



Department of Biological Sciences
Montana Tech

Native-Plant Restoration Project

Year 3 Annual Plan
April 1, 2015 - December 31, 2015

Prepared by

Robert Pal and Krystal Weilage



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The Project Sponsor proposes to perform the following tasks during Project Year 3 (through December 31, 2015) in order to accomplish the objectives.

1. Coordinate with stakeholders to select priority planting and optimize project impact

Coordinate with NRDP, BSB, DEQ, and BNRC to identify planting locations and opportunities. A representative of Montana Tech and this project will attend and participate in all meetings held to coordinate this project with stakeholders and regulators and report to NRDP and BNRC. Information gained from the meetings will guide priorities for 2015 and the development of the Year 4 (2016) plan.

2. Monitor the success of the project at every site

Monitoring the native plant restoration sites that have been launched in the last few years would be the main initiative of 2015. Based on the results, we will be able to evaluate and rethink the work that has been accomplished so far, so that we can tailor the best techniques to further improve the sites in their current state, and use the successful strategies to restore native plant communities to more locations in Butte Area One.

- Inspect and evaluate the dispersal islands.
- Determine which species are surviving, propagating and spreading.
- Determine which planting techniques and which locations are the most successful.
- Make subsequent adaptations to increase the probability for achieving the project goals most cost effectively.

Description of the monitoring methods

1. Check the survival rate and condition of the plants planted at each site
 - a. Plants (trees, shrubs, forbs and grasses) will be located
 - i. Their survival will be registered (dead/alive)
 - ii. Their fitness will be evaluated (healthy reproductive plant, healthy non-reproductive plant, unhealthy reproductive plant, unhealthy non-reproductive plant)
 - iii. Evaluate data
2. Monitor the spread of plants from the seed dispersal islands
 - a. Conduct 4, 50 m long transects towards each cardinal point
 - i. Each transect will have 50 1x1 m quadrates
 - ii. In each quadrate list all plant species present
 - iii. Estimate their coverage
 - iv. Estimate bare ground coverage
 - v. Estimate litter coverage
 - b. Evaluate quadrates for their
 - i. Total vegetation cover
 - ii. Total bare ground cover
 - iii. Total litter cover
 - iv. Exotic species cover
 - v. Native species cover
 - vi. Exotic species number
 - vii. Native species number

- viii. Distance of species migration from the center of dispersal islands
 - ix. Change of diversity from the center of dispersal islands
 - x. Change of the number and coverage of native and exotic species from the center of seed dispersal islands
3. Evaluate the vegetated sites according to their current vegetation
 - a. Conduct 20 1x1 m randomly assigned plots at each site
 - i. List all plant species present in the plots and estimate their coverage
 - ii. Estimate bare ground in the plots
 - iii. Estimate litter in the plots
 - b. Evaluate plots for their
 - i. Total vegetation cover
 - ii. Total bare ground cover
 - iii. Total litter cover
 - iv. Exotic species cover
 - v. Native species cover
 - vi. Exotic species number
 - vii. Native species number

Based on these results we will make further suggestions on future restoration steps.

3. Locate and survey reference sites in native vegetation around Butte

Native reference sites would help us to identify the best species composition and the ratio of best performing plants at different habitats and aspects, so that the new sites will meet the criteria for a successful restoration. During the growing season we will locate 20 undisturbed and native-plant-covered reference sites in every aspect (south facing dry slopes, hill tops, and north facing more mesic sites). At each site we will conduct five 1 × 1 m vegetation plots, where we record the plant species present and their coverage. We will evaluate different habitats (with different ecological conditions) separately and as a final result we will provide a species list for possible site conditions that are characteristic of the Butte area. At the surveyed reference sites we will also be able to perform seed collection for the restoration project.

4. Maintain and expand the seed orchard on the Montana Tech Campus.

The expansion will accommodate shrubs and a greater variety of forbs. Seed collection will continue this summer in the seed orchard.

