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*Providing a Continuous Supply of Locally
Adapted Native Plants for the Restoration of
BPSOU to improve the water quality in Butte
Area One*

Asst. Prof. Robert Pal (PI)
rpal@Mtech.edu
Montana Tech
1300 W park St
CBB 218
Butte, MT 59701

Mark Mariano (graduate
student)
mmariano@mtech.edu
Montana Tech
1300 W park St
CBB 302
Butte, MT 59701

Project Summary

In the Butte Priority Soils Operable Unit (BPSOU), the majority of problematic former mine sites have already been reclaimed. However, there are large areas that should be restored to meet the Applicable or Relevant and Appropriate Requirements that were adopted for Montana Superfund sites. This requires that a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area be established. The requirements relate to the planting of self-regenerating trees and shrubs to achieve plant succession that equals the natural vegetation of the given area (ARM 17.24.711). The Montana Tech Native Plant Program (MTNPP) and other groups have been successfully performing the required restoration steps but there is a continuous need for native species in areas that are identified annually. The most essential element of this process is to work with locally collected and grown native plants, which can be more successfully established on the selected sites and provide a self-sustainable native ecosystem. The MTNPP has been growing a large number of these plants. However, the need to grow even more plants for the program and other collaborators is getting more demanding, and it is exceeding the capacity of the available greenhouse space.

MTNPP could and should be growing more native plants for itself, as well as for BSB restoration projects and other restoration projects in the Butte area. Therefore, we propose to build a second greenhouse at Montana Tech that could provide, a minimum of 5000 native plants (trees, shrubs, forbs) per year for the restoration partners that work in the area. The MTNPP has the expertise, the experience and the capability to perform this work. Additionally, there are no locally available native plant providers that could grow locally collected materials. Therefore, MTNPP would not be competing with any local nurseries or landscapers.

Having this greenhouse available would provide the additional capacity needed to produce many additional plants that would pay back the invested price in two years. Other NRDP projects would pay the cost to produce the plants, significantly discounted from the price that would include the infrastructure investment through this project.

We have selected a location for the greenhouse next to MTNPP's seed orchard at Montana Tech (see attached map in Appendix A).

The proposed project will greatly enhance the reclaimed sites by moving BPSOU towards proper restoration that will lead to the improvement of water quality in BAO.

Project Goal and Objectives

GOAL:

To build a greenhouse at Montana Tech that could provide, at a minimum, 5000 native plants (trees, shrubs, forbs) yearly for the restoration partners that work in the area. This greenhouse would be a crucial resource for increasing the amount of restoration accomplished in the BPSOU, which would, ultimately, help restore water quality in BAO.

The long-term goal of the project is to improve water quality in Silver Bow Creek by producing a large number of native plants every year for restoration projects. This goal can be accomplished by simply growing locally collected and pioneer native species, by matching the species to the sites, and by selecting the perfect planting time. If these circumstances are taken into consideration in most cases, these plants would not need further maintenance after planting.

OBJECTIVES:

- Finalize quotes that were already acquired from different companies specialized in manufacturing and building greenhouses
- Prepare site location at Montana Tech seed orchard area
- Build the greenhouse with the help of contractors, Highlands College, and Montana Tech Physical Plant
- Optimize the species list of trees, shrubs, and forbs tailored to the needs of the Native Plant Program, Butte Silver Bow, and other partners that do restoration in the Butte area (Appendix B contains the species list our program works with)
- Collect the propagules (seeds and cuttings) of native plants in the Butte area
- Prepare propagation (seeds, cuttings, pots, soil, mycorrhiza) in the new greenhouse
- Grow a minimum of 5000 locally adapted native plants yearly

Project Benefits

Growing locally collected and adapted native plants is one of the most crucial elements for successful restoration. With the help of the proposed greenhouse, MTNPP will be able to provide a minimum of 5000 such native plants for our restoration partners. The quality and quantity of native plants that we can provide are not currently available at other local nurseries and are an integral part of successful restoration in Butte.

