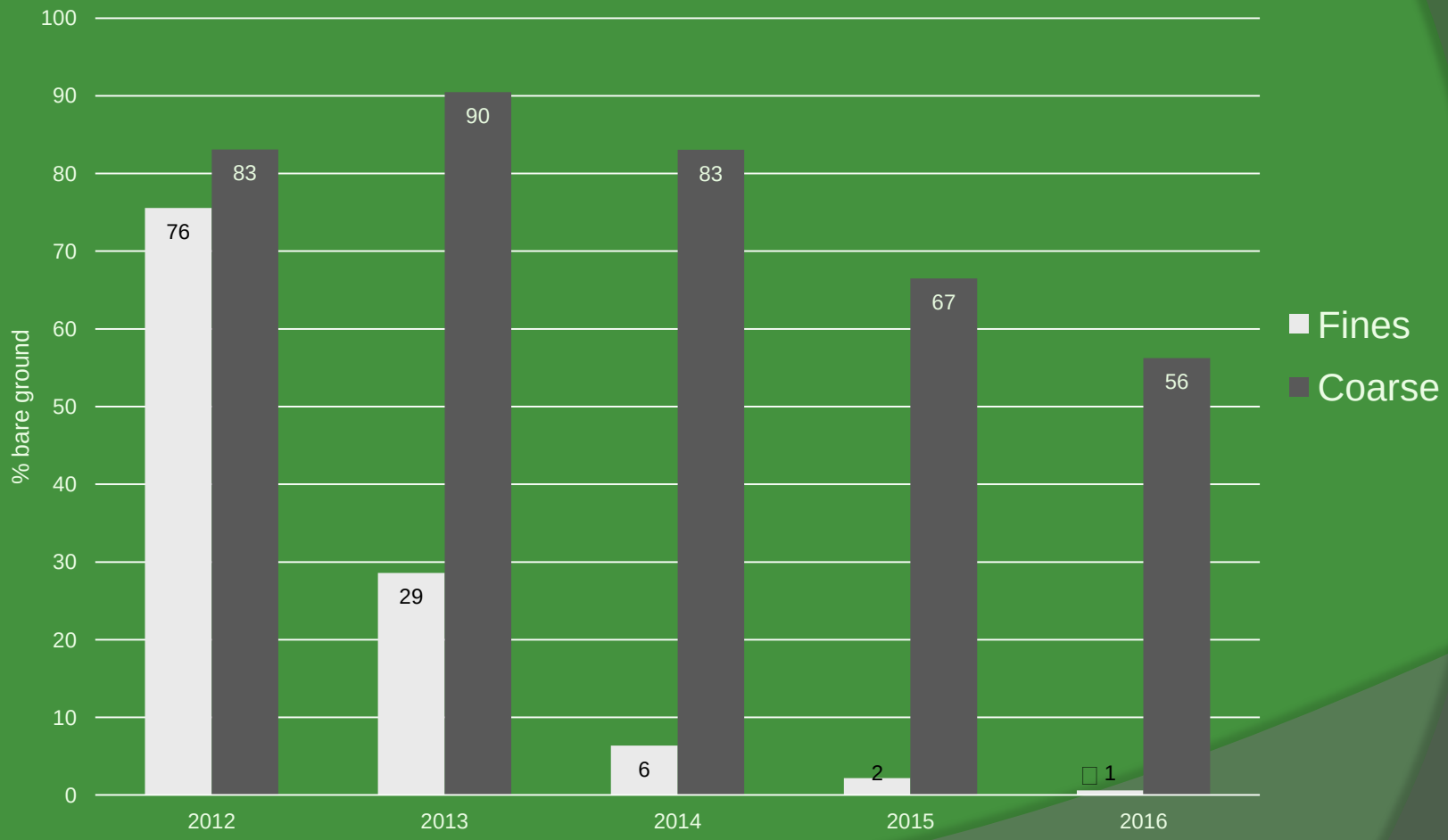
Woody species composition

- Composition of woody species was significantly different in planted sites
  - p-value = 0.0063
- Indicator species:
  - Douglas-fir, Nootka rose, grand fir, western red cedar, thimbleberry, snowberry, western crabapple, twinberry

