The Effectiveness of Native Seed Dispersal Islands in Reclaimed Mine Lands Dominated by Eurasian Grasses

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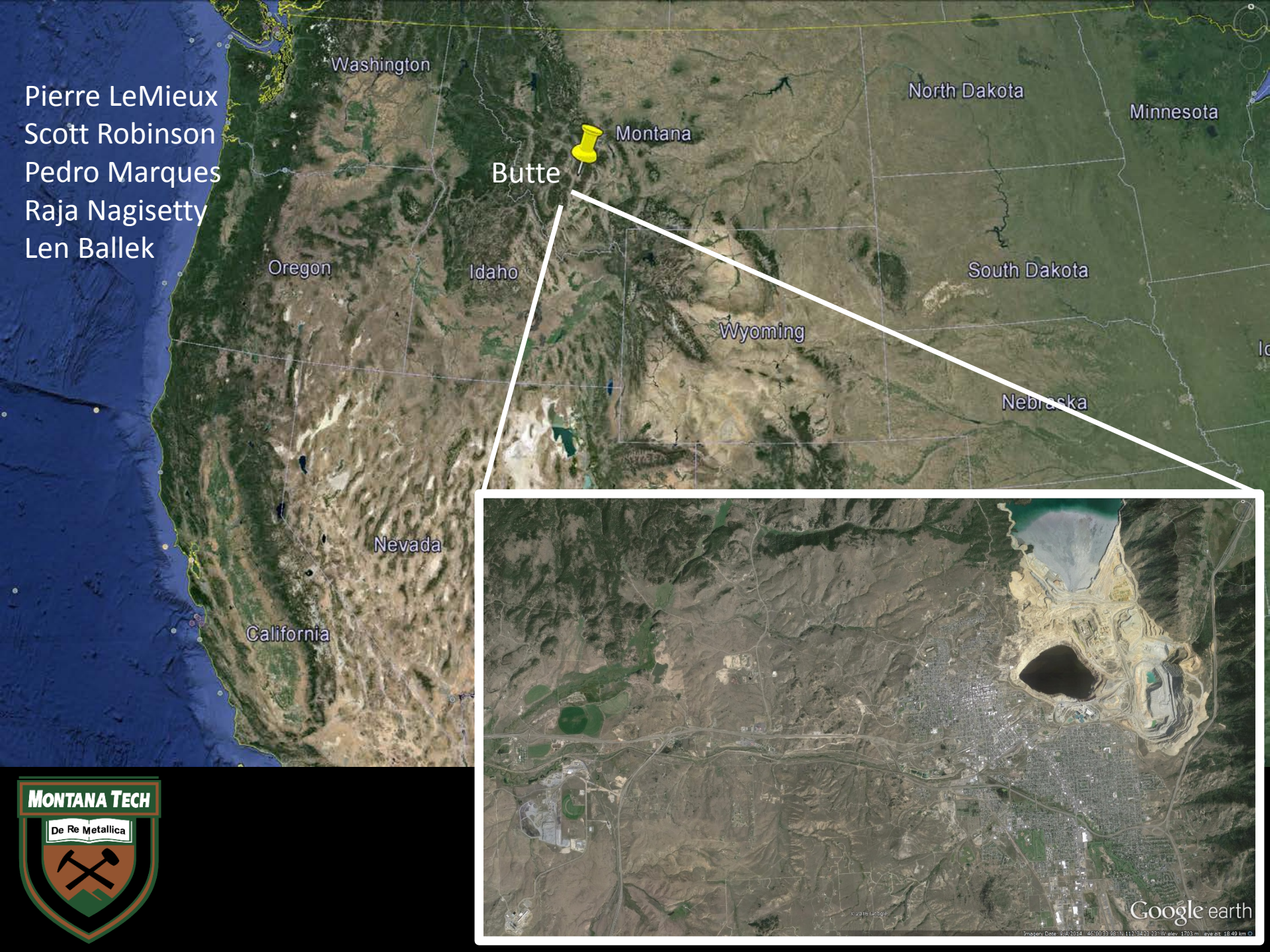

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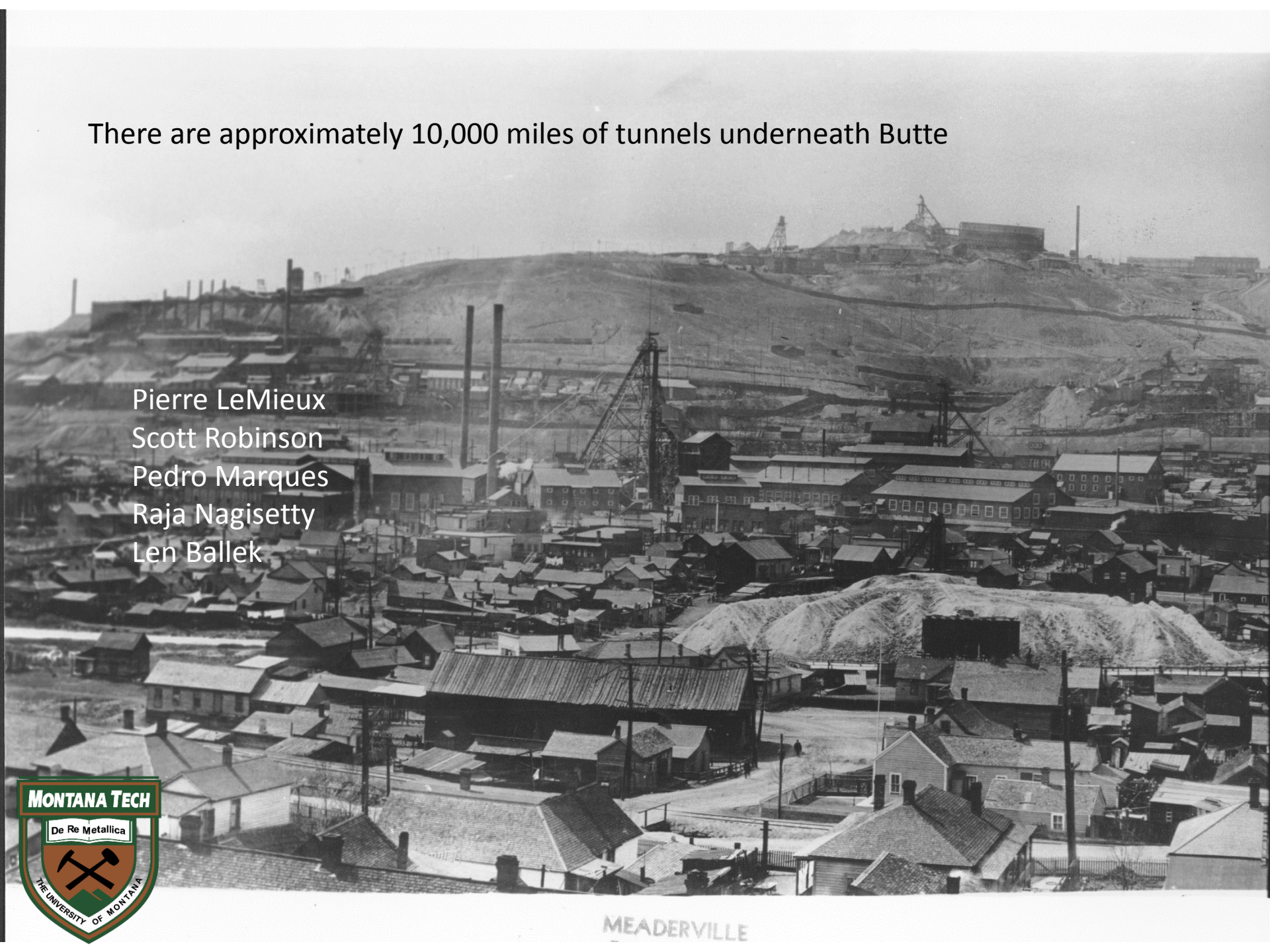
There are approximately 10,000 miles of tunnels underneath Butte