Maintaining seed/forb orchard:

- Watering is on a timer but must be checked regularly according to environmental conditions and to check for necessary repairs.
- Weeding primarily involves maintaining the edges free from grass encroachment. In the past we have used herbicide carefully to keep grass out of the plots. The herbicide does not appear to be working and the seed orchard would benefit from having plastic or metal edging placed around the site to mechanically prevent grasses from invading the orchard. The general area requires occasional mowing and weed whacking.

Plants in cold sheds and nursery will be cared for and handled appropriately:

The plants that are sown into containers from treated seeds are moved outside to the nursery early in the spring to harden and acclimatize. During the winter months (mid Nov – April) these plants are moved inside the cold sheds, insulated with sawdust, and covered with frost cloth (as needed). The plants must be watered occasionally during the winter even though they are dormant.

Approximately 5,000 plants from previous years in various size pots have been over-wintered. In 2015 we intend to plant enough to replace the number planted, so the inventory at the start of next year (January 2016) would be at least 5000. All plants over 3 years old must be planted in 2015, since the older the plant becomes, the less likely the plant is to survive overwintering. There should be a turnover every 3 years, so that no plants stored at Montana Tech are more than 3 years old.

5. Operate and maintain the Montana Tech greenhouse.

The greenhouse will function as the center of seed and plant management. Collected seeds will be dried, cleaned and stored for future use. Cleaned seeds are stored in sealed Ziploc bags which are then refrigerated at approximately 40 degrees F. Of the approximately 85 species of forbs and approximately 26 species of shrubs, all but 25 forb species and 4 shrub species require treatment before they will germinate. The number of species and the amount of each species needed for the year will be determined, so that the seeds can be treated to initiate germination, if necessary. Seedlings will be grown in the greenhouse until they are mature enough to be hardened outside. “Conetainers” are tubes of various sizes within which treated seeds grow into individual plants for the project.

The greenhouse will be cleaned, operated routinely and maintained in functioning condition. The hoop house has been completed and will be put into operation this spring, so that we will have the ability to increase our productivity as needed.

6. Maintain seed dispersal islands and propagate native plants for use in ecological restoration in Butte Area One

a. Maintain dispersal islands until some degree of self-sufficiency is established.

The initial watering that the new dispersal islands require will be performed by BSB, where necessary, using watering devices at the same time they water their nearby plantings. This coordination will reduce labor time and costs to establish the plantings. Weeding will be performed by Montana Tech as needed. In coordination with the dispersal islands to be established along the Copper Trail, we recommend including two small islands of primarily native grasses. Inclusion of the grasses will help address one of the difficulties this native plant project faces: interference/competition from the large-stature, established, introduced species of grasses planted during remediation. It will be instructive to future efforts to compare how the native grasses perform compared to the grasses on the remediated sites, and how the forbs fare in competition/proximity to the native grasses in these plantings.

b. Propagate native plants on sites identified by NRDP and BSB

- Native shrubs, forbs and grasses will be planted at the Britannia Blvd area that was identified in early February 2015. The site is divided by the road into a drier and a mesic part. As the sites contain a couple of native grass species like Indian ricegrass

(*Oryzopsis hymenoides*) and Great Basin wild rye (*Leymus cinereus*) we plan to enhance its diversity by planting in perennial forbs (e.g. for the mesic sites giant goldenrod - *Solidago gigantea*, Maximilian Sunflower – *Helianthus maximiliani*; for dry sites *Artemisia ludoviciana* - white sagebrush) and shrub species (e.g. for the mesic sites red osier dogwood - *Cornus sericea*, willow species – *Salix sp.*; for dry sites big sagebrush - *Artemisia tridentata*, antelope brush - *Purshia tridentata*).

- In a coordination with BSB and NRDP we plan to vegetate the 11th Street triangle. As it is a highly visible site we will be using more ornamental native shrub species, such as *Philadelphus lewisii*, *Sorbus scopulina*, *Amelanchier alnifolia*, *Symphoricarpos* spp., *Rosa* spp., and *Ribes* spp. Additionally, the ornamental native forb species should include *Linum lewisii*, *Geranium viscosissimum*, *Lupinus* spp., *Penstemon procerus*, *Packera cana*, *Balsamorhiza sagittata*, and *Eriogonum umbellatum*.
- Montana Tech also met with BSB's Tom Malloy in early February to coordinate 2015 sites. Our colleagues will participate in the planting of the Copper Mountain Ball Field.