Surface 2: Coarse Sediments

Former Lake Mills
June 2013

Changes in *bare ground* in the former Lake Mills Reservoir



Coarse terrace
November 2011: before planting


August 17, 2012

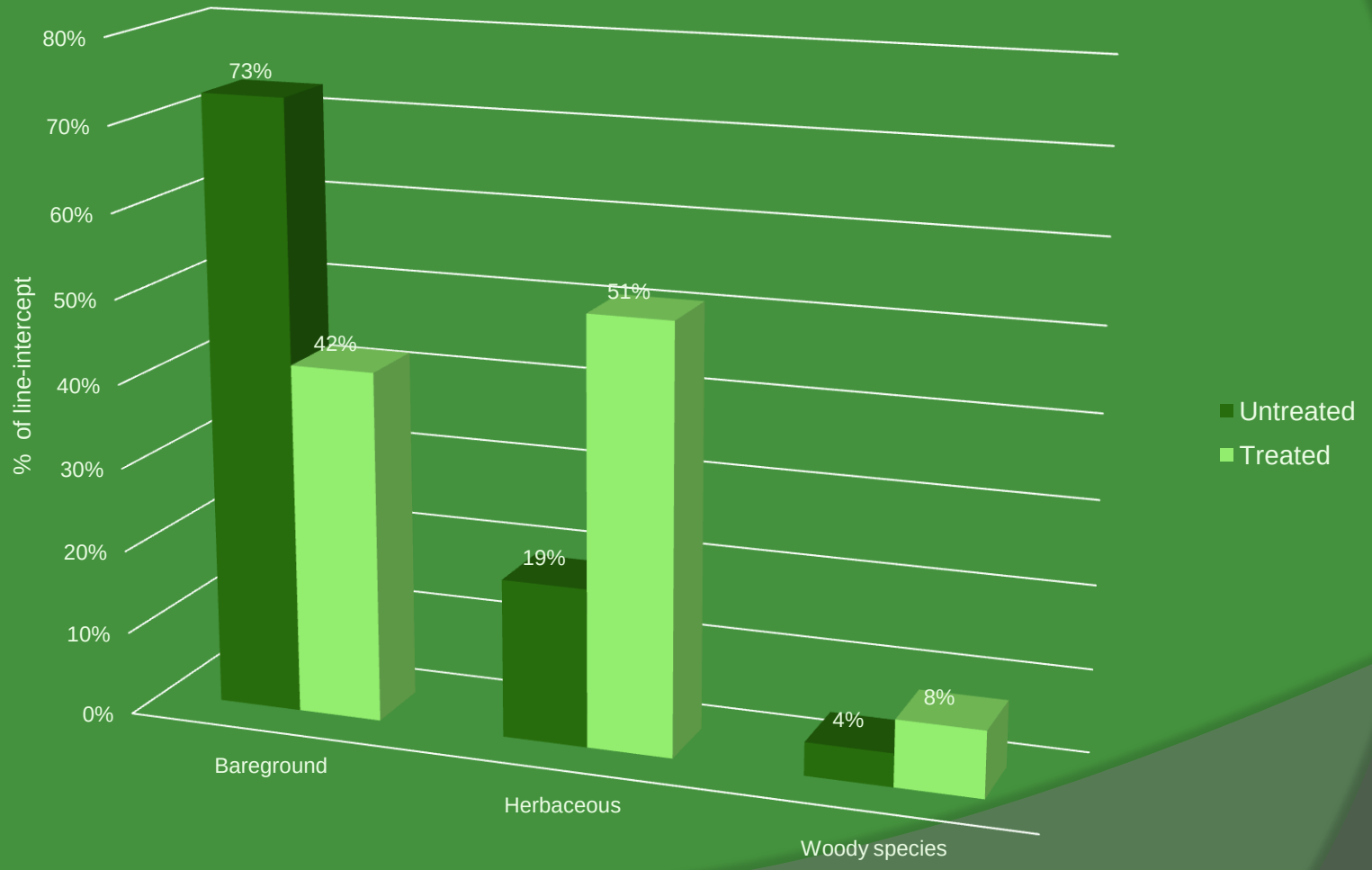

June 13, 2013


June 4, 2014

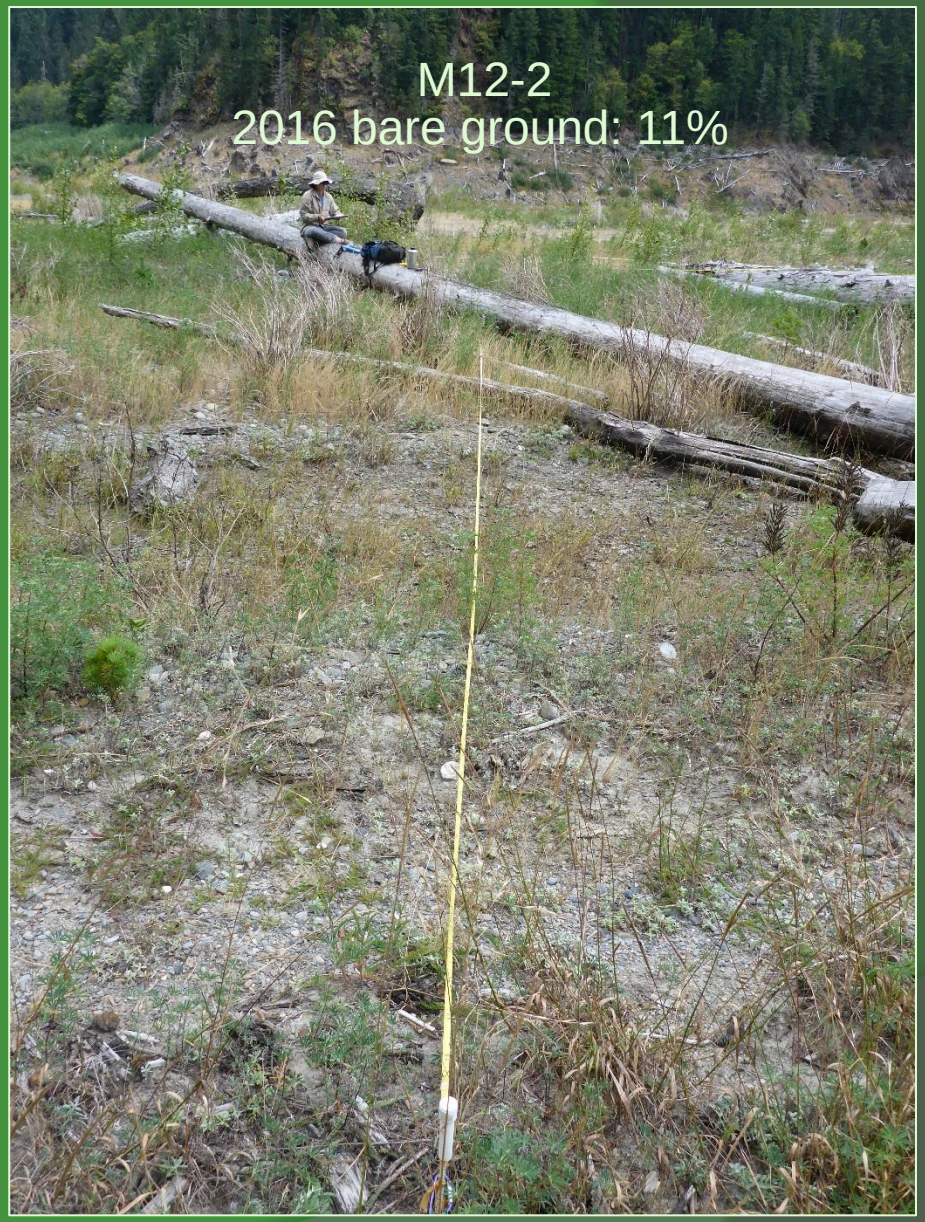
July 15, 2015

Sept 30, 2016

Seeding and planting affects on *bare ground* in the coarse sediments, 2016



Untreated site



Seeded Site

Seeding the coarse sediments

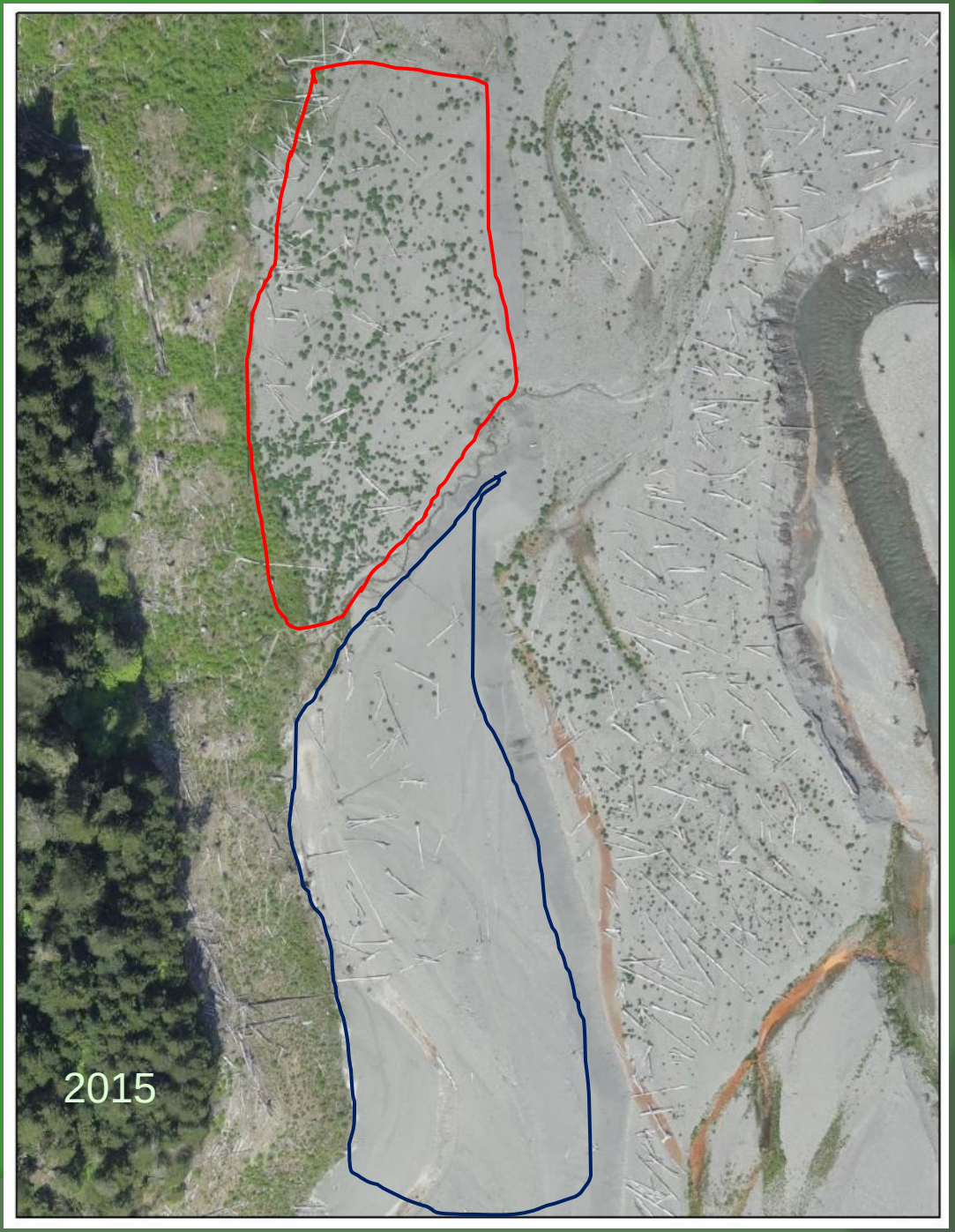
- Seeding had a significant effect on:
  - Bare ground
    - P-value = 0.012
  - Species composition
    - P-value = 0.0002
  - Indicator species:
    - Blue-wildrye (grass)
    - Oregon sunshine (forb)
    - Riverbank lupine (forb)
    - Sitka brome (grass)


Former Lake Mills reservoir
May 14, 2015
Riverbank lupine (*Lupinus rivularis*)
Seeded Oct 2013 and again in 2014


Former Lake Mills reservoir
May 15, 2015

Former Lake Mills reservoir:
Seeded Sites

Unseeded Sites



Aug 11, 2016
Aerial photo

No bare ground along this line-intercept in 2016!

- 1st time for a plot located on coarse sediment!