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Berkeley Pit

- It is the largest mine flooding that has ever taken place in the world
- The largest contaminated body of water in the U.S.
- It's the deepest body of water in Montana (1068' deep)
- It currently contains over 45 billion gallons of toxic water
- The pH of the water at some levels is less than 2
- Water must be pumped, treated and discharged in perpetuity in eight years

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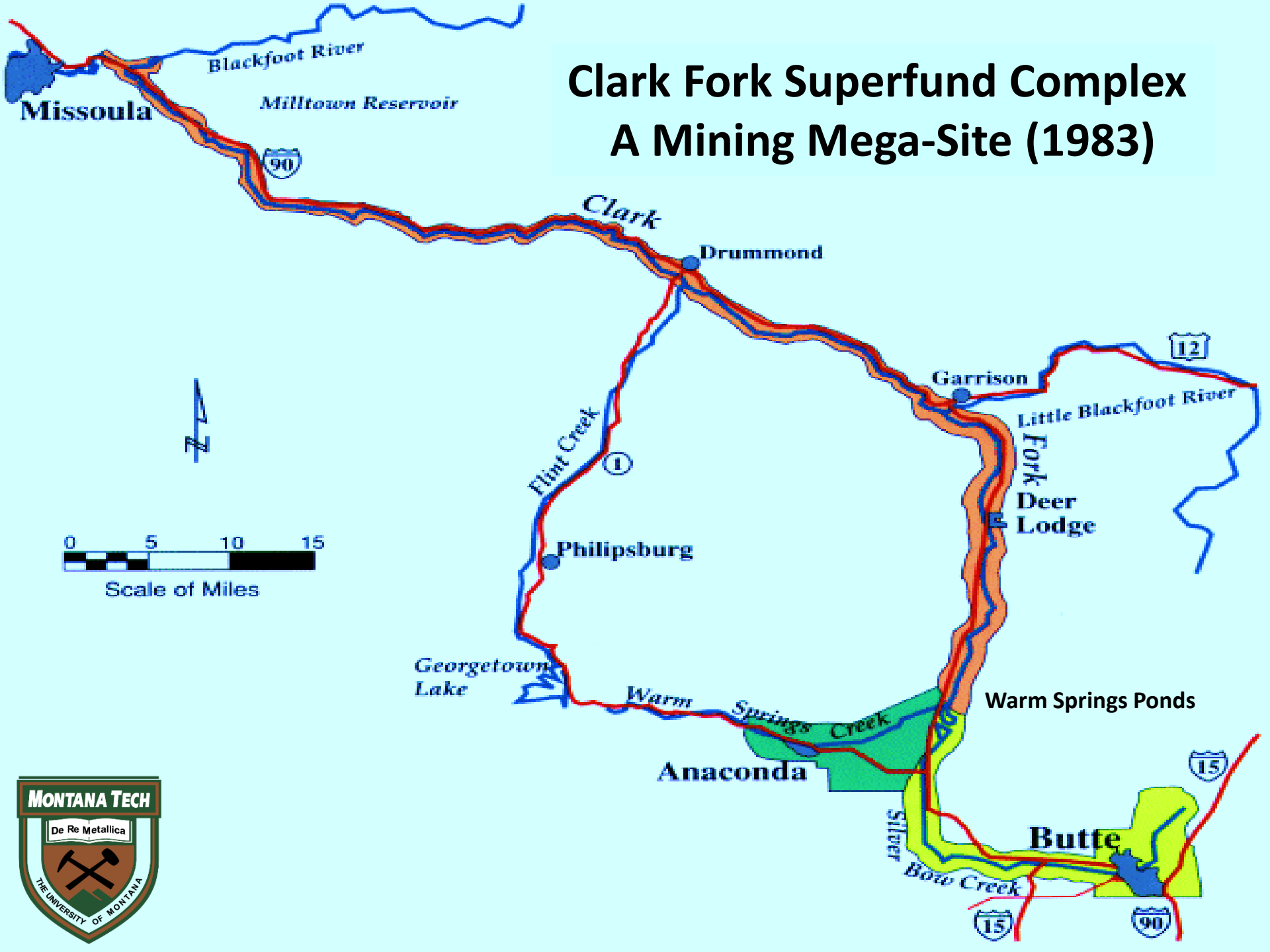
Clark Fork Superfund Complex
A Mining Mega-Site (1983)



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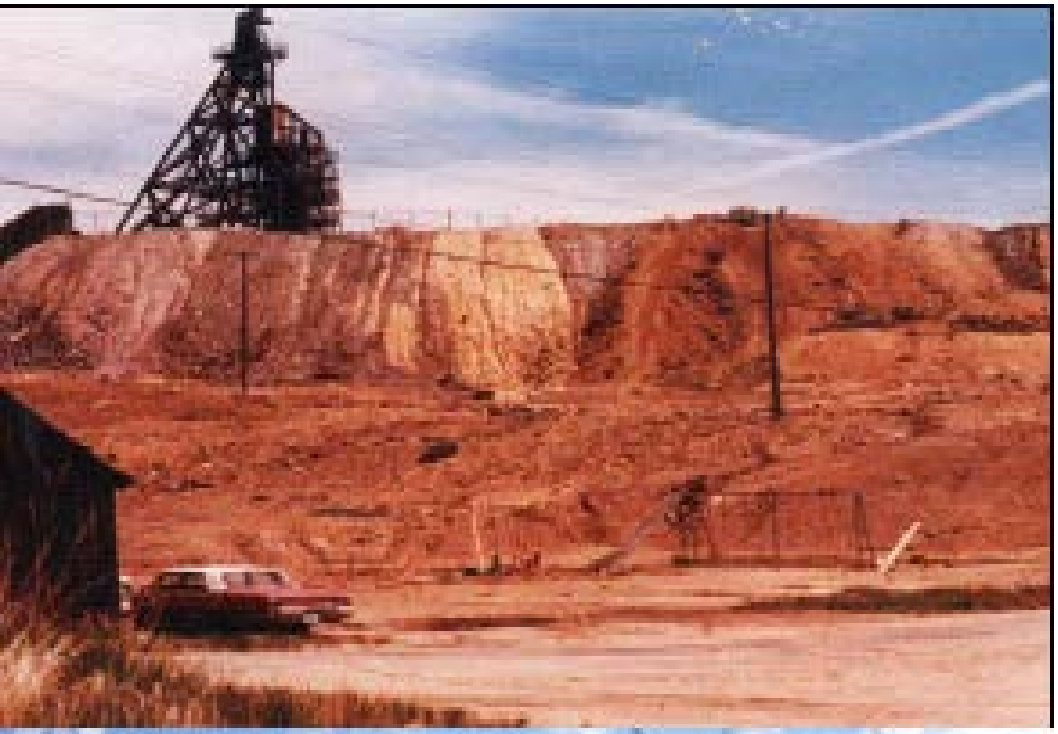

Lexington mine

Surface Mining Control and Reclamation Act (SMCRA)