7. Promote stewardship among the community and make information about this project available locally by attending and presenting information at community meetings and symposiums and by preparing outreach materials.

MT Tech is proposing a plan to create a “native plant alley” interpretive trail section along the Mine Yard & Butte Hill Trail. Along a trail section coordinated with BSB and NRDP we would try to plant as many native trees and shrubs as possible, tailoring the groups of species according to the water availability and the aspect of the sections. The plants would be name tagged, and after each group of natives there should be a short description of the habitats in which the plants live.

BUDGET AND BUDGET NARRATIVE

Expense Category	Budget		
Salaries & Wages:	Rate	Hours	
Restoration Ecologist + PI - Robert Pal (3 months/20 hrs/wk)	\$34.09	255	\$ 8,693
Green House Manager - Krystal Weilage (9 months/40 hrs/wk)	\$18.45	1560	\$ 28,782
Grad student - Mark Mariano (40hrs/wk summer & 20 hrs/wk academic year)	\$16	1040	\$ 16,640
Undergrad students 60 hrs/wk summer & 20 hrs/wk academic year)	\$10	1420	\$ 14,200
Subtotal			\$ 68,315
Fringe Benefits:			
Restoration Ecologist + PI (46% of salary)		0.46	\$ 3,999
Green House Manager (46% of salary)		0.46	\$ 13,240
Grad student (3% during school term/10% in summer)		0.07	\$ 1,165
Undergrad students (3% during school term/10% in summer)		0.07	\$ 994
Subtotal			\$ 19,397
Other:			
Contracted Services			\$ 2,500
Supplies/Materials			\$ 7,000
Communications			\$ 1,000
Travel			\$ 500
Other			\$ -
Subtotal			\$ 11,000
Direct Cost Subtotal			\$ 98,712
Miscellaneous:			
Indirect Cost (25% of Direct Costs)		0.25	\$ 24,678
Grand Total			\$ 123,390

The Year 3 budget request is for 9 months, from April 1, 2015 through December 31, 2015. This 9 months is the most labor-intensive part of the year, requiring about 85% of the annual effort.

Salaries and wages are requested for the full-time Greenhouse manager for the entire period, and for half-time of the restoration ecologist for October through December only. Dr. Robert Pal officially joins Montana Tech October 1, 2015 in this role. He has been involved with the project since January 2015 and will continue involvement through September under his current position as a Marie Curie Research Fellow, funded by the European Union. Pending his official arrival in October, the Greenhouse manager will also serve as the day-to-day operational manager for the project. Also included is one graduate student (1040 hours) and several undergraduate students totaling 1420

hours. This team will allow the project to start to catch up on the planting work and also to thoroughly evaluate the work to date in order to inform the future effort and lead to improved efficiency and effectiveness. The site evaluation activity proposed is both systematic and labor intensive, and it will be much more limited in future years. Fringe benefits are calculated using Montana Tech's standard rates.

An additional \$11,000 is requested for contracted services (\$2,500), supplies (\$7,000), communications (\$1,000), and travel (\$500) to the planting and monitoring locations. Supplies include: soil (\$1,000) and pots (\$1,000) for starting the plants, edging around the seed orchard (\$1,000) to limit encroaching weeds, watering system supplies (\$1,000), seeds (\$1,000) and plant material (\$1,000), fertilizer and incidentals (\$1,000).

This total 9-month budget, though only covering three-quarters of a year, is nearly equal to the annual average over the 8 year duration of the project. This summer is planned to be especially labor intensive in order to accomplish the retrospective evaluation to inform and guide future efforts. Future 12-month budgets will be consistent with the 8-year duration of the project.

**Butte Area One
Native Plant Diversity
Site Improvement Plan**

Site Name: 2015 Site A Date: 3/15/15

Site Location/Size: Tzarena Dump/BRES #119 (Britannia Blvd Northern Side)

GPS: 46 00 12.59 N; 112 33 26.22 W

BRES Site #/Name: Not a BRES site (remediation done by state--?)