M10-2

Mitigating environmental stress on the coarse sediments

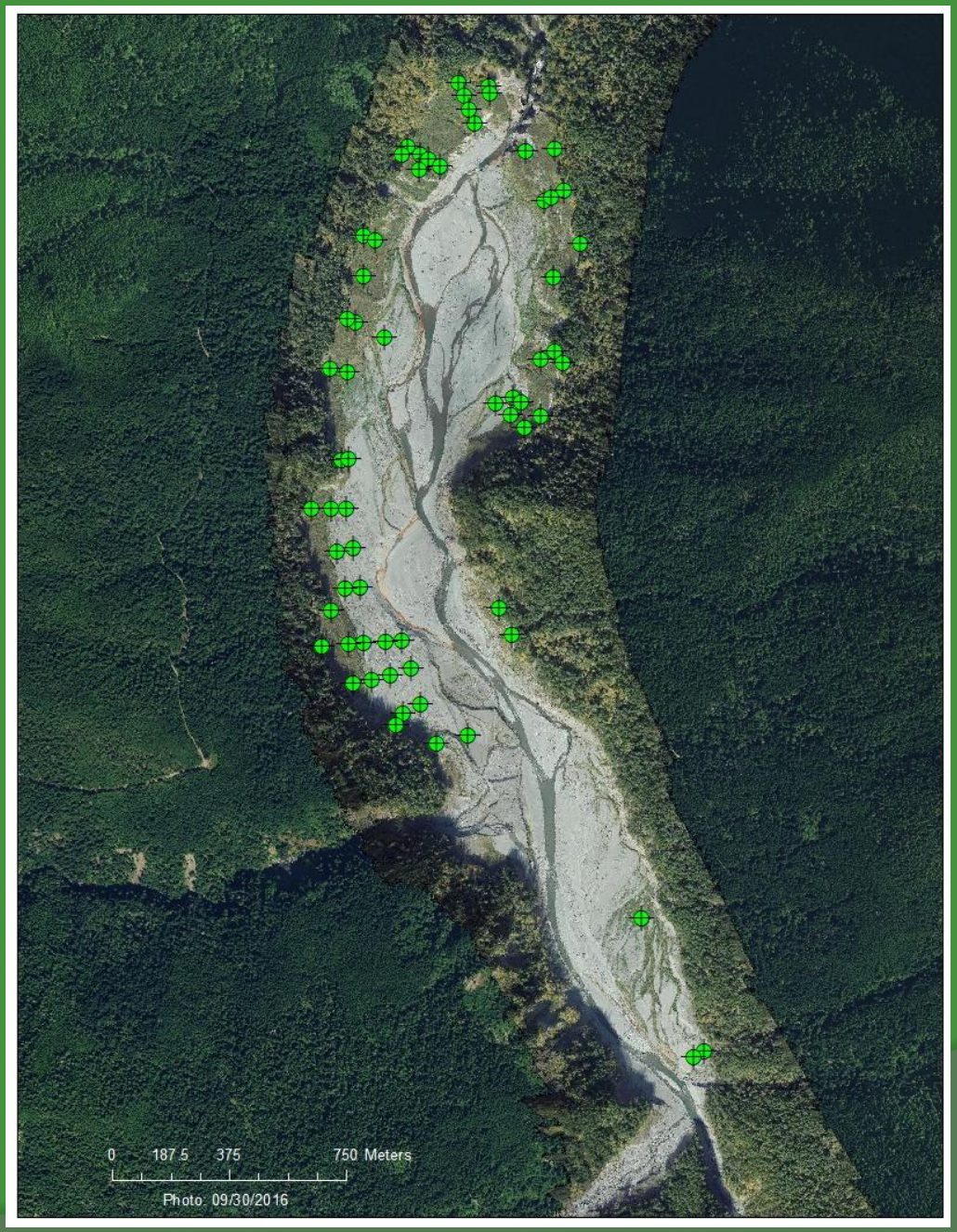
Creating safe sites…

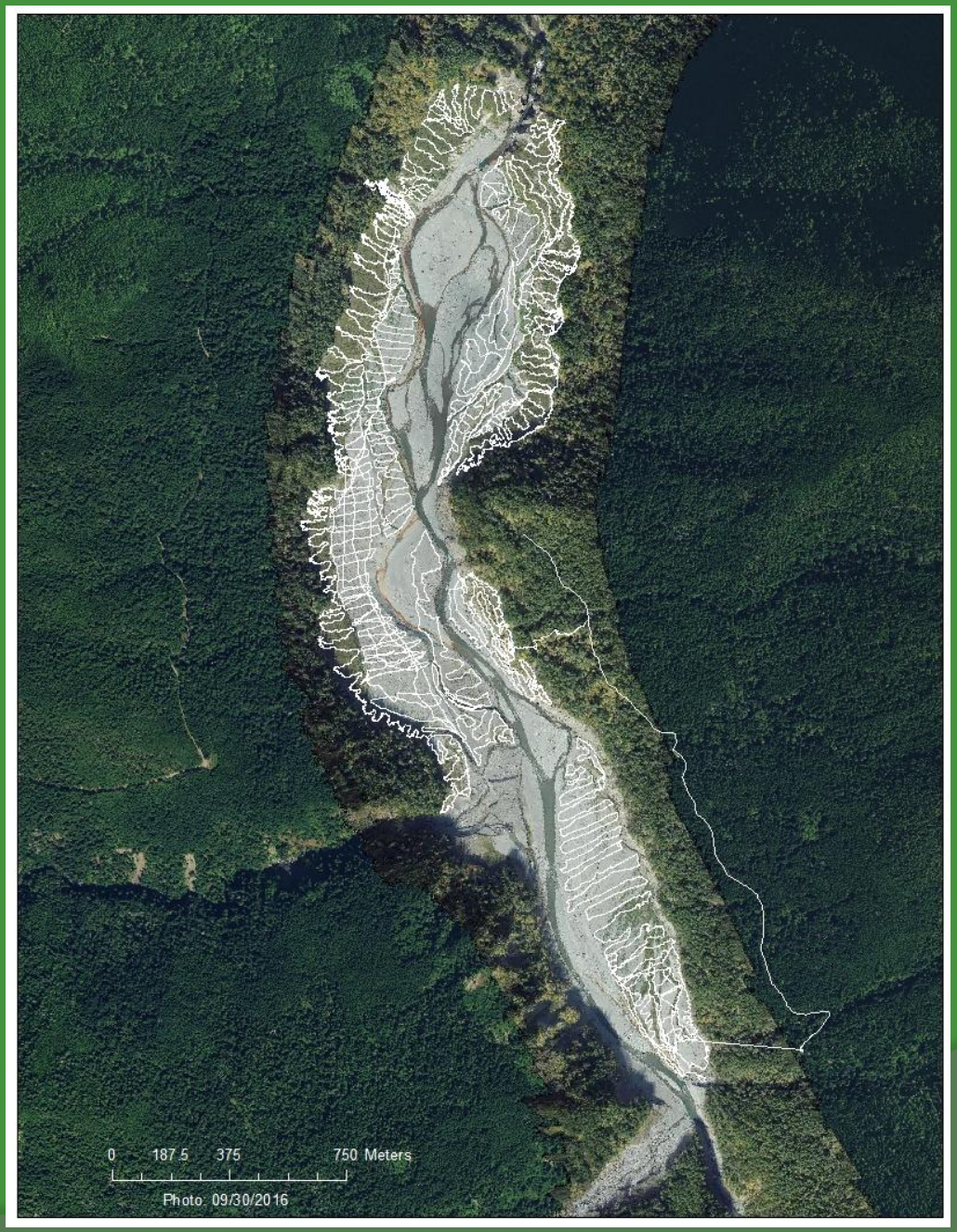
April 2016

Managing Invasive Species

- 20 species targeted for treatments
  - Natureserve
  - Noxious weed lists
  - Local experts
- Management began prior to dam removal
- Assessing invasive colonization…

Species	Common Name
Bromus tectorum	cheatgrass
Centaurea jacea	brown knapweed
Cirsium arvense	Canada thistle
Cytisus scoparius	Scot's broom
Geranium robertianum	herb Robert
Hedera helix	English ivy
Hypericum perforatum	common St. John's wort
Ilex aquifolium	English holly
Lathyrus latifolius	perennial pea
Lathyrus sylvestris	small everlasting peavine
Linaria vulgaris	butter and eggs
Phalaris arundinacea	reed canarygrass
Polygonum cuspidatum	Japanese knotweed
Polygonum sachalinense	giant knotweed
Polygonum x bohemicum	Bohemian knotweed
Potentilla recta	sulfur cinquefoil
Prunus laurocerasus	Laurel cherry
Rubus discolor	Himalayan blackberry
Rubus laciniatus	evergreen blackberry
Senecio jacobaea	tansy ragwort