P.L. 95-87, Enacted August 3, 1977

Administrative Rules of Montana

Strip and Underground Mine Reclamation Act: Topsoiling, Revegetation, Protection of Wildlife and Air Resources

ARM 17.24.711 (Relevant and Appropriate)

…requires that a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area of land to be affected shall be established…

….relates to the planting of trees and other woody species… capable of self-regeneration and plant succession at least equal to the natural vegetation of the area…

…specifies that revegetation success must be measured against approved unmined reference areas…


Public enemy number 1
No structural and species diversity
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Matt Rinella
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7 cm average leaf litter


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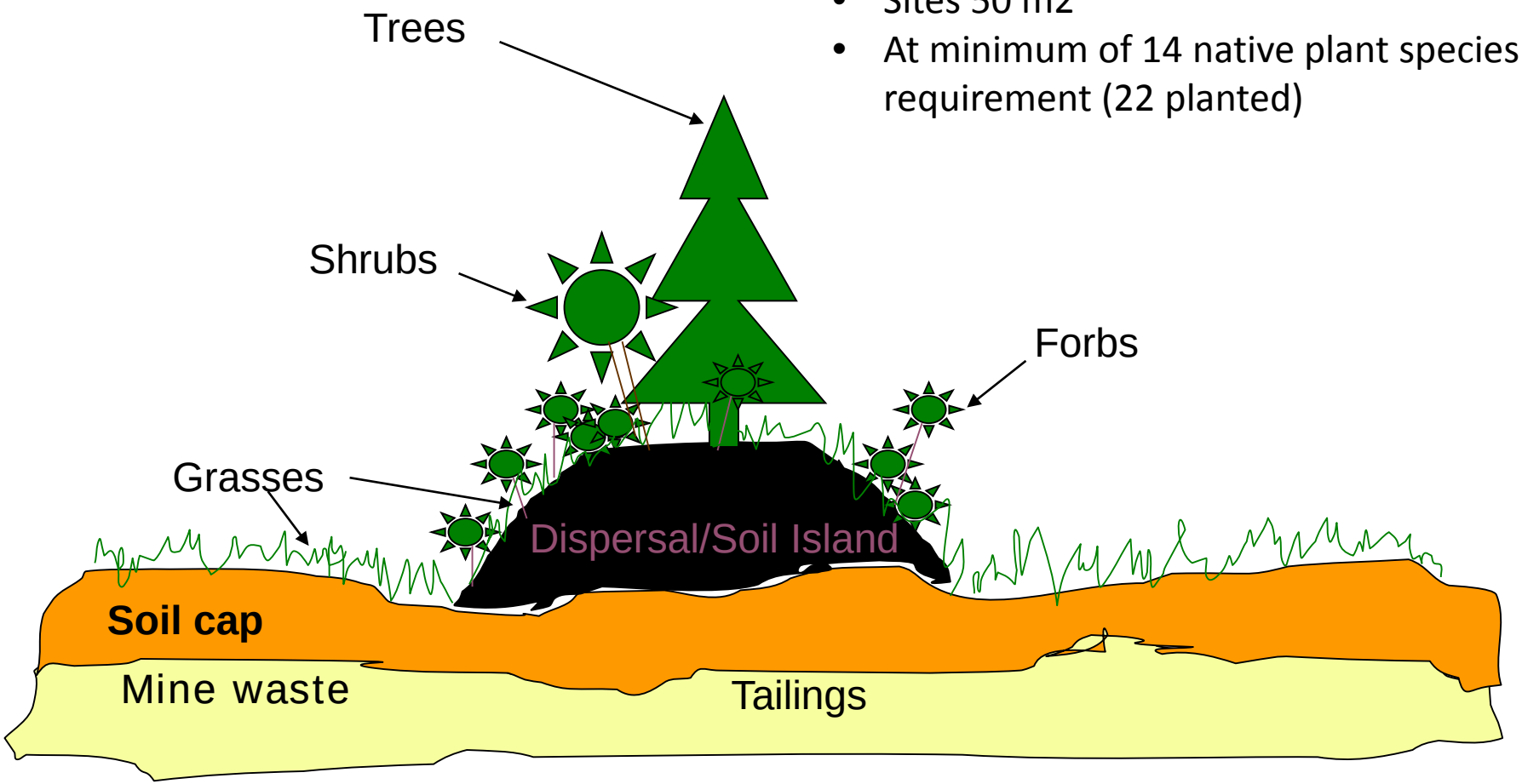
Trees
Shrubs
Grasses
Dispersal/Soil Island
Soil cap
Mine waste
Tailings

Sudbury Canada

- Planting 2008-2012
- Sites 50 m2
- At minimum of 14 native plant species requirement (22 planted)