BSB Zoning Classification(s) at Site: One family residential

Vegetative Deficiencies/Problems at this Site: Enhancement, species do not represent local native plant diversity

Proposed Efforts to Improve the Site: Montana Tech plans to increase diversity by planting native perennial shrubs and forbs in the area tailored to the site's dry and more mesic conditions

Efforts to Co-ordinate with other Entities: Coordinated with Butte-Silver Bow and their tree pod project manager

Materials and Labor Estimate: Materials: 750 containers of forbs and shrubs, 3 ounces native seed. Labor estimate for planting: 120 hrs

Estimated Cost: \$6,000 (including propagation/preparation of plants)

Proposed Start Date: Summer 2015 Proposed Evaluation Date: June 2017

Submitted by: Montana Tech

**Butte Area One
Native Plant Diversity
Site Improvement Plan**

Site Name: 2015 Site B Date: 3/15/15

Site Location/Size: Tzarena Dump/BRES #119 (Britannia Blvd Southern Side)

GPS: 46 00 11.72 N; 112 33 26.79 W

BRES Site #/Name: Not a BRES site (remediation done by state--?)

BSB Zoning Classification(s) at Site: One family residential

Vegetative Deficiencies/Problems at this Site: Enhancement, species do not represent local native plant diversity

Proposed Efforts to Improve the Site: Montana Tech plans to increase diversity by planting native perennial shrubs and forbs in the area tailored to the site's dry and more mesic conditions

Efforts to Co-ordinate with other Entities: Coordinated with Butte-Silver Bow and their tree pod project manager

Materials and Labor Estimate: Materials: 750 containers of forbs and shrubs, 3 ounces native seed. Labor estimate for planting: 120 hrs

Estimated Cost: \$6,000 (including propagation/preparation of plants)

Proposed Start Date: Summer 2015 Proposed Evaluation Date: June 2017

Submitted by: Montana Tech

**Butte Area One
Native Plant Diversity
Site Improvement Plan**

Site Name: 2015 Site C

Date: 3/15/15

Site Location/Size: 11th Street triangle

GPS: 46 01 26.44 N; 112 32 57.13 W

BRES Site #/Name: Not a BRES site (remediation done by city/county--?)

BSB Zoning Classification(s) at Site: One family residential

Vegetative Deficiencies/Problems at this Site: Enhancement, species do not represent local native plant diversity

Proposed Efforts to Improve the Site: Montana Tech plans to increase diversity by planting native perennial shrubs and forbs in the area tailored to the site's dry conditions

Efforts to Co-ordinate with other Entities: Coordinated with Butte-Silver Bow and their tree pod project manager

Materials and Labor Estimate: Materials: 1000 containers of forbs and shrubs, 4 ounces local native seed. Labor estimate for planting: 160 hrs

Estimated Cost: \$10,000 (including propagation/preparation of plants)

Proposed Start Date: Summer 2015 Proposed Evaluation Date: June 2017

Submitted by: Montana Tech

**Butte Area One
Native Plant Diversity
Site Improvement Plan**

Site Name: 2015 Site D Date: 3/15/15

Site Location/Size: Copper Mountain Ball Field GPS: 45 58 41.80 N; 112 32 35.55 W

BRES Site #/Name: TBA (approximately 12 sites—we will pick one or two)

BSB Zoning Classification(s) at Site: Open Space - Developable

Vegetative Deficiencies/Problems at this Site: Enhancement, species do not represent local native plant diversity, site needs more trees and shrubs for wind shelter and aesthetics

Proposed Efforts to Improve the Site: Montana Tech plans to increase diversity by planting native perennial shrubs and forbs in the area tailored to the site's habitat conditions

Efforts to Co-ordinate with other Entities: Coordinated with Butte-Silver Bow and their tree pod project manager

Materials and Labor Estimate: Materials: 1000 containers of forbs and shrubs, 4 ounces native seed. Labor estimate for planting: 200 hrs

Estimated Cost: \$14,000 (including propagation/preparation of plants)

Proposed Start Date: Summer 2015 Proposed Evaluation Date: June 2017

Submitted by: Montana Tech

**Butte Area One
Native Plant Diversity
Site Improvement Plan**

Site Name: 2015 Site E Date: 3/15/15

Site Location/Size: A section of Emmett and Henry Trailside site GPS: 46 00
N; 112 33 W

BRES Site #/Name: BRES map coming

BSB Zoning Classification(s) at Site: Open Space - Developable

Vegetative Deficiencies/Problems at this Site: Enhancement, species do not represent local native plant diversity. As part of the stewardship promotion Montana Tech plans to create an interpretive trail section with native species.