0 187.5 375 750 Meters
Photo: 09/30/2016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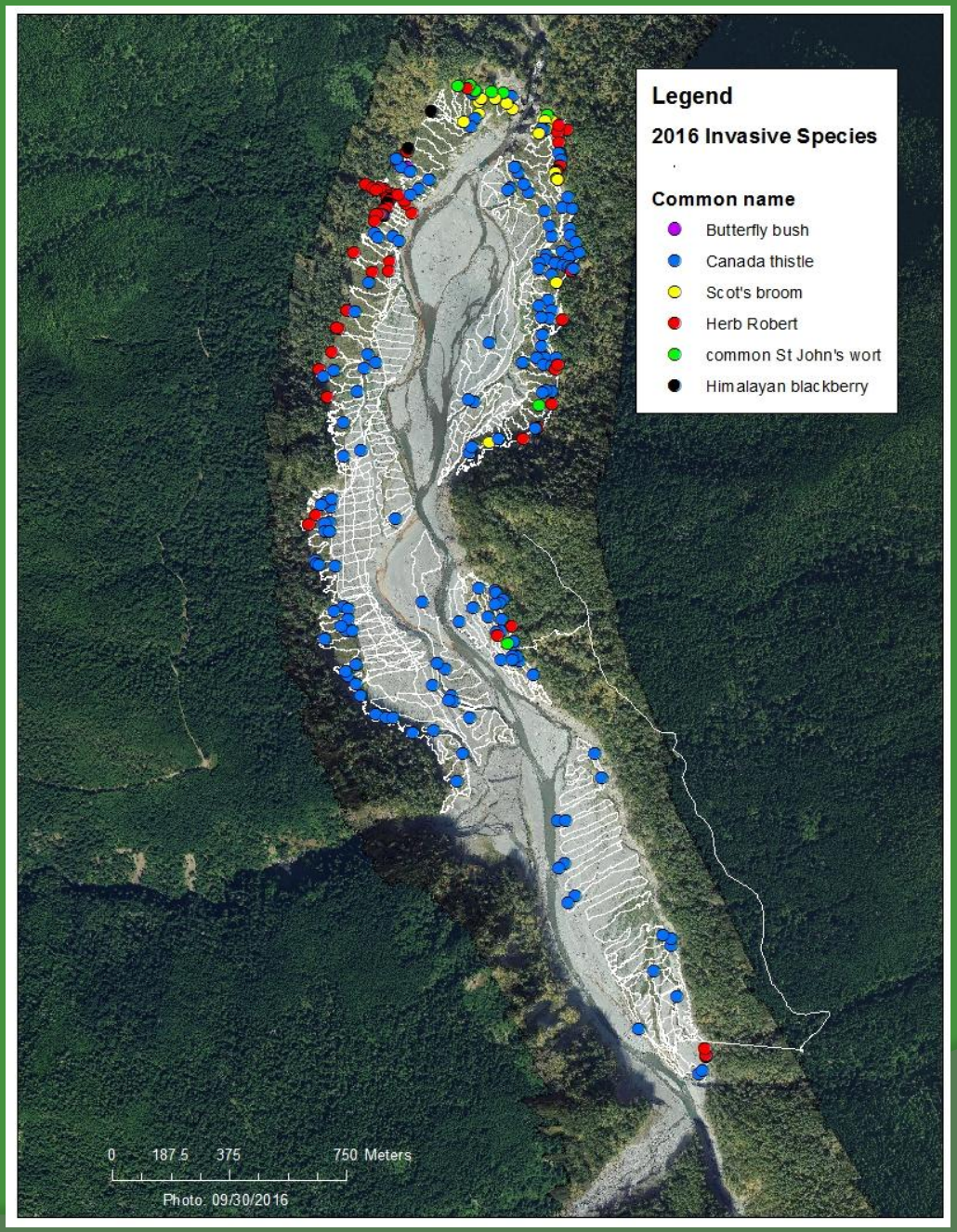