DISPERSAL ISLANDS

Approaches for restoration

- Seeding
- Sods
- Containers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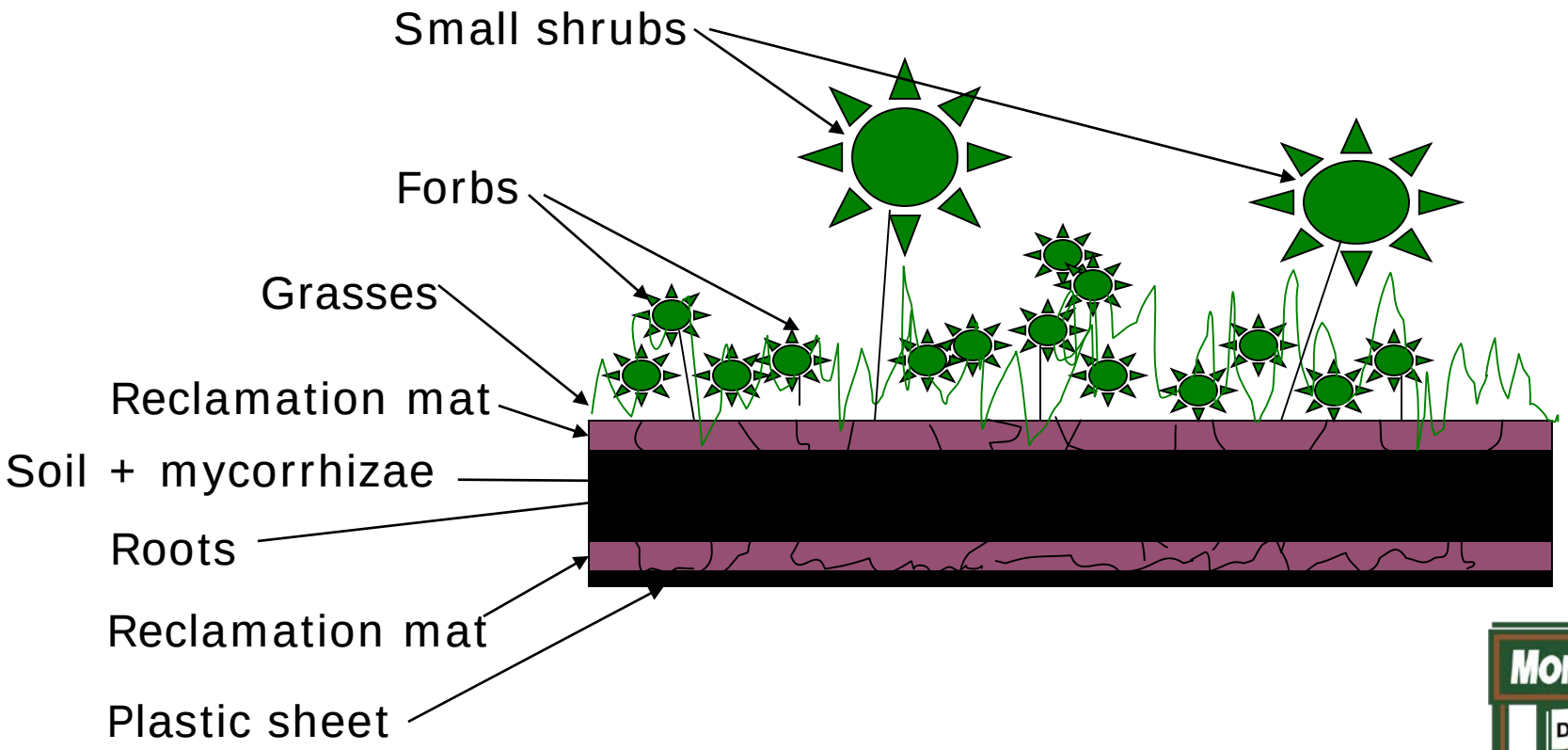
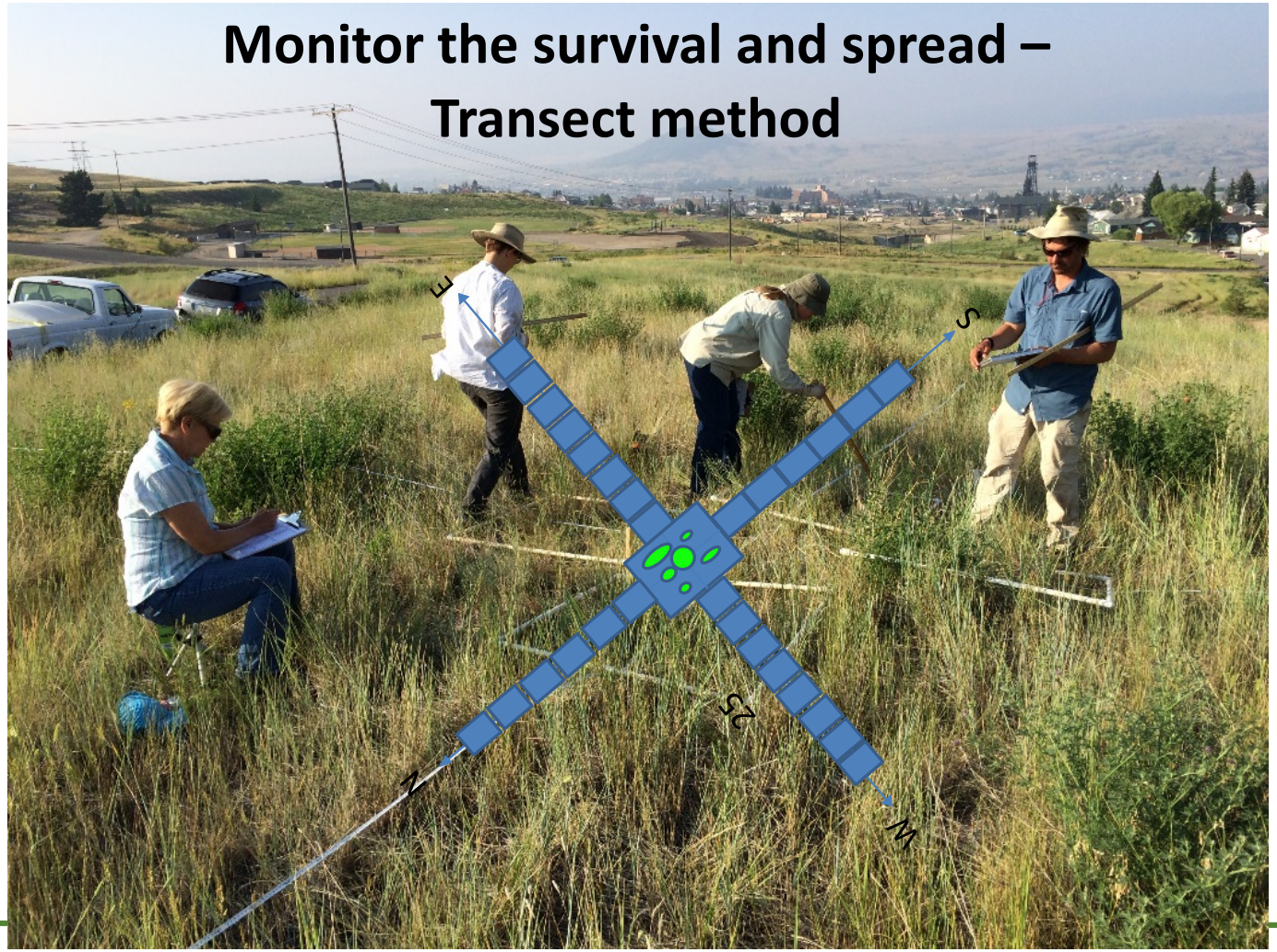
FORB SOD


Small shrubs
Forbs
Grasses
Reclamation mat
Soil + mycorrhizae
Roots
Reclamation mat
Plastic sheet

Questions

- How was the survival rate of the plants with different approaches?
- How far did plants spread out from the dispersal islands?
- Is it effective?

Methods



100x40=**4000**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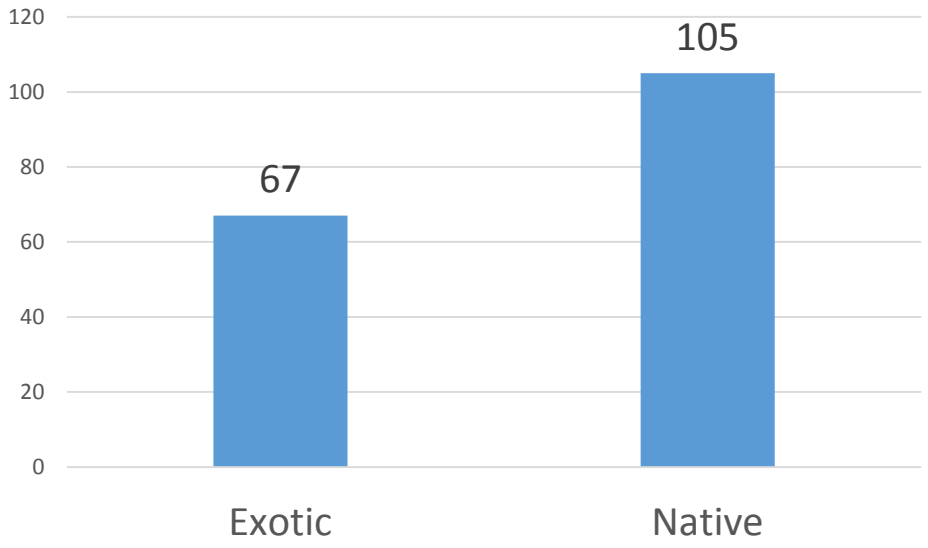
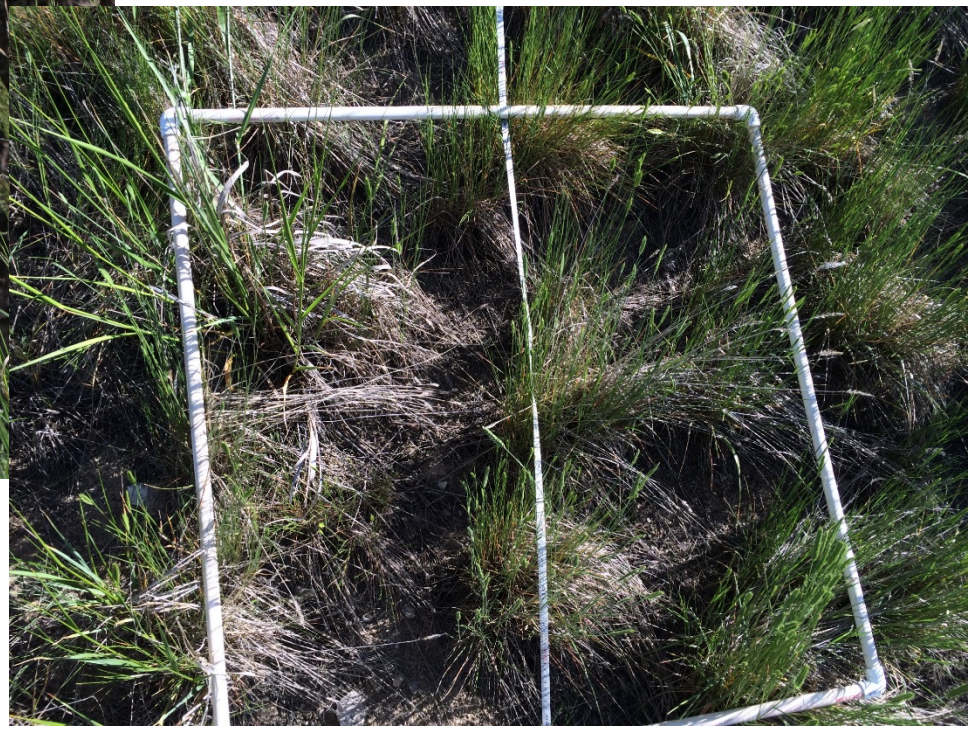
Results

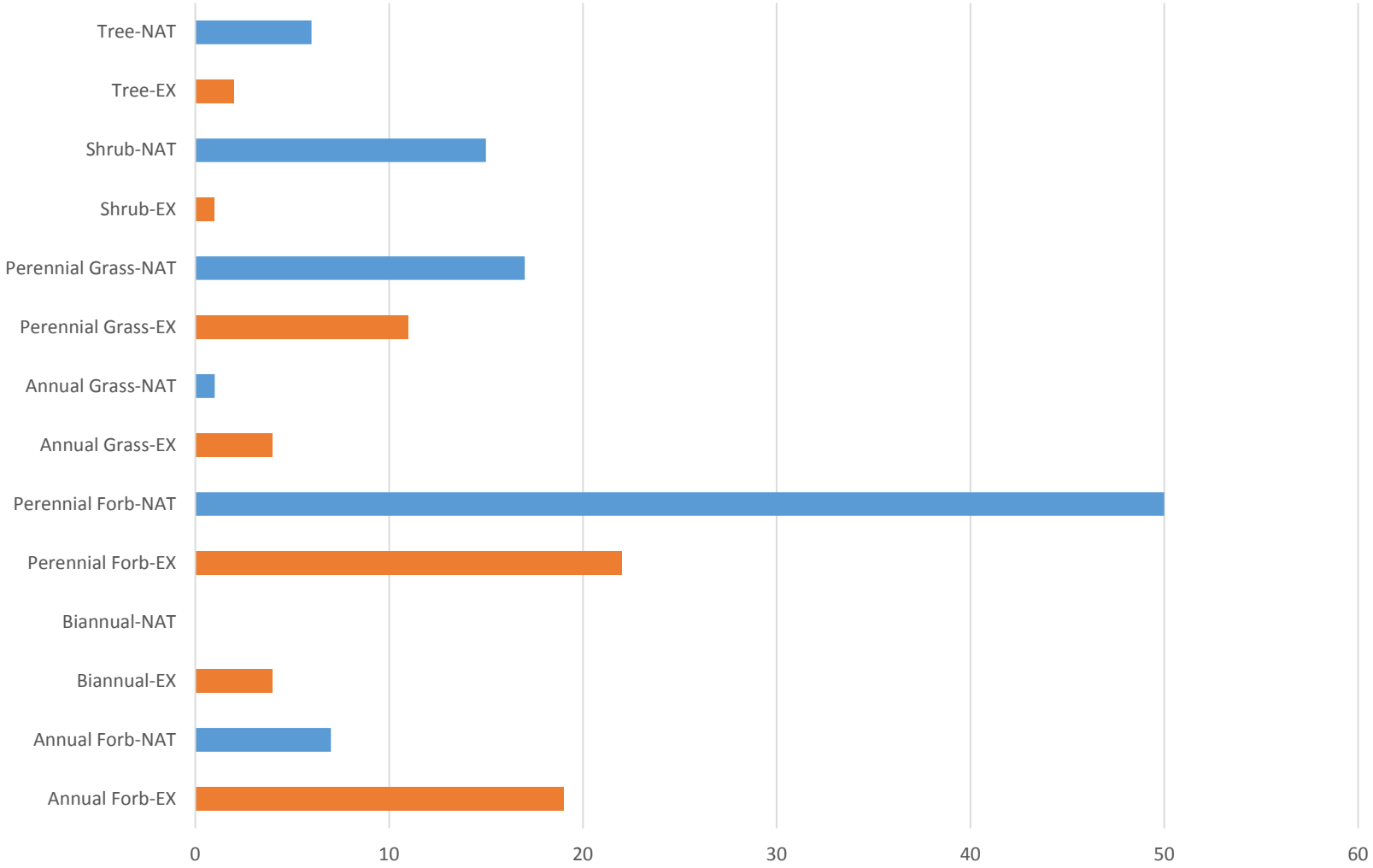
- 40 sites surveyed
- 172 total species



- Five Eurasian grasses gave 48 percent of the total cover (*Agropyron cristatum, Bromus inermis, Festuca ovina, Festuca rubra, Poa pratensis*)

