**Date:**  October 28, 2013

**To:** Donald Huebner

Director of Freeman Center

**From:** Geotrek

**Subject:** Progress on the geodatabase for Freeman Center

This memo explains the progress that Geotrek has made on the project of creating a geodatabase of the Freeman Center. In this memo, we will review the nature of the project and explain the work that has been completed, is currently in progress, and tasks that will be completed by project’s end, December 5. As we described in the proposal on September 30, this project will provide a functional database and map atlas with the purpose to guide visitors throughout the ranch and to be used in future spatial analysis.

**Project Description**

**Purpose:** The goals of this project are to build a geodatabase and create a brochure with a map atlas for the Freeman Center. Another task our team will be taking up is a land cover classification for weesatch. This project is designed to enable future research and assist in the maintenance required to keep up the ranch. The map atlas will also be used to help navigate the ranch to visitors, research partners, and stakeholders.

**Scope:** The project will cover the cultural and physical features present on the 4200 acres that make up the Freeman Center. In our earlier proposal we elected to cover the following features:

Cultural Features

* Roads
* Boundary
* Fences
* Creeks
* Buildings
* Pastures
* Wells
* Drinkers

Physical Features

* Geology
* Soils
* Watershed
* Vegetation
* Topography

**Task1: Creating a Geodatabase of cultural features**

***Work completed:***

The work we have completed on the project so far follows the timeline set in the proposal. We assessed the needs of our client to come up with a basic framework for the database. This framework included the cultural features shown on page 1 of this progress report, which were decided upon with discussion with our client. Once we decided which feature classes were to be included we went on to data collection. We acquired this data through a .kmz file given by ranch director Chris Thomas. From this file we were able to export and create individual feature classes with in a data set in arc catalog. This process included creating and specifying topology rules.

**Completed:**

* Determining included features
* Data collection
* Creation of feature classes for layers that will be used producing cultural features maps
* Populating the geodatabase
* Creating and specifying rules for the topology

***In-Progress:***

To date, we have populated the geodatabase and set topological rules for the feature classes. The follow up work for the database which is currently in progress is identifying topology errors and fixing these areas using tools such as snip, trim and extend. The feature class this rule is most prominent on is the fences feature class which had dangling and/or overlapping segments. We are also currently using 6-inch resolution imagery to confirm that errors marked as exceptions are truly exceptions and not self-made errors. Once this is complete it will allow for the editing of the attribute table of each feature class into more detailed categories. Polygons and attribute tables will also be created for pasture names and sustainable farming areas; converting from degrees will allow for metric units to be used to measure lengths and areas.

**In-Progress:**

* Topology editing and validation
* Flood Zone Map
* Fixing topology errors
* Editing Attribute Tables
  + Converting degrees to linear units

***Future Work:***

Once we have completed fixing errors and accurately confirm the topology we will go into our last editing features before the cultural database is complete. This work will conclude editing on the database and will allow us to move into our cartographic design phase in which a brochure, poster, and website will be created displaying the cultural features as a whole and individually.

**To Be Done:**

* Create polygons for pastures and buildings
* Elevation (DEM) Map
* Create stand-alone tables for soil, geology, and watershed
* Cartographic design
* Map atlas creation
* Brochure

**Problems**

Due to the extent of the study area and the lack of variety for many of the physical features such as soils, watershed, and geology, a dataset for these features will not be created. In substitution, Geotrek will create a standalone table that features common varieties for geology, soils, and watershed delineation.

**Task2: Remote Sensing Applications for Assistive Ranch Management**

***Work Completed:***

The source for these DOQQ’s is from the National Agriculture Imagery Program (NAIP). The northwest and southwest San Marcos DOQQ’s were combined with the northeast and southeast Wimberly DOQQ’s using Erdas Imagine to create a mosaic from which the boundary of the Freeman Center was clipped to form the AOI.

The Tasseled Cap Transformation is a method of band interpolation that provides an image of the AOI in which the first 3 bands represent brightness, greenness, and wetness in that order. An NDVI image is a form of unsupervised classification that produces a panchromatic image in which bright features represent healthy vegetation. NDVI images are also a first step in other forms of classification and change detection.

**Completed:**

* Gather Digital Ortho Quarter Quadrants (DOQQ’s) of the study area for 2008 and 2012
* Mosaic of DOQQ’s and clipping of Area of Interest (AOI)
* Tasseled Cap Transformation
* Normalized Difference Vegetation Indices (NDVI)

***In-Progress:***

Training data is a term used to describe “control points” that are used to classify the spectral variability of a given subject. For the purposes of this project, we will be using GPS coordinates of Weesatch trees in the Freeman Center to classify the spectral response of this plant species. Hence, we will be supervising the software’s classification for Weesatch using data verified in the field to represent the spectral response of Weesatch.

**In-Progress**

* Gather Weesatch Training Data
* Supervised Classification for Weesatch using Training Data

***Future Work:***

Before the results of the Weesatch land-cover classification can be accepted, its overall accuracy must be vetted and approved. Correspondence with Eric Redeker, Director of the Wildlife Research Technologies Laboratory at Texas A&M University has outlined some potential hazards to accuracy as outlined in the Problems section below.

Change detection is done by taking classified images of the same AOI from different years and comparing them to highlight the changes in a landscape over time. Essentially, the classification for Weesatch will be represented by pixels containing the brightness values (BV’s) corresponding to the Weesatch training data. With two classified images, one can “subtract” the classified pixels from the earlier image from the later to ascertain the growth or decline of Weesatch in the area.

**To be Done:**

* Evaluate accuracy of the supervised classification for Weesatch
  + Reformulate design for classification as necessary
* Appropriate detailed soil classification data
* Perform change detection for Weesatch classification between 2008 and 2012 images

**Problems**

A likely problem to be encountered with this classification is the lack of spectral separability between Weesatch and Mesquite. However, the key to success in this endeavor is to use multiple methods of classification to find the best (most accurate) classification. Suggested additions to improve accuracy is using ancillary data like soil type/texture, interpolation of all available bands (rather than just the Near Infra-red) and the generation of an NDVI image to use in classification rather than the false-color composite image of the AOI. Unfortunately, the maps of soil type viewed thus far for the AOI are too generalized to be used in separating Weesatch from Mesquite, but we are confident that such data can be found and utilized before the end date of this project.

**Conclusion**

The project to build a geodatabase for the Freeman Center is going well. The problems that have been found as previously described have been accounted for and a solution has been created for all. We can foresee no other major problems that will keep us from completing this project by the submit date of December 5. As a whole the project is coming along great, we are on schedule for all tasks. Full details on the project will be present in the final report.

Sincerely,

Geotrek