MTNPP will not only provide native plants but also expertise for every restoration situation. Our experience and the newly developed GIS model (by Mark Mariano) could provide the list of most suitable native plants tailored for each restoration site.

Project Implementation

The proposed project will be implemented by performing the following steps:

1. Build a greenhouse near Montana Tech's former daycare facility, next to the seed orchard currently used by the Native Plant Program
 - 1.1. Site preparation (performed by Montana Tech's Facilities services)
 - 1.2. Utilities (performed by Montana Tech's Facilities services)
 - 1.3. Permitting (performed by Montana Tech's Facilities services)
 - 1.4. Building (performed by Highlands College and Montana Tech's Facilities services)
 - 1.4.1. Structure
 - 1.4.2. Heaters and vents

- 1.4.3. Control system
- 1.4.4. Tables
- 1.4.5. Watering system
- 1.4.6. Lights
- 2. Set up to grow native plants for restoration partners (performed by the MTNPP personnel)
 - 2.1. Define species list with partners
 - 2.2. Provide expertise for restoration (species, site preparation, amendments, planting, need of maintenance)
 - 2.3. Seed and propagules collection
 - 2.4. Preparation for growing native plants (stratification, germination tests, pots, tray, soil, etc.)
 - 2.5. Propagation (seeding, planting of cuttings)
 - 2.6. Grow seedlings and plants for one or more seasons, depending on the size requirements of partners.

Project Schedule

As soon as the grant is approved in 2017 the acquisition and installation of the greenhouse will start. Based on the expertise from the companies, the assembly of the greenhouse can be performed in a week after site preparation. The growing operation can start right after the building is ready, potentially, by fall 2017 (depending on the starting date of the project).

Project Budget

We requested three quotes from different companies that manufacture greenhouses (see Appendix C). For each of the greenhouses there will be a charge of \$22,400 for site preparation, installing utilities, and permitting. Montana Tech’s Facilities Services will perform this work.

SITE PREPARATION, UTILITIES, AND PERMITTING

• Cold water rough plumb-in	\$1,000
• Electrical Panel	\$5,000
• Gas	\$1,000
• Site Excavation	\$4,000
• Concrete Pillar Foundation (may need more expensive foundation)	\$9,200
• Gravel Floor	\$1,000
• MT Tech Approved Lock Hardware	\$500
• Building Permit	\$700

Total: \$22,400

Montana Tech will provide the land for the greenhouse and will provide long-term maintenance.

Budget for the three different greenhouse options

NRD			
	Option#1	Option#2	Option#3
Site Preparation, Utilities, Permitting	\$ 22,400	\$ 22,400	\$ 22,400
Greenhouse	\$ 63,347	\$ 42,850	\$ 25,982
NRD Total	\$ 85,747	\$ 65,250	\$ 48,382
Cost Share			
	Option#1	Option#2	Option#3
Greenhouse Construction	\$ 10,000	\$ 16,200	\$ 11,998
Unrecovered IDC's	\$ 23,937	\$ 20,363	\$ 15,095
Cost Share Total	\$ 33,937	\$ 36,563	\$ 27,093
Grand Total			
	Option#1	Option#2	Option#3
Grand Total	\$ 119,684	\$ 101,813	\$ 75,475