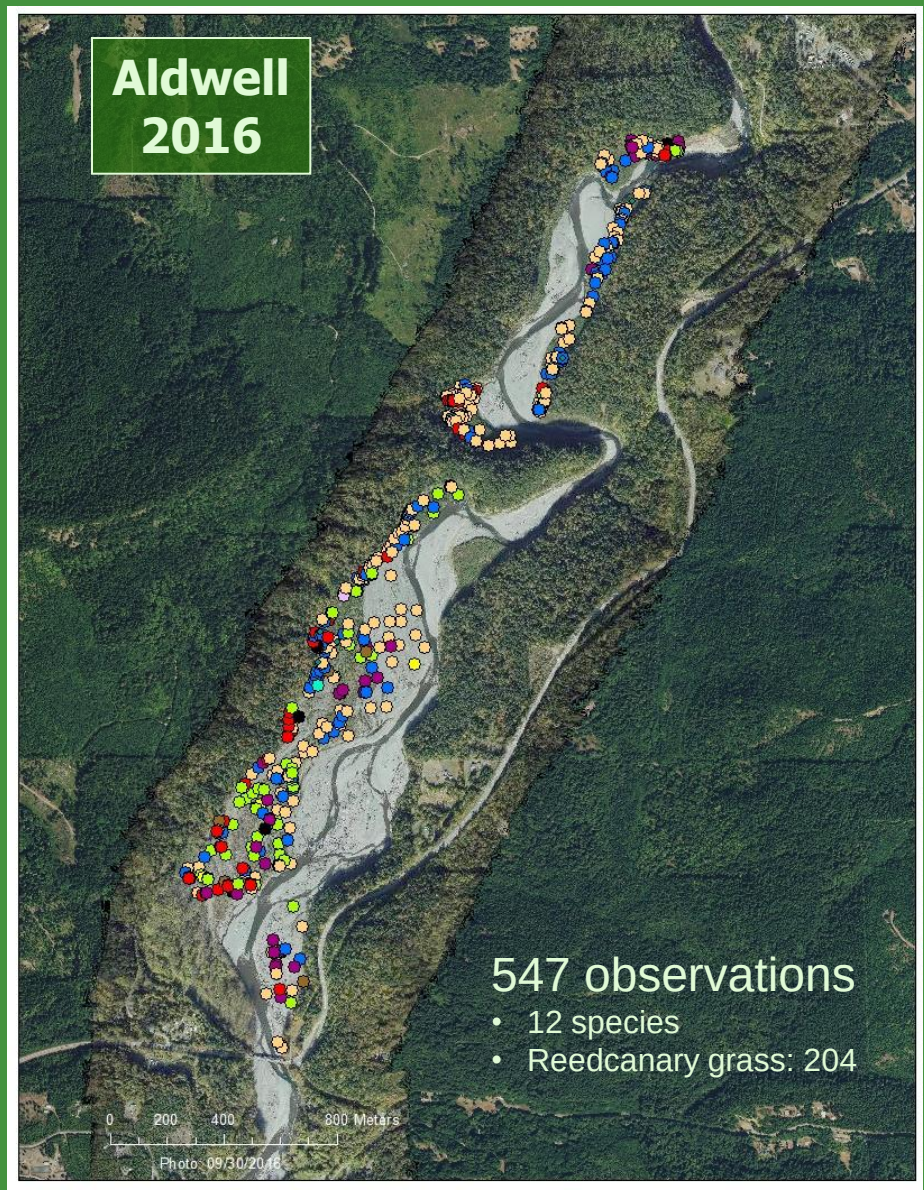
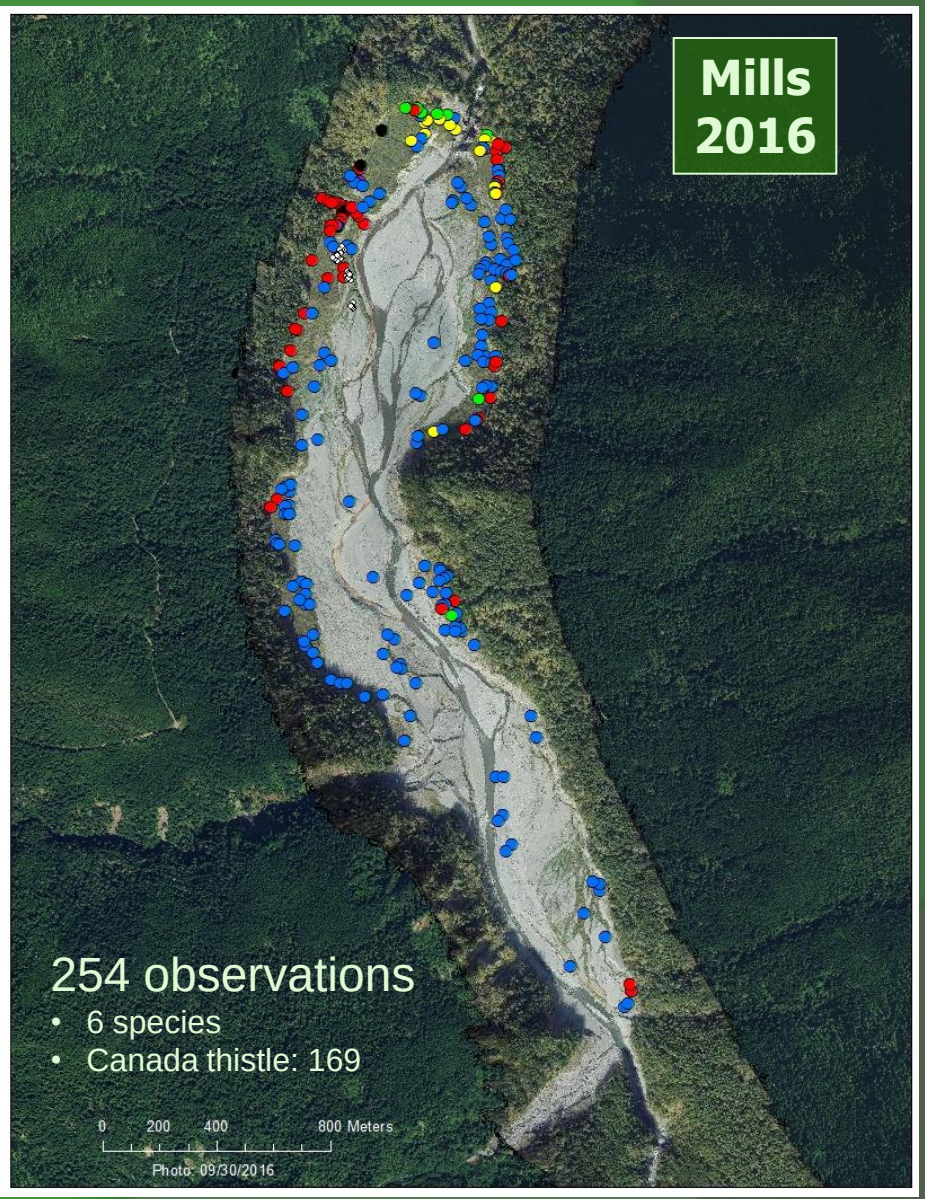
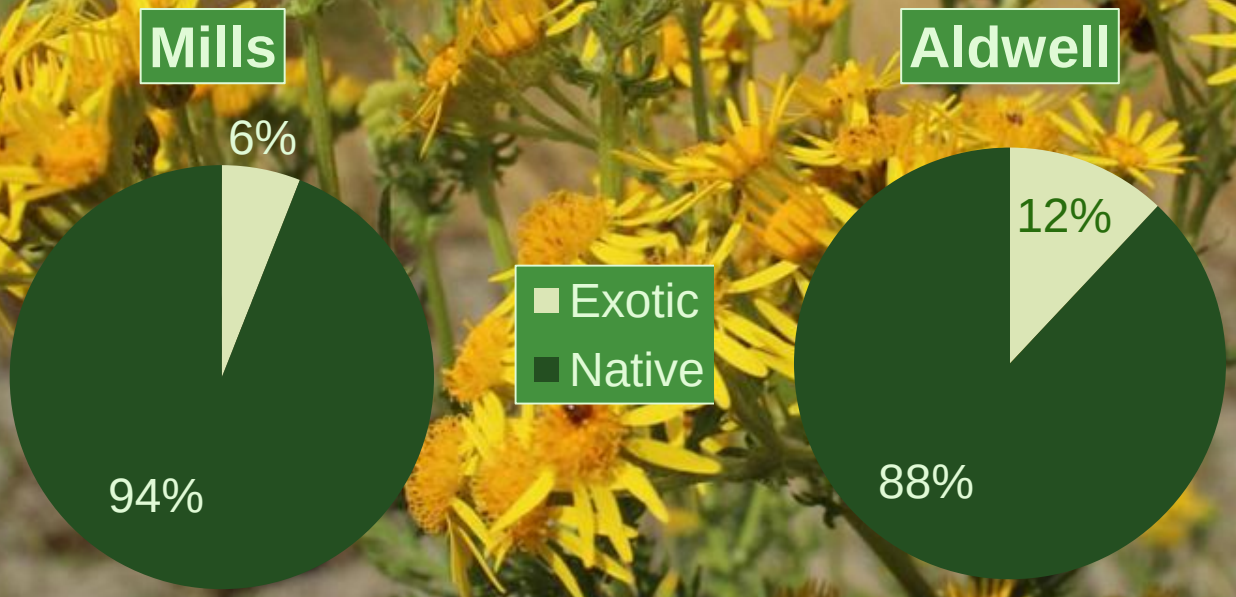

