Data Organization and Consolidation of the Bureau of Land Management's El Centro Non-Wilderness Restoration Data to Determine the Effectiveness of Desert Restoration Methods

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Introduction

The Bureau of Land Management California Desert District (BLM CDD) has been collecting restoration data for over 17 years. Data has been inputted, filed, and collected in multiple ways making it difficult to analyse the effectiveness of various restoration methods. There are several types of data collection including incursion points, monitoring points, and restoration points, all of which overlap in varying ways.

In order to make this data referable, the BLM CDD has built an Enterprise GIS system that includes relationships between each step in the restoration process. Transferring past data into this system requires several steps, which can be automated into a user-friendly Python script.

The study area, seen in Figure 1, is the El Centro field office. Migrating their data into the enterprise system is a time consuming task, yet crucial due to the amount of Areas of Critical Environmental Concern (ACEC) present in this region.

The product of this project will aid in the consolidation and organization of all BLM CDD field offices. By decreasing the processing time through Python coding, the BLM will be able to produce restoration effectiveness reports for further funding, legal documentation, and overall effectiveness monitoring.

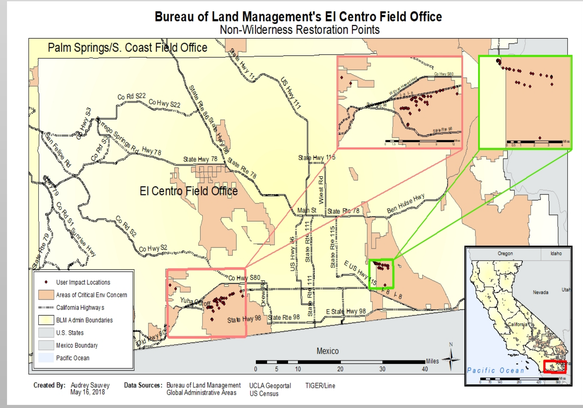


Figure 1. *Map of study area including Areas of Environmental Concern*

Data and Data Sources

Data used for this project was collected by the BLM CDD. BLM Navigator website was also used to obtain information on ACEC regions. Table 1 shows the data and sourcing used throughout the project.

Table 1. *List of data and data sources used in the project*

Dataset	Source
El Centro Field Data	The Bureau of Land Management California Desert District office
ACEC Polygons	BLM Navigator
BLM Office Polygons	BLM Navigator

Methodology

Data collected by the BLM CDD has been organized in multiple different schemas based on collection season and year. Using the flow of events seen in Figure 2 as a guidance, the consolidation process began.

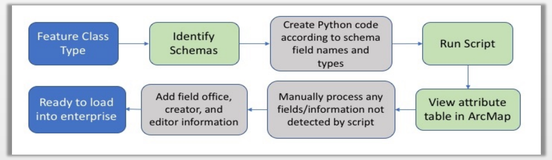


Figure 2. *Flow chat depicting process of methodical steps*

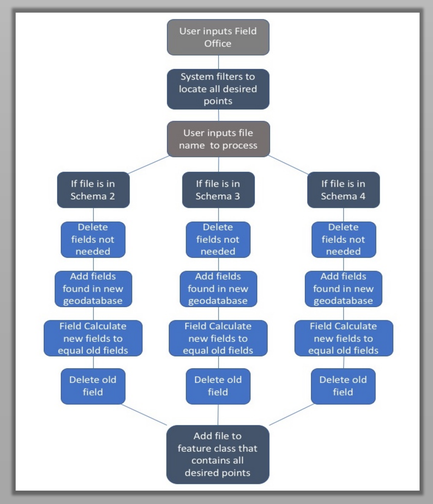
There were multiple feature classes labelled as monitoring points, incursion points, and restoration points. Creating a Python script for each of these major feature class types allowed the scripts to add, delete, and field calculate unique to the corresponding layer in the enterprise system. A user input helped filter through the archive geodatabase to locate all feature classes within the chosen field office.

Figure 3 shows the flow each script runs through to process the feature class. Once the script is ran, the processes seen in Figure 2 can continue. Since older data files contain multiple layers of information, manually parsing through the data is needed. Through manually parsing, information on desert tortoise sighting and sign kiosks, needed for other layers in the enterprise geodatabase, are found.

Examining the processed feature class in ArcMap is a crucial step to ensure all fields were processed correctly. Through this step, valuable reference information such as creator, edit date, and field office can be inputted.