Proposed Efforts to Improve the Site: Montana Tech plans to plant as many native trees and shrubs as possible, tailoring the groups of species according to the water availability and the aspect of the trail sections. Plants would be identified by name tags.

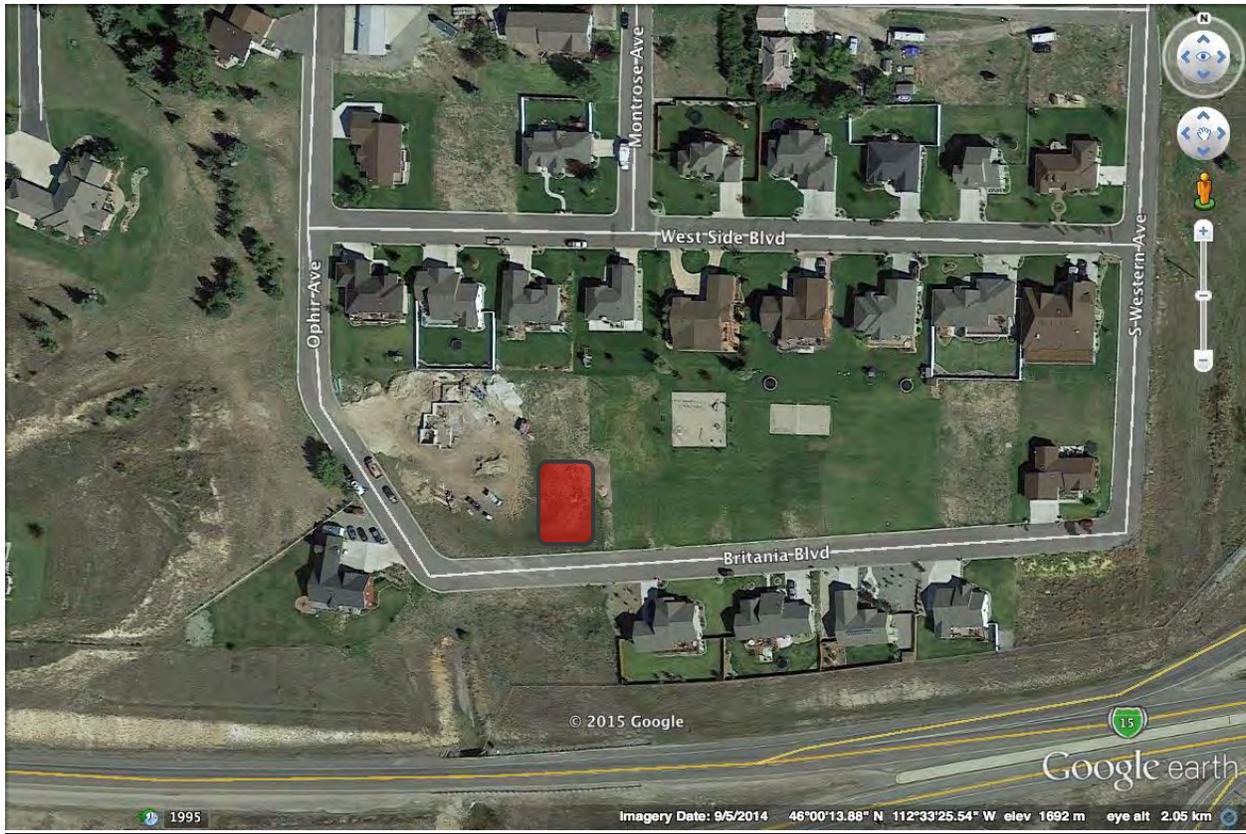
Efforts to Co-ordinate with other Entities: Coordinated with Butte-Silver Bow and their tree pod project manager

