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The Relationship Between Site Contamination and Native Plant Success in Butte, MT: Implications for Future Restoration

A Proposal

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Project Summary

In the Butte Priority Soils Operable Unit (BPSOU) there are still some unreclaimed areas that offer a unique opportunity to investigate their ecology with the aim of furthering our understanding of restoration of the Butte area that impact Butte Area One. The Montana Tech Native Plant Program (MTNPP), and other groups are active in the restoration of these areas, but because of contaminates success of the projects could be improved by better understanding what conditions and in what associations these tolerant plants grow. We propose a research project to identify native plants, and plant communities that thrive in various types and levels of contamination. This baseline data will increase the success, and reduce costs of current restorations and will allow us to navigate future restoration challenges better.

We have selected two unreclaimed study areas to establish sites (Appendix A). (1) Within the BPSOU and (2) the area West of Montana Tech. The application of this research is intended only for the injured areas that impact Butte Area One, however, by studying many unreclaimed areas West of Montana Tech, we will be able to develop a more robust dataset. Study sites will consist of a variety of aspect, slope, proximity to less disturbed areas, and hydrologic conditions. We will survey sites along transects at defined intervals. At each interval, a vegetation plot, pH, and soil sample will be measured. Then, we will analyze our data for relationships between particular contaminates and plant species.

Currently, MTNPP tries to match species to compatible sites using general knowledge of species preference for slope, aspect, and hydrologic conditions. However, often the limiting factor is high levels of contaminants. This study will help remedy this situation by allowing us to target species to specific areas. We can also use this information as a predictive tool. In areas yet to be restored where we don't know the makeup of contaminates, we should be able to generally assume site contamination based on the plant communities that are already present on the site and therefore eliminate the need for expensive soil tests or using a trial and error approach. Of course, where we already know the contaminants we can create a more successful restoration plan. In addition, this data could be integrated into Mark Mariano's GIS model (that was funded by the BNRC small projects in 2016) to match species to sites with plant contaminate tolerance information.

Future restorations of capped areas will need to consider contamination below. Many native plants have deep roots that will provide the most robust protection against erosion of the cap in the future. However, we will have to contend with the interaction of native plants and the contamination below. Understanding the specific plant-contaminate relationships will allow us to diagnose failures as plants grow deeper into the cap.

Project Goal and Objectives

GOAL:

Investigate the relationship between plant communities and the varying levels, and types of contaminates in Butte to increase the effectiveness of future restorations that impact Butte Area One.

OBJECTIVES:

- Develop protocols and procedures for vegetation, soil, and pH sampling.
- Identify study areas.
- Perform vegetation description and soil, and pH sampling on a wide variety of ecosystem attributes such as: slope, aspect, and hydrologic conditions.
- Analyze data to determine typical vegetation composition of various classes of contamination types.
- Create quick reference guide of which plant species grow on areas of typical contamination.
- Share results with restoration and reclamation professionals in the Butte community.
- Integrate data into Mark Mariano's GIS model.

Project Benefits

- Reduce waste and costs of restoration plantings by identifying which plant species are successful in various types of contamination.
- Further understanding of restoration failures.
- Increase our understanding of restoration in unreclamied areas.
- Increase abundance of native plant cover to reduce storm water run-off and erosion in reclaimed areas.

Project Implementation

1. Protocols and procedures will be adapted from industry standards to fit the purposes of this study.
2. Permission will need to be obtained from the various land owners in the study area (Butte-Silver Bow, ARCO, etc.).
3. Obtain necessary equipment such as: portable pH meter, portable X-ray Fluorescence Analyzer, GPS, and, quadrates.
4. Analyze data in conjunction with Professor Robert Pal and submit for publication.
5. Work with Mark Mariano to integrate data into GIS model.

Project Schedule

May 2017

1. Develop field data collection protocols including data entry sheets, soil sampling methodology, pH sampling methodology, data entry protocols, and transect protocols.
2. Identify study areas with a diverse set of attributes such as slope, aspect, size, proximity to undisturbed and reclaimed sites.

June 2017

1. Field work: Visit selected sites and collect data using protocols and methodology developed.

July 2017

2. Data entry and analysis.
3. Write a paper on findings.
4. Integrate data into GIS model.

Monitoring Activities

Direct monitoring of this study does not apply, however, it could provide a great opportunity for future research to understand how using the results impact restoration in Butte.

Project Budget

Montana Tech will contribute many valuable items that are not considered matching funds but are worth noting.