Legend
2016 Invasive Species
Common name
Butterfly bush
Canada thistle
Scot's broom
Herb Robert
common St John's wort
Himalayan blackberry
0 187.5 375 750 Meters
Photo: 09/30/2016


Aldwell
2016
547 observations
• 12 species
• Reedcanary grass: 204
0 200 400 800 Meters
Photo: 09/30/2016


Mills
2016
254 observations
• 6 species
• Canada thistle: 169
0 200 400 800 Meters
Photo: 09/30/2016

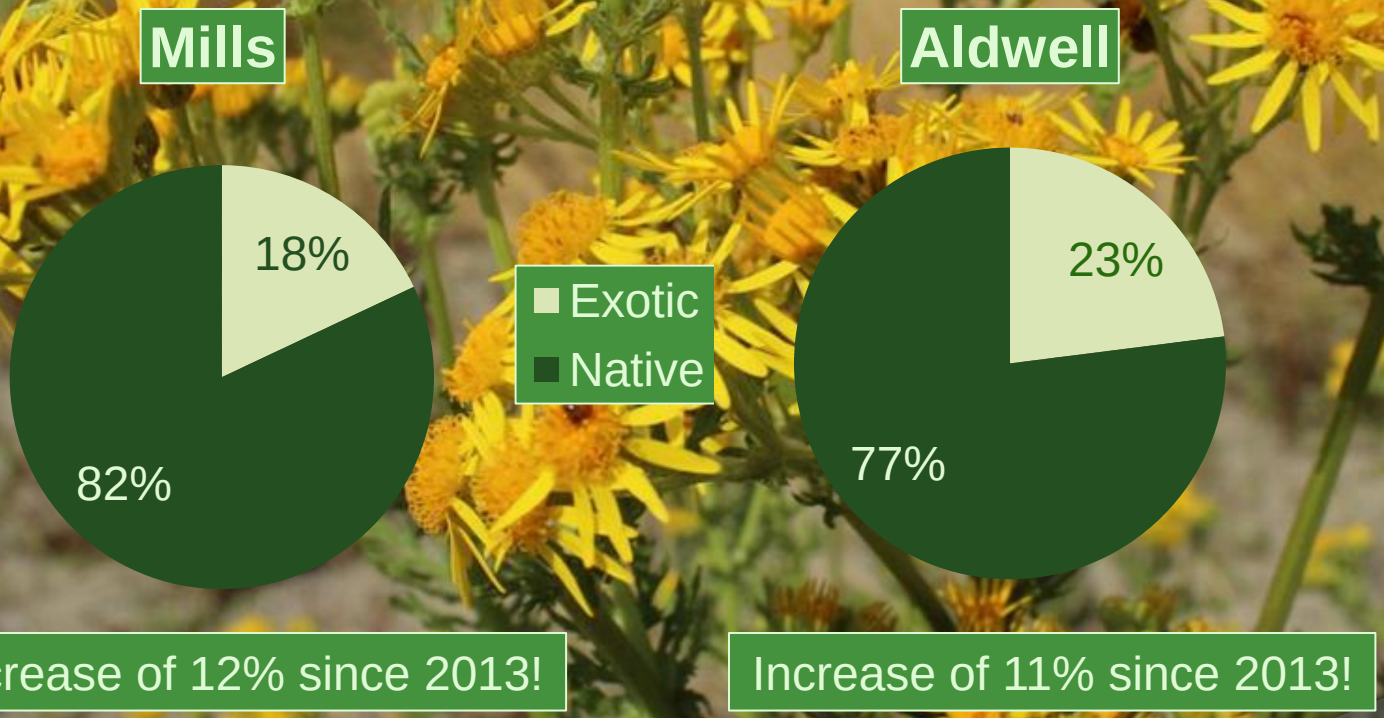
Relative frequency 2013



Most frequent exotic:
Sagina procumbens
(Relative Frequency 2%)

Most frequent exotic:
Agrostis stolonifera
(Relative Frequency 2%)

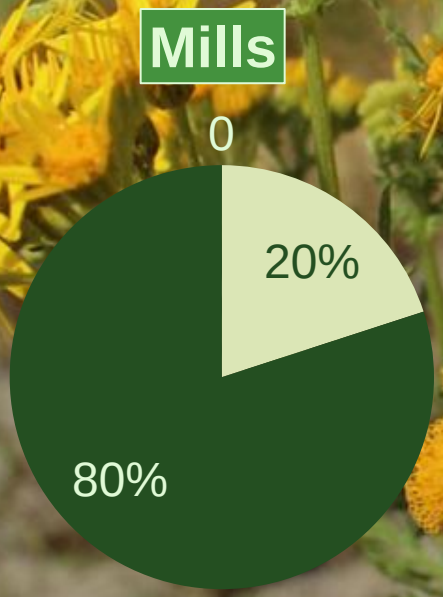
Relative frequency 2015

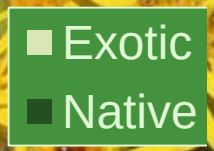


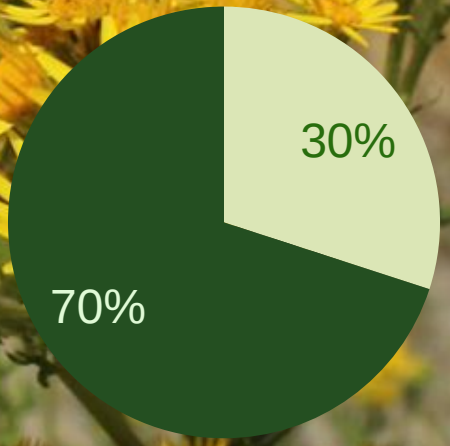
Increase of 12% since 2013!

Increase of 11% since 2013!