Materials and Labor Estimate: Materials: 300 containers of trees and shrubs. Labor estimate for planting: 160 hrs

Estimated Cost: \$10,000 (including propagation/preparation of plants)

Proposed Start Date: Summer 2015 Proposed Evaluation Date: June 2017

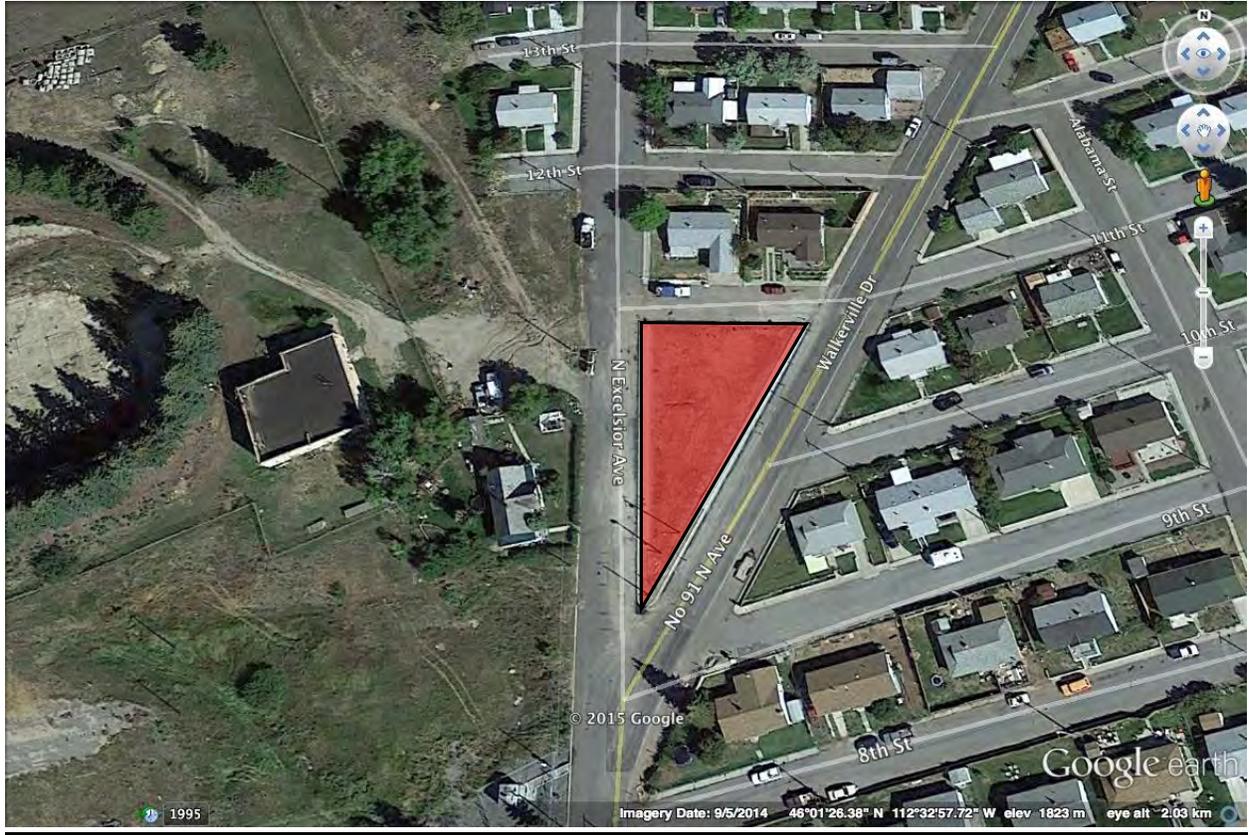
Submitted by: Montana Tech



Tzarena Dump/BRES #119 (Britannia Blvd Northern Side)



Tzarena Dump/BRES #119 (Britannia Blvd Southern Side)



11th Street triangle



Copper Mountain Ball Field



A section of Emmett and Henry Trailside site