Appendix A

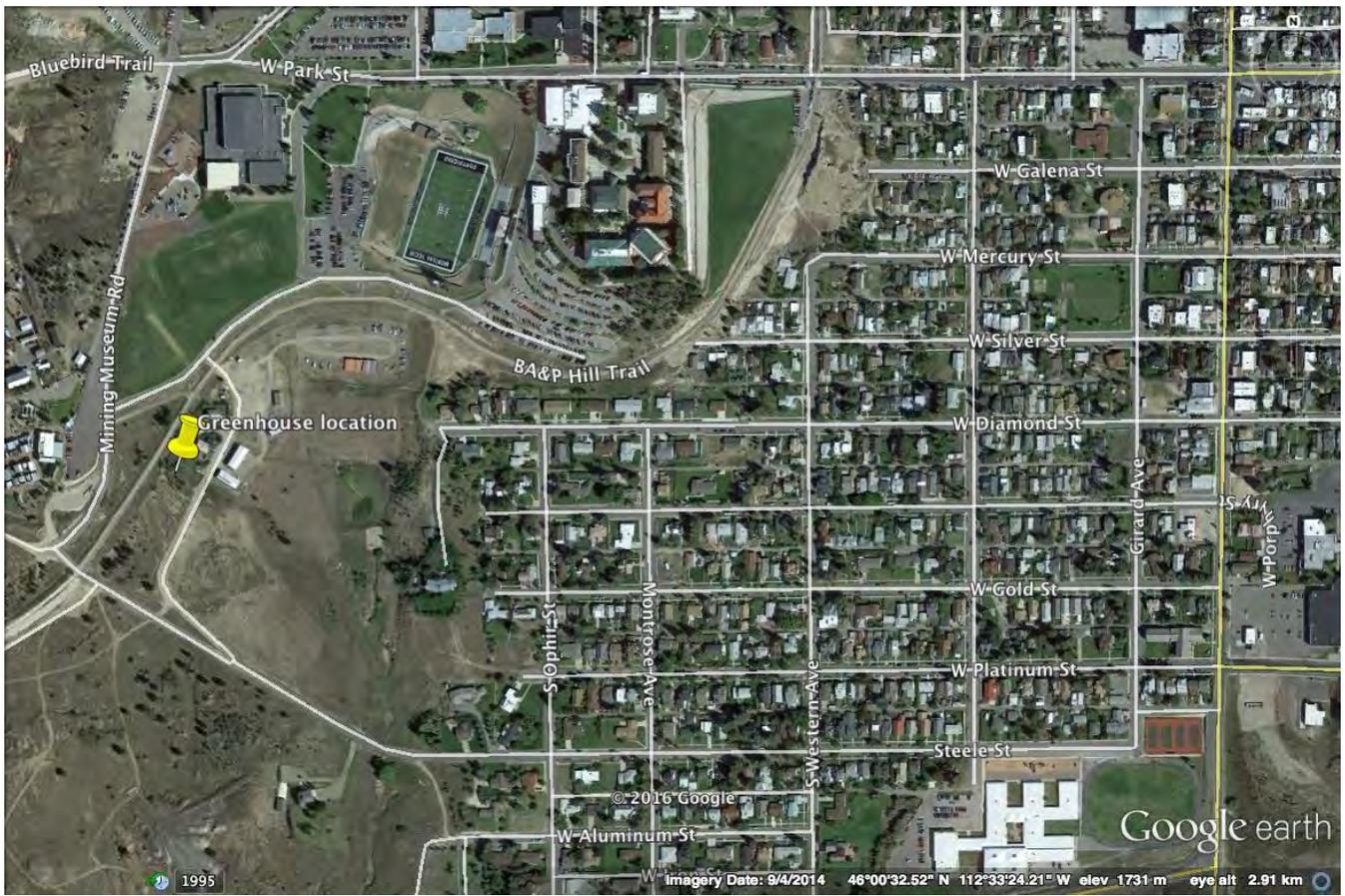


Figure 1. Location of the proposed greenhouse

Appendix B

Native plant list MTNPP

TREES		
Genus	species	Common Name
<i>Juniperus</i>	<i>scopularum</i>	Rocky Mountain Juniper
<i>Pinus</i>	<i>contorta</i>	Lodgepole Pine
<i>Pinus</i>	<i>ponderosa</i>	Ponderosa Pine
<i>Pinus</i>	<i>flexilis</i>	Limber Pine
<i>Prunus</i>	<i>virginiana</i>	Western Chokecherry
<i>Pseudotsuga</i>	<i>menziesii</i>	Douglas Fir
<i>Salix</i>	<i>exigua</i>	Sandbar Willow
<i>Sorbus</i>	<i>scopulina</i>	Mountain Ash