Relative frequency 2016



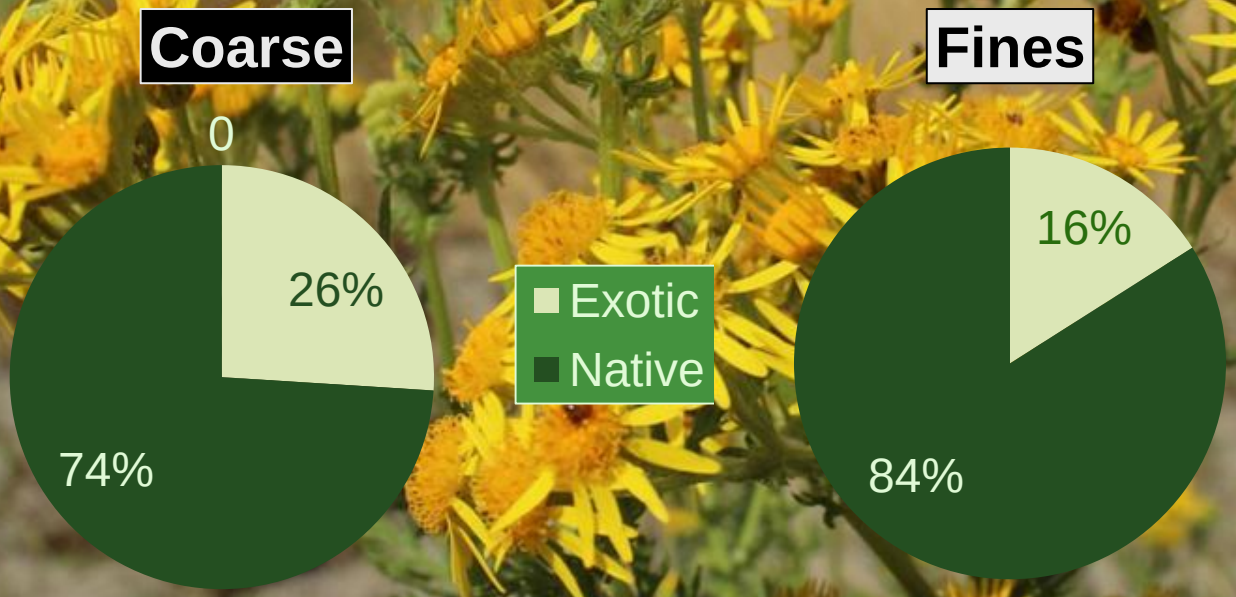




Most frequent *invasives* :
Cirsium arvense (<1%)
Geranium robertianum (<1%)

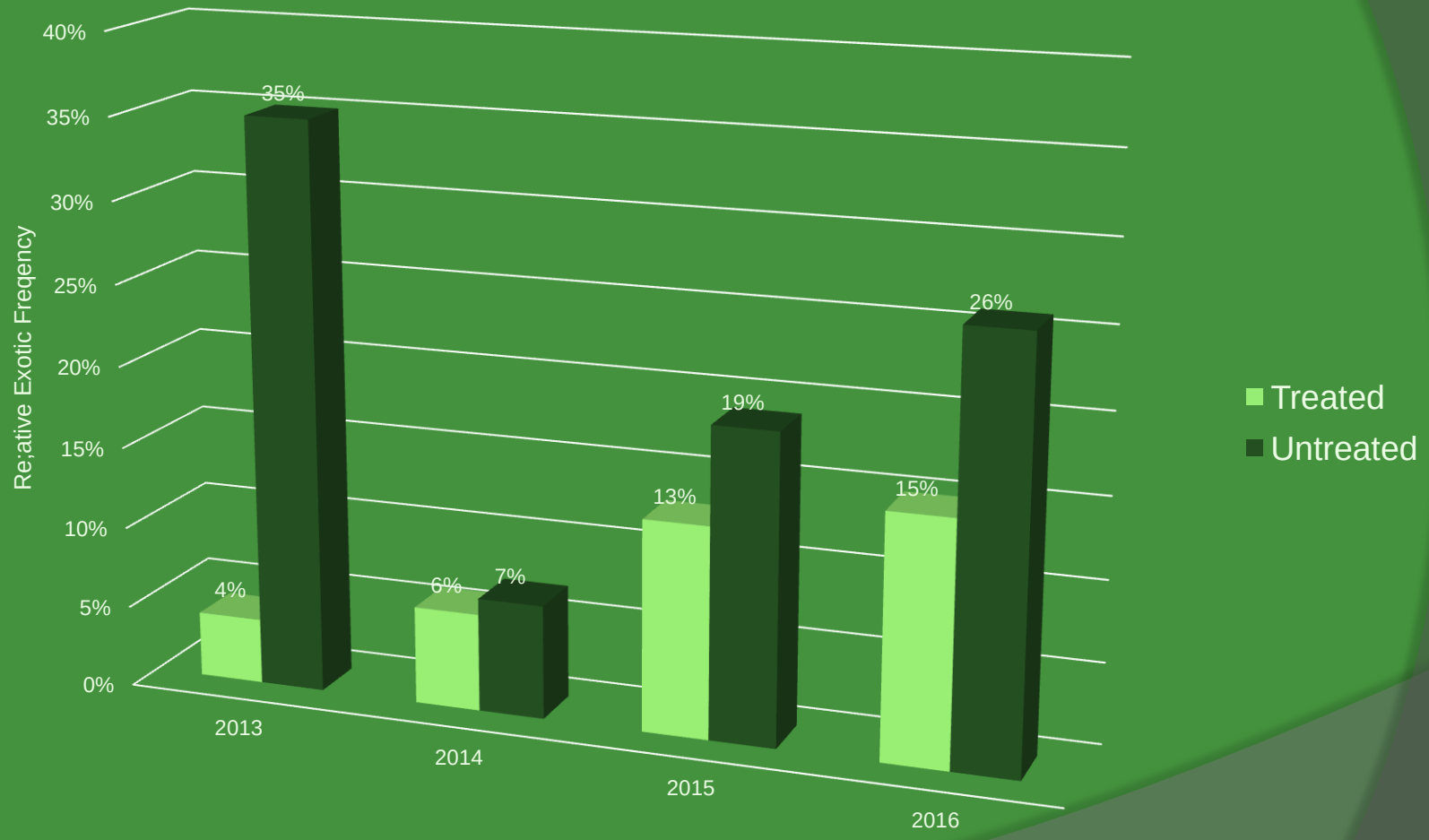
Most frequent *invasives* :
Phalaris arundinacea (4%)
Cirsium arvense (1%)

Relative frequency, Mills 2016



Exotic abundance in the fine sediments, Mills

Exotic abundance in the coarse sediments, Mills



- Texture is driving vegetation development in the former reservoirs
- Fine sediments: natural regeneration and plantings are thriving
  - Converting rapidly to forests
  - Seeding and planting ***have not*** significantly effected bare ground reduction
  - Planting has effected woody species composition and richness and possibly exotic plant abundance
- Coarse sediments: no significant natural regeneration and plants struggle to survive
  - Timing of drawdown critical for establishing plants
  - Seeding ***has*** effected species composition and bare ground reduction and possibly exotic species abundance
    - Riverbank lupine proving to be an excellent colonizer!
- Smokey Bottom is open to the public!
  - The west-side dam abutment and former boat launch are now open to foot traffic!


Questions?