

# A GIS Model to Guide Revegetation Efforts in Butte

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## Project Summary

A variety of revegetation projects are being implemented on the Butte hill with anticipated benefits for Butte Area One. However, up until now these projects randomly selected revegetation sites with little regard to basic ecological background features that should be considered when designing a successful restoration project. This is a proposal for funding to develop a GIS model using ESRI software's ArcGIS to enhance the level of success of these projects by calculating the best possible location and habitat for any of the plant species selected. This GIS model will be a systematic planning tool to select for future sites and will also help determine the most appropriate plant materials habituated to each of the sites. This will, in turn, save on resources and result in higher success rates for all of the revegetation projects.

This GIS model is an iterative program constructed to run a series of analytical tools available in the ArcGIS software. Once constructed, the resulting program can be reused and/or modified to test different variables and parameters. Additionally, the GIS model will be shareable for use by anyone with the necessary licensure for the software. The "plug and play" nature of the completed model makes it useful even with very little GIS training, similar to using a smartphone app.

The revegetation model will utilize a base of publicly available geographical and topographical information. Data collected by Montana Tech's Native Plant program of "reference sites" matching plant species to the aspect, slope, and hydrologic conditions will be incorporated to determine suitable planting areas on the Butte hill. These data will be GPS marked and entered onto a grid overlaid on the Butte area. This information will be used to define the model's parameters to determine which species are appropriate for these specific site conditions.

To run the model, the user will enter the known habitat type for a species or a group of species. The model will then run multiple tools and develop a map showing all suitable locations within the defined area where species or sets of species are ecologically appropriate. The model will also filter out areas which contain reclamation species which may interfere with success. It may also be possible to map areas on the hill which are heavily contaminated and not suitable for planting.

For the purpose of demonstrating the capabilities of the model, the following the following criteria are assumed:

- Sticky geranium (*Geranium viscosissimum*) thrives on north-facing slopes and at a low gradient.
- This species may also not be able to tolerate areas which are dominated by crested wheatgrass (*Agropyron cristatum*).

By entering this data into the model, areas that meet the correct slope and aspect but are not on reclaimed sites dominated by crested wheatgrass can be immediately highlighted. This map can then



be used to direct the selection of appropriate sites and will lead to a higher rate of successful revegetation.

(APPENDIX A shows a rough sample of such a map)

## *Project Goal and Objectives*

### GOAL:

Construct a GIS model in ArcGIS which can be used by any person, party, or agency as a planning tool when attempting to vegetate or revegetate areas in the Butte area which will offer improvements to Butte Area One.

### OBJECTIVES:

- Obtain the needed GIS layer files from Butte - Silver Bow's Department of Geographical Information Systems (GIS) and/or the Montana State Geographical Information Clearinghouse. These layer files will include National Agriculture Imagery Program (NAIP) imagery and a Digital Elevation Models (DEM).
- Enter reference site data collected by the Montana Tech Native Plant Program in the fall and spring of 2015-16 into ArcGIS.
- Develop the model in ArcGIS Model builder.
- Teach revegetation practitioners how to use the model and provide assistance when needed.

## *Project Benefits*

Developing a GIS model to help guide revegetation efforts will benefit Butte area resources in the following ways:

- By enhancing the level of success for vegetation projects by calculating the best possible location and habitat on the Butte hill for planting and installation.
- By acting as a systematic planning tool to select for future sites and will also help determine the most appropriate plant species for each of the sites.
- By increasing the efficiency of field revegetation efforts.



## *Project Implementation*

1. Reference site data collected by the Montana Tech Native Plant Project will need to be uploaded into ArcGIS.
2. The necessary layers (GIS files) will be gathered, uploaded, processed, and formatted.
3. A model will be built in ArcGIS Model Builder to use entered variables and produce a usable map showing the appropriate locations and habitat types for plant species and communities within the project areas.
4. The GIS model will be shared with the Montana Native Plant Project, Butte – Silver Bow, and anyone who can benefit from it.

## *Project Schedule*

### **October-January 2015/16**

Montana Tech's Native Plant Project will gather reference data and GPS plant community types outside of the Butte reclamation areas as well as the reclamation areas. This data will be entered onto a grid in ArcGIS.

### **January – March 2016**

I will develop the GIS model and make it available to people involved in the revegetation of reclaimed sites in Butte.

## *Monitoring Activities*

Although monitoring for this project does not directly apply, more information and lessons learned can be entered into or built upon the model.



## *Project Budget*

### **Matching funds and services:**

The Montana Tech Native Plant Project is funded to provide the reference site data and have committed to provide information for this project, which covers the cost of labor and materials for a large portion of the project.

Montana Tech will also provide a GPS unit for collecting further data, valued at approximately \$160.

Montana Tech's Biological Sciences Department has purchased a dedicated GIS computer and has made it available for this project. The approximate value for this project is \$250.

My desktop computer and office supplies are approximately \$200.

Montana Tech's GIS instructor has volunteered her time to help me with this project if need be.

### **Labor and materials:**

The publicly available GIS files are free.

The cost of labor is estimated at \$2000 and is derived from an estimate of 100 hours of work at \$20 an hour.



Appendix A