SHRUBS		
Genus	species	Common Name
<i>Artemisia</i>	<i>tridentata</i>	Big Sagebrush
<i>Cercocarpus</i>	<i>ledifolius</i>	Curlleaf Mountain Mahogany
<i>Chrysothamnus</i>	<i>viscidiflorus</i>	Green Rabbitbrush
<i>Ericameria (CHR)</i>	<i>nauseosa</i>	Rubber Rabbitbrush
<i>Juniperus</i>	<i>horizontalis</i>	Creeping Juniper
<i>Juniperus</i>	<i>communis</i>	Common Juniper
<i>Philadelphus</i>	<i>lewisii</i>	Mock Orange
<i>Potentilla (Dasiphora)</i>	<i>fruticosa</i>	Shrubby Cinquefoil
<i>Purshia</i>	<i>tridentata</i>	Antelope Bitterbrush
<i>Ribes</i>	species	Currant
<i>Rosa</i>	<i>woodsii</i>	Woods' Rose
<i>Spiraea</i>	<i>betulifolia</i>	White Spiraea
<i>Tetradymia</i>	<i>canescens</i>	Horsebrush

FORBS		
Genus	species	Common Name
<i>Achillea</i>	<i>millefolium</i>	Yarrow
<i>Agoseris</i>	<i>glauca</i>	False Mountain Dandelion
<i>Allium</i>	<i>cernuum</i>	Nodding Onion
<i>Allium</i>	<i>textile</i>	Textile Onion
<i>Antennaria</i>	<i>microphylla</i>	Pussytoes
<i>Apocynum</i>	<i>androsaemifolium</i>	Spreading Dogbane
<i>Arenaria</i>	<i>congesta</i>	Ballhead Sandwort
<i>Arnica</i>	species	Arnica
<i>Artemisia</i>	<i>frigida</i>	Fringed Sage
<i>Artemisia</i>	<i>ludoviciana</i>	White Sage

<i>Astragalus</i>	<i>atropubescens</i>	Milkvetch
<i>Balsamorhiza</i>	<i>sagittata</i>	Arrowleaf Balsamroot
<i>Boechera/Arabis</i>	<i>holboellii</i>	Holboell's Rockcress
<i>Campanula</i>	<i>rotundifolia</i>	Bluebell Bellflower
<i>Chaenactis</i>	<i>douglasii</i>	Dusty Maiden
<i>Chamerion/Epilobium</i>	<i>angustifolium</i>	Fireweed
<i>Cryptantha</i>	<i>interrupta</i>	Miner's Candle
<i>Douglasia</i>	<i>montana</i>	Rocky Mountain Douglasia
<i>Erigeron</i>	<i>compositus</i>	Cutleaf Daisy
<i>Eriogonum</i>	<i>umbellatum</i>	Sulfurflower Buckwheat
<i>Eriogonum</i>	<i>ovalifolium</i>	Cushion Buckwheat
<i>Gaillardia</i>	<i>aristata</i>	Blanketflower
<i>Geranium</i>	<i>viscosissimum</i>	Sticky Geranium
<i>Geum</i>	<i>macrophyllum</i>	Largeleaf Avens
<i>Geum</i>	<i>triflorum</i>	Old Man's Whiskers
<i>Grindelia</i>	<i>squarrosa</i>	Curlycup Gumweed
<i>Heterotheca</i>	<i>villosa</i>	Hairy Goldenaster
<i>Heuchera</i>	<i>cylindrica</i>	Roundleaf Alumroot
<i>Hymenoxys</i>	<i>acaulis</i>	Stemless Fournerve Daisy
<i>Lewisia</i>	<i>rediviva</i>	Bitterroot
<i>Linum</i>	<i>lewisii</i>	Lewis' Flax
<i>Lithospermum</i>	<i>ruderales</i>	Puccoon
<i>Lupinus</i>	<i>sericeus</i>	Silky Lupine
<i>Mentzelia</i>	<i>laevicaulis</i>	Smoothstem Blazingstar
<i>Oenothera</i>	<i>biennis</i>	Common Evening Primrose
<i>Packera</i>	<i>cana</i>	Woolley Groundsel
<i>Penstemon</i>	<i>eriantherus</i>	Fuzzytongue Penstemon
<i>Penstemon</i>	<i>procerus</i>	Littleflower Penstemon
<i>Penstemon</i>	<i>aridus</i>	Stiffleaf Penstemon
<i>Phacelia</i>	<i>hastata</i>	Silverleaf Phacelia
<i>Phlox</i>	<i>longifolia</i>	Longleaf Phlox
<i>Phlox</i>	<i>muscoides</i>	Moss Phlox
<i>Polemonium</i>	<i>pulcherrimum</i>	Jacob's Ladder
<i>Potentilla</i>	<i>gracilis</i>	Slender Cinquefoil
<i>Sedum</i>	<i>lanceolatum</i>	Stoncrop
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod
<i>Solidago</i>	<i>missouriensis</i>	Missouri Goldenrod
<i>Symphotrichum/Aster</i>	<i>spathulatum/occidentalis</i>	Western Meadow Aster
<i>Zigadenus</i>	<i>venenosus</i>	Meadow Death Camas

Appendix C

Detailed Quotes of the three greenhouses

Ceres HighYield Greenhouse 23' X 48' (1,104 ft²)

Benefits:

- **No contractor needed (kit)**
- Highly insulated. **Triple wall 16mm with 3" panels on N wall for R-21**
- Passive solar design
- **Engineer stamped plans included**
- **All hardware included in price of building**
- Construction assistance included
- Company architect lives in Livingston

Drawbacks:

- Higher upfront cost of building

Estimated Costs:

Excavation and Foundation:	\$22,400
Building:	\$56,000
Hardware:	Included
Shipping:	\$3,000
Heaters:	\$500 - \$700
Vent fans and vents:	Included
Control System: (From IGC)	
Thermostat:	\$50
Engineer Stamp:	Included
Door:	Included (Metal and insulated)
Tables: (From IGC) 3 @ 4' X 36' =	\$1,212
Circulation fans: (\$100 a piece)	\$1,000 - \$2,000
Watering System: (From Growers Supply)	\$385
Total: \$22,400 + \$63,347 =	\$85,747

Agratech Greenhouse 30' X 48' (1,440 ft²)

Benefits:

- Moderately insulated with 3 layer 16mm on entire building
- Cheaper upfront cost of building

Drawbacks:

- **Contractor Needed**

Estimated Costs:

Excavation and Foundation:	\$22,400
Building: (\$12,780 x 3 for a super rough estimate) =	\$32,253
Contractor: (50% of Building cost) =	\$16,200
Hardware:	Included
Shipping: (Taken from Ceres quote)	\$9,000
Heaters:	Included
Vent fans and vents:	Included
Control Panel:	
Thermostat:	Included
Engineer Stamp: Not Needed	
Circulation Fans: 2 20" fans	Included
Door: (4' sliding door)	Included
Tables: (From IGC) 3 @ 4' X 36' =	\$1,212
Watering System: (From Growers Supply)	\$385
Total: \$22,400 + \$59,050 =	\$81,450

IGC Greenhouse 30' X 60' (1,800 ft²)

Benefits:

- Cheaper upfront cost of building
- Heaters included
- Free shipping
- Largest size of all three

Drawbacks:

- **Contractor needed**
- Low insulation value: **Double wall 8mm on entire building**
- Door is just a storm door
- Low sidewall at 4'
- **DOES NOT MEET SILVER BOW/MTECH BUILDING CODE REQUIREMENTS !!!**
 - BSB Code = 57 lb. live load; 90 mph wind
 - IGC highest 30 lb. load, 85 mph wind

Estimated Costs:

Excavation and Foundation:	\$22,400
Building:	\$23,995
Contractor: (50% of Building cost) =	\$11,998
Hardware:	Included
Shipping:	Included
Heaters:	Included
Vent fans and Vents:	Included
Control Panel:	
Thermostat:	Included
Engineer Stamp:	Not Needed
Circulation fans:	Included
Door:	Included (storm door)
Tables: 3 @ 4' X 48' =	\$1,602
Watering System: (From Growers Supply)	\$385
Total: \$22,400 + \$37,980 =	\$60,380