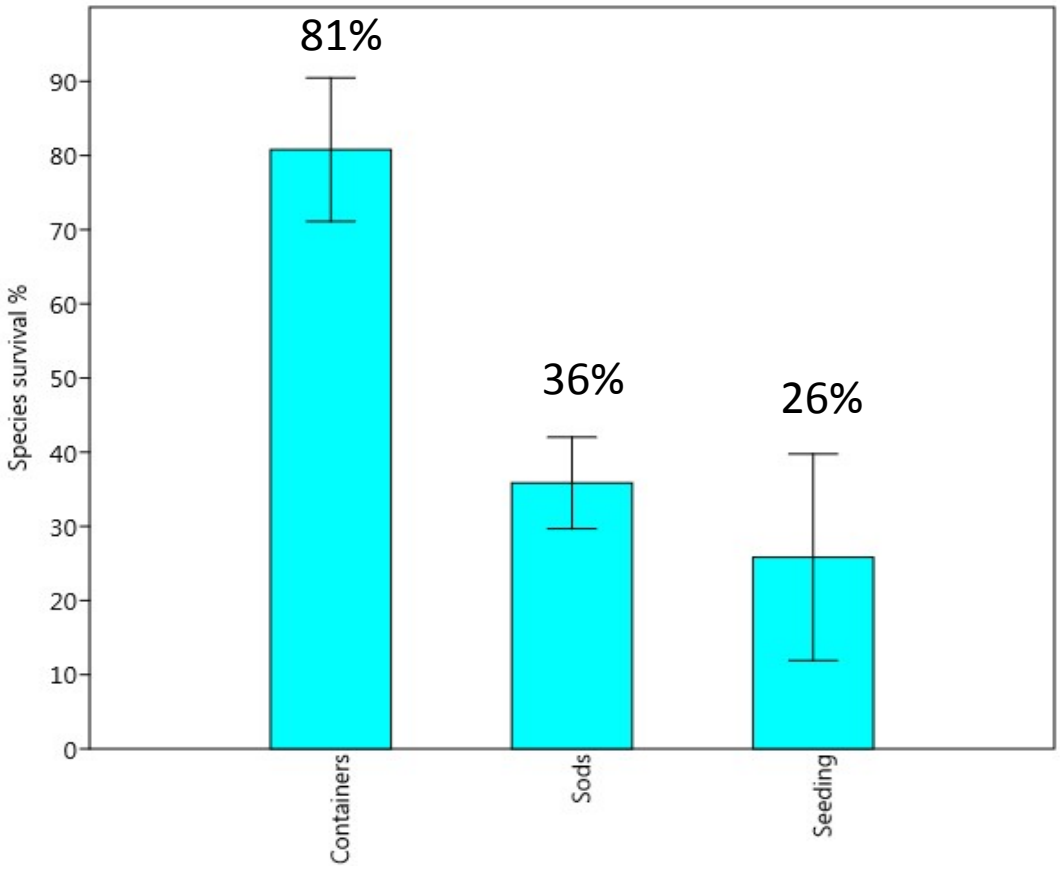


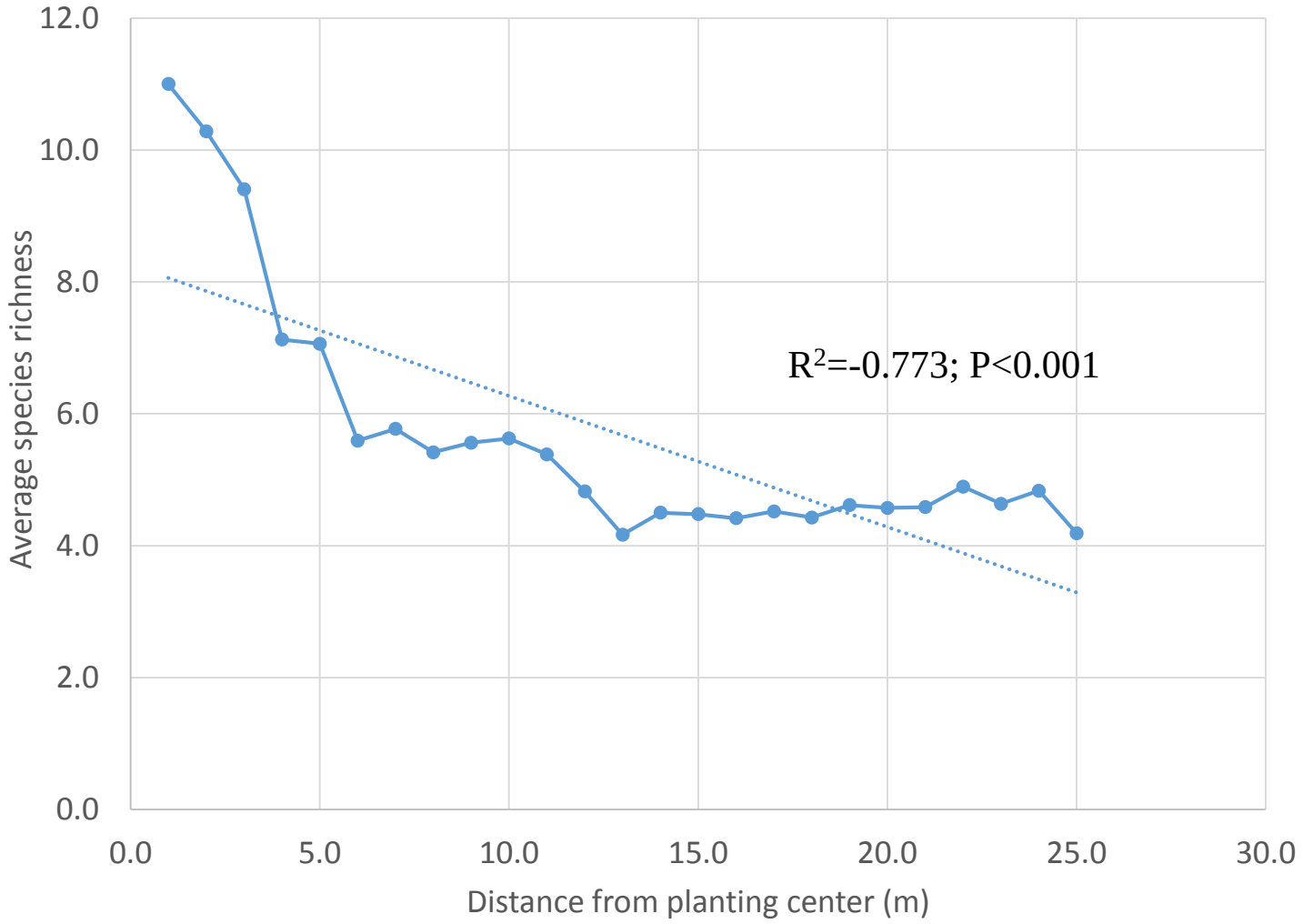
Distribution of growth forms



Plant survival rate at the 40 earlier established sites

- Survival rate of plants 60% (species survival)



