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Publications in this series have not been edited; they are released as submitted by the author.

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1.0 Introduction

Over the past 175 years, the Geological Survey of Canada (GSC) has accumulated over 520,000 photographs. Some of these photographs have been catalogued in the NRCan Photo Gallery that as of January 2018 are located at http://www.nrcan.gc.ca/media-room/photo-gallery/1871. Within the gallery there are links to the Canadian Landscape Photo Collection, the NRCan Library Photo Database, and the National Air Photo Library.

With the advent of digital cameras, the cost of acquiring photographs has been greatly reduced and thus the number of photographs taken during a typical geological field season has increased significantly. This influx of photographs has become increasingly difficult to capture and archive. The geographic location, metadata, and a record of the content of each photograph in a photo collection must be recorded and stored in a readily-accessible format otherwise these valuable scientific images may fall into disuse over time. Previous initiatives to capture and display field season photographs include the Geo-mapping for Energy and Minerals (GEM)-Victoria Island project. This project was very successful in releasing a series of photographs and videos as a virtual fly-through using Google Earth© to highlight 18 geographic locations visited during 2010 and 2011 (Williamson et al., 2013a, b). Others (e.g., Oviatt, et al., 2014; Plouffe et al., 2008) have provided a photographic record of field activities; however, the images are not dynamically linked to a geographic location and are not able to be viewed on a platform such as Google Earth©.

2.0 Background

During the summer of 2008 and 2009 the Geological Survey of Canada (GSC) undertook a Mineral and Energy Resource Assessment (MERA) of the proposed Thaidene Nëné National Park Reserve in the East Arm area of Great Slave Lake, Northwest Territories. The area has historical significance to the habitation and development of the north as it encompasses exceptional hunting and fishing areas, while providing passage through Pikes Portage to the barren lands, a gateway to Arctic Canada (Asfeldt and Henderson, 2010). An overview on land withdrawal and progress for Park creation is available in Wright et al., 2013.

The proposed National Park Reserve covers approximately 33,500^2 km within 10 250K NTS maps and includes the Pethei, Kahochella, and Douglas peninsulas, Redcliff Island, McCleod and Chrisite Bay of Great Slave Lake, Artillery Lake and east towards the Thelon River. The southern part of the study area is the northern extent of the boreal forest; however, most of the area supports a gradational transition from stunted spruce to low tundra and heath vegetation, which allows an unobstructed view of the landscape. Scientific results of this multi-year project were published by Wright et al., 2013.

During the process of carrying out the surficial geology component of the MERA assessment approximately 4500 photographs of the area were collected using digital cameras. Cameras used during this project were not equipped with a GPS however; images were linked to geographic locations using a stand-alone Garmin GPS. As such, methodologies were pursued to streamline the capture of images to geographic locations and both scientific and cultural themes. Originally, the photographic record of the study was to be included in the scientific report of Wright et al., 2013 however, the number of images that needed to be located and given figure captions exceeded the timeline of the report release.

In order to facilitate the capture, location and viewing of these images an ArcGIS toolbox entitled KML Photo Index was developed by the authors that contains a set of tools to package images and related

attribute data in a geo-referenced format using Keyhole Markup Language (KML). Images captured with this method for the MERA project are presented in Knight et al., 2017.

3.0 Input Requirements

In order to facilitate the use of the toolbox the following dependencies must be installed on your computer: *PIL-1.1.7.win32-py2.7.exe* and *pyexiv2-0.3.2-setup_py27.exe.* These files are included in with this open file in the ToolFiles/Resources folder. The tool is executed from the ToolFiles folder (*KML Photo Index Toolbox.tbx)* and has been tested for ArcGIS 10.0 or 10. The toolbox requires a set of input files, including an ESRI point shapefile, a database table of photos, and a folder containing the photos to be included. Geographic coordinates must be available either through embedded GPS coordinates in the image EXIF tags, XMP headers, GPS waypoints and tracks or, for older images, point locations can be manually assigned and converted to an ESRI point shapefile. Before executing the tool, any photo attribute information to be conveyed must be populated in the photo database. An Outputs folder is provided to place the resulting KML files developed using the toolbox. The workflow for creating a KML file is illustrated in Figure 1. All other input parameters are optional, and depend on the information available to the user, and the type and style of content desired.

3.1 Station Point Shapefile

The station point table must have one unique entry for every photo location. This includes all locations at which any image was acquired. The name of each station must match exactly the station names that occur in the photo database table Station ID field. Field titles must have no special characters, no spaces, and must be 10 characters or less. Field contents may include spaces, but not special characters, including parentheses. Attributes from this table will appear with the photo image in Google Earth©. An example of a point shapefile for a sample set of 12 photos is provided in the Inputs folder of this Open File.

3.2 Photo Database Table

The photo database table should contain an individual entry for every photo in the photo bank with the file name of each photo, without the .jpeg extension. The tool requires the population of a location field in the data table. The location of each photo should match exactly the point name in the station shapefile, even if it matches the photo name. The location may repeat if more than one photo occurs at a single location, however there should not be multiple entries of