1. Portable X-ray Fluorescence Spectrometer valued at $40,000
2. Computer software: ArcGIS suite, Turboveg, Microsoft office suite
3. Computers
4. Use of state 4x4 truck

Please find the detailed budget on the following page.

| Expense Category			NRD	Cost Share
Labor	Rate	Hours		
Restoration Ecologist + PI - Robert Pal (2 weeks)	$54.14	80		$ 4,331
Grad Student (Jared Trilling) - 360 hours	$22.00	360	$ 7,920	
Subtotal			$ 7,920	$ 4,331
Materials				
Personal protection, office supply, plastic bags			$ 250	
Portable pH meter			$ 250	
Vehicle mileage reimbursement			$ 250	
Laboratory analysis (10 samples $250 each)			$ 2,500	
Subtotal			$ 3,250	
Grand Total			$ 11,170	$ 4,331

Appendix A
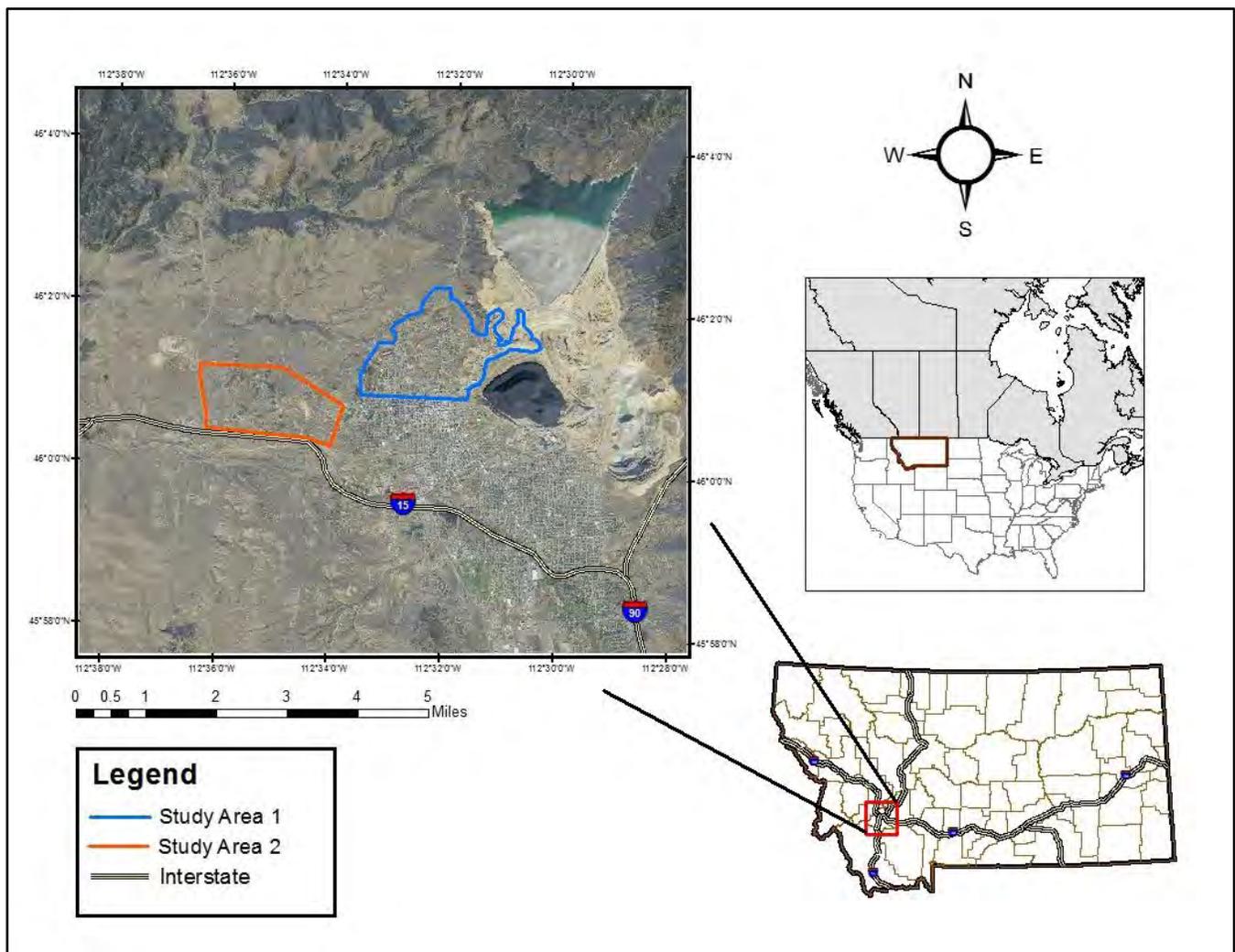
Figure 1. Locations of study areas. Study Area 1 is located in the northern part of the BIPSOU, while Study Area 2 is located West of Montana Tech. Study areas located outside areas that impact Butte Area One are used solely to expand the data set and are not intended to benefit from study applications.