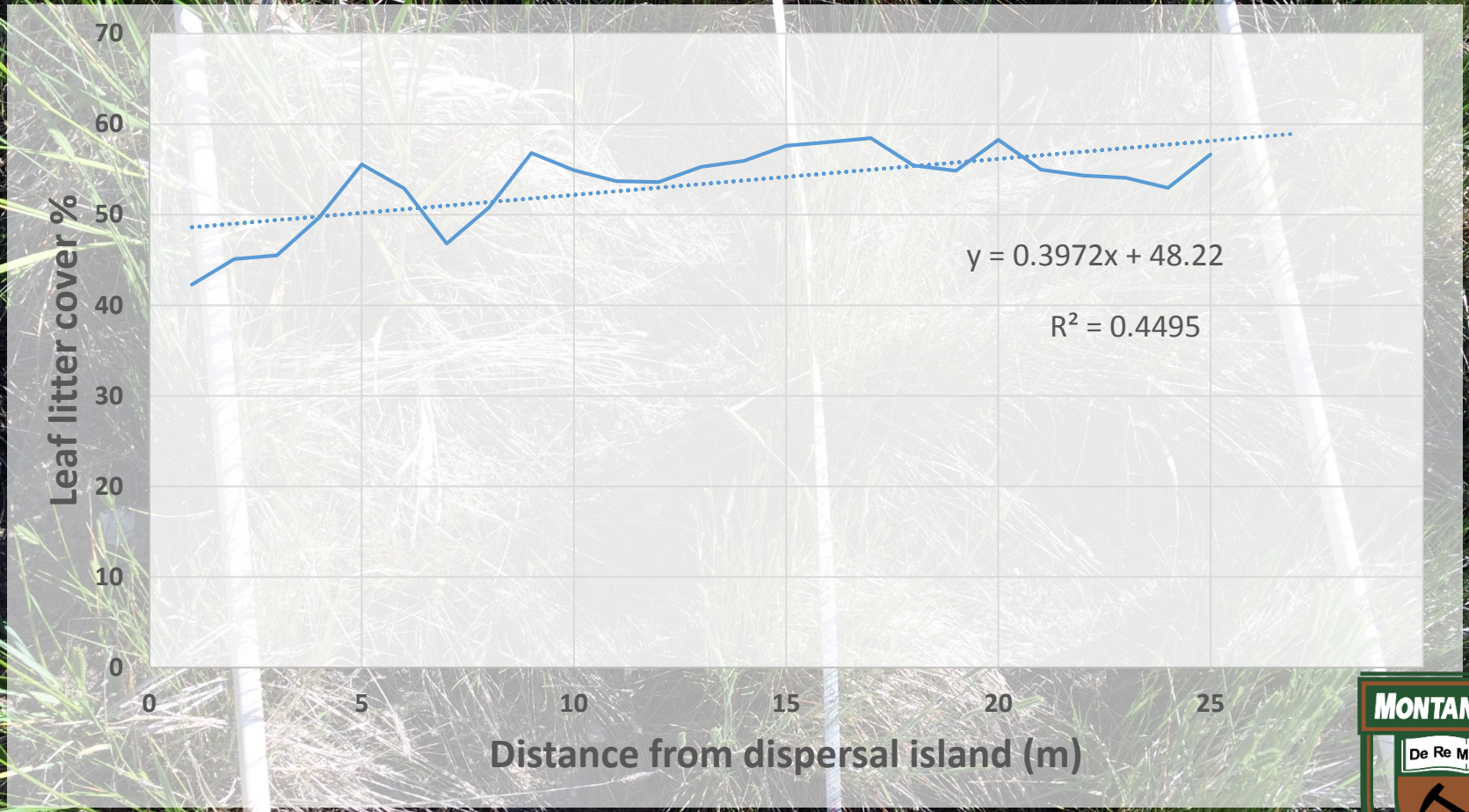

12.0
10.0
8.0
6.0
4.0
2.0
0.0
Average species richness
0.0
5.0
10.0
15.0
20.0
25.0
30.0
Distance from planting center (m)
R2=-0.773; P<0.001

Spreading species

Lewis flax

Holboell's rockcress

Change of Litter Cover



Lessons learnt – New approaches

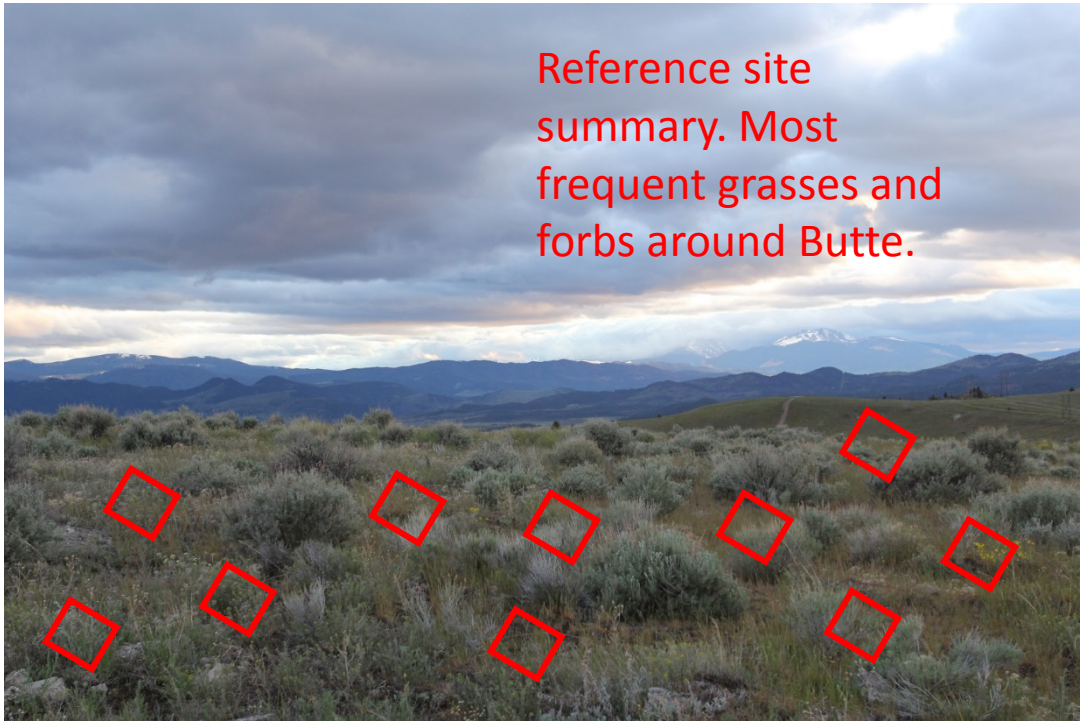
Survey reference sites for more apropriate site tailoring in future plantings

Lessons learnt – New approaches

Survey reference sites for more apropriate site tailoring in future plantings

Plateau example

Common name	Scientific name	Presence %
Silky lupine	*Lupinus sericeus*	60
Prairie Junegrass	*Koeleria cristata*	53
Bluebunch wheatgrass	*Pseudoroegneria spicata*	47
Sulphur buckwheat	*Eriogonum umbellatum*	40
Common yarrow	*Achillea millefolium*	33
Idaho fescue	*Festuca idahoensis*	33
Longleaf phlox	*Phlox longifolia*	33
Sagebrush	*Artemisia tridentata*	33
Slender cinquefoil	*Potentilla gracilis*	33



Survey reference sites for more apropriate site tailoring in future plantings

Based on these results a new EPA approved native seedmix was designed together with BSB and Len Ballek for the Butte hill.

Common Name	Species	% mix	Desired Seeds/SF	Seeds/lb.	lbs PLS/acre
Bluebunch wheatgrass	*Pseudoroegneria spicata*	30%	30	117,500	11.12
Idaho fescue	*Festuca idahoensis*	37%	37	450,000	3.58
Rough fescue	*Festuca scabrella*	9%	9	200,000	1.96
Prairie junegrass	*Koeleria macrantha*	9%	9	2,300,000	0.17
Sandberg bluegrass	*Poa sandbergii*	10%	10	925,000	0.47
Quick guard (sterile triticale)	*Triticale*	3%	3	22,700	5.76
Blue flax	*Linum lewisii*	1%	1	233,750	0.19
Rubber rabbitbrush	*Ericameria nauseosa*	1%	1	693,000	0.06
	Grand Totals	**100.0%**	**100**		**23.3**