Once the above steps were completed, the data was transferred into the enterprise geodatabase. Relationship classes related each layer based on the site ID, or polygon route number along with the incursion number, known as the Combined ID. This allowed for each user impact point to contain all data collected at a particular site, making viewing restoration progress simple.

Figure 3. *Flow chart showing process of Python script*



Timeline

Table 2. *Timeline of steps taken to complete project*

Date	Step Completed
4/24/2018	Finish Python script for User Impact points
5/15/2018	Met with BLM CDD to discuss progress and further desires for project
5/24-6/3/2018	Montana vacation
6/8/2018	Finish Python script for Ground Effectiveness points
6/20/2018	Complete scripts for Post Restoration lines and all "no schema" scripts
6/21/2018	Run all scripts to process data, make manual adjustments, load data into enterprise geodatabase

Results

Creating Python scripts automating the consolidation process significantly decreased the amount of time taken to process past BLM CDD non-wilderness restoration data. The Python scripts also ensured fields were properly inputted and calculated to resemble the enterprise system. This significantly lowered the rate of human error throughout the process. It also provided the processor more time to parse through data that may have been previously missed.

By having a separate script for each feature class type, it ensured data can be uniquely altered to represent what fields are needed for that particular feature class type in the enterprise system. This also allowed the BLM to easily add new fields.

The enterprise geodatabase that was created organized layers by feature class type rather than collection year as seen in the archive geodatabase (Figure 4). This organization system also allowed for the layers to represent each step in the restoration process with A being the initial point taken, B being part of the planning stage, C showing the type restoration completed, and D representing the monitoring done on the site. This system, represented in the geodatabase in Figure 4B, quickens the time take for data collectors and data analysis to view progress of a site. The enterprise system also allowed for the relationships, so a point taken in the A layer can be referenced by its combined ID and show all data collected on the selected restoration site.

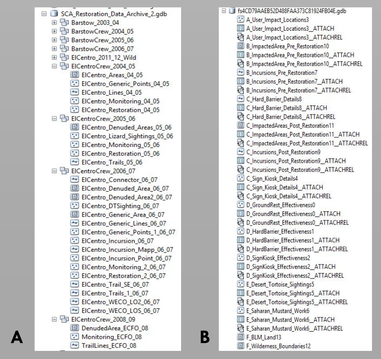


Figure 4A and B. *Shows the original archived geodatabase format (A) and the enterprise geodatabase format (B).*

Discussion

This project is not only beneficial to the BLM CDD, but the Bureau of Land Management (BLM) as a whole as well as other sectors of the U.S. Department of Interior (DOI). The Python scripts can be used as a template to consolidate the BLM CDD's wilderness restoration data and for similar data consolidation projects. Through the organization of the enterprise geodatabase, the BLM can create restoration reports that contain information on how effective a restoration method was on each site. Such reports and findings can then be passed to other sectors of the DOI for further restoration efforts. They can also provide documentation for legal purposes and grant funding.

Human error accounts for many problems and limitations throughout the project. As BLM CDD's data collection protocol changed, so did the site ID format. This resulted in Combined ID's for a single site not being the same, resulting in issues relating the points. This issue is being resolved by reinputting the ID information as field collection teams return to the site for monitoring purposes.

Changes in the data collection protocol also change the amount and type of data collected per year. As years progressed, more information was collected at a given time, thus many fields in the processed data were left empty. Again, some of this information can be collected as teams revisit the restoration site.

Correcting such errors can take multiple years as teams do not regularly visit fully restored sites. However, none of these limitations impede on the completion of the project.

Conclusion

With the El Centro data processed and loaded into the enterprise geodatabase, the BLM CDD can process restoration reports for those sites. Having these reports will help determine the effectiveness of different restoration methods, aid in federal funding for further restoration efforts, and have a referable document for legal purposes. Having the data in an organized fashion allows for visual progress on a site to be seen. As the BLM CDD determines the most effective and cost efficient restoration methods, they can begin implementing them on other ACEC regions.

Furthering this project will include processing the archived data for the other four field offices in the BLM CDD. As those are processed, the Python scripts, and system of consolidation, can be altered to accommodate a wider array of data.

The product of this project will benefit many sectors of the DOI, especially the BLM. By automating a large portion of the consolidating process, the BLM CDD is able to have all archived data in the enterprise system within a few months.

Submitted in partial fulfillment of the requirements of the Masters of Science in Geographic Information Science(MSGISci), August 11, 2018.

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