Lessons learnt – New approaches

Collect propagules of locally adapted pioneer species

Lessons learnt – New approaches

Locally adapted pioneer species



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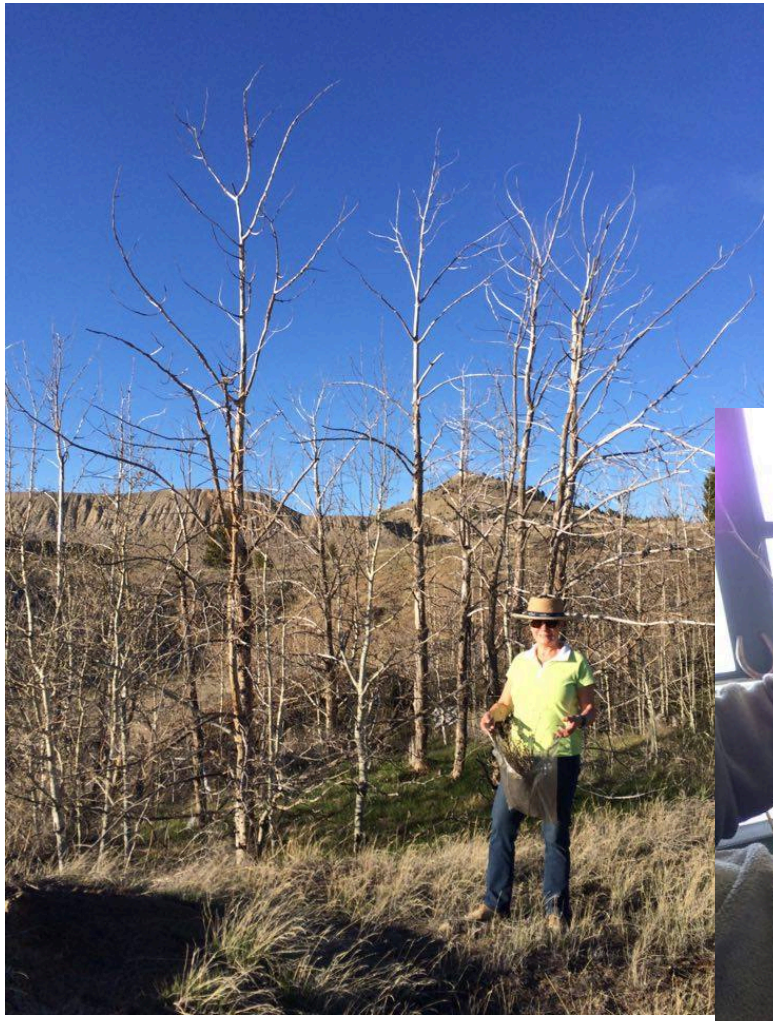
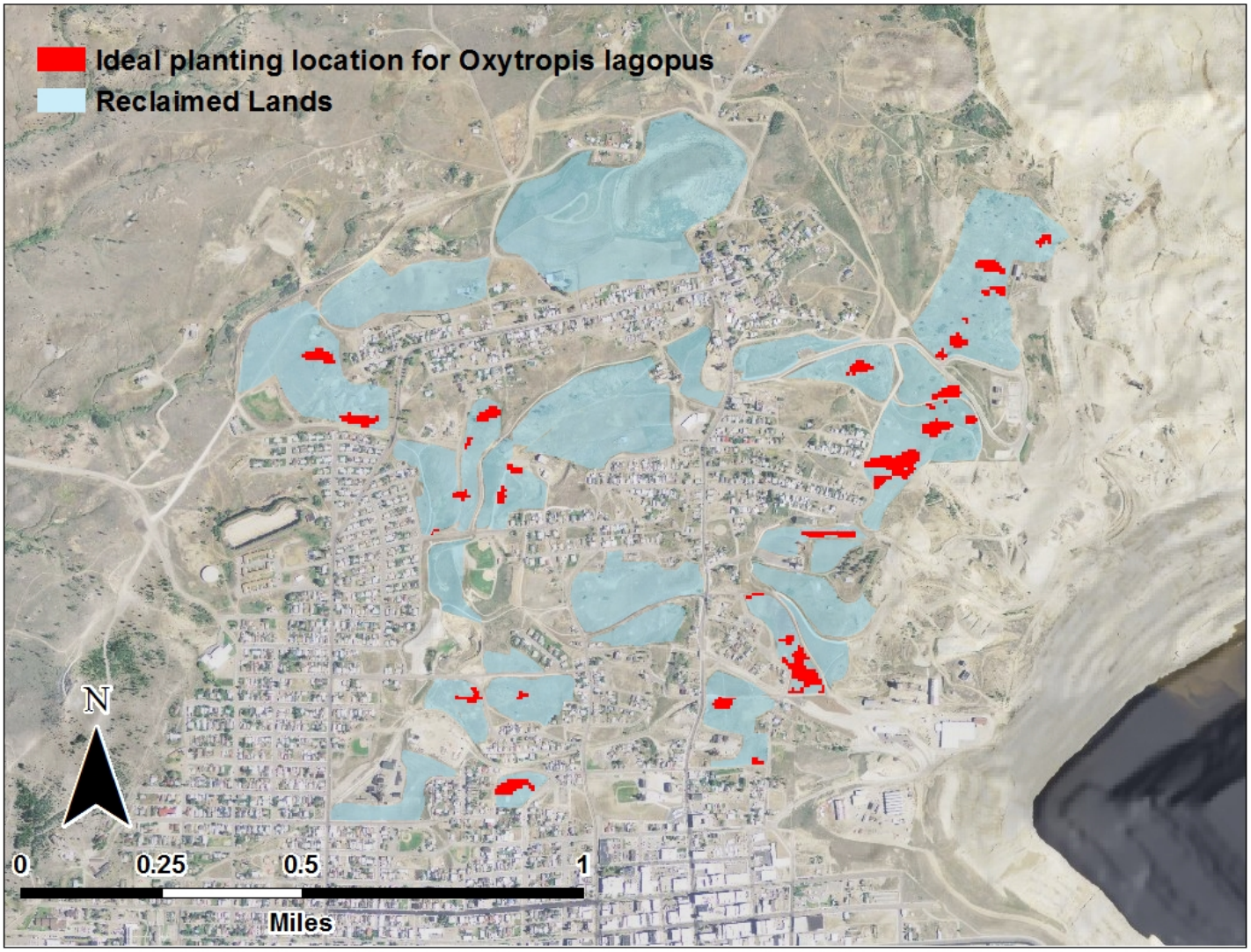
"stabilizing pioneer"



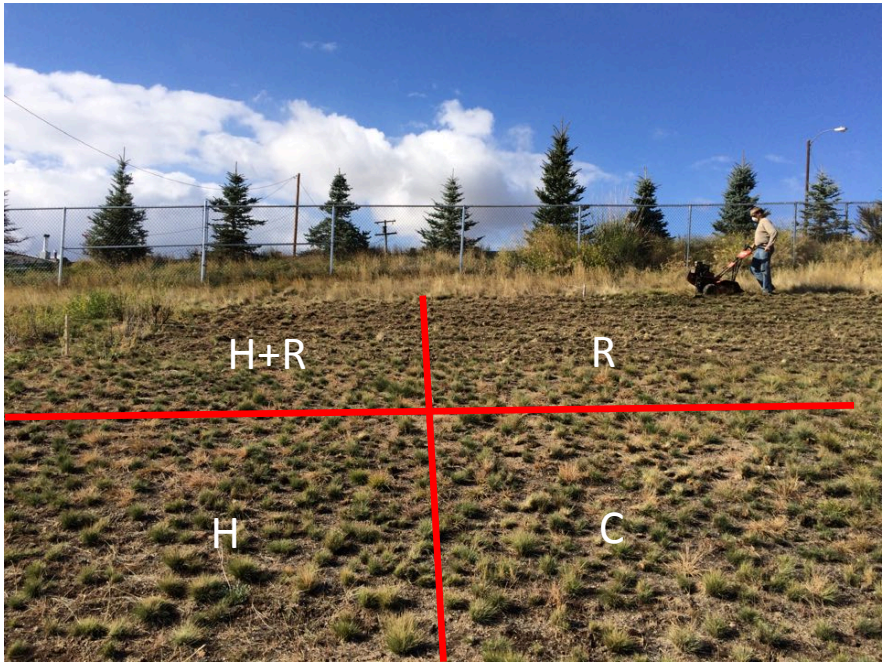
Lessons learnt – New approaches

GIS model for best planting locations



Lessons learnt – New approaches

Apply methods for knocking back Eurasian grasses



Seed in 6 grass species

Syndicate Pit

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Lessons learnt – New approaches

Apply methods for knocking back Eurasian grasses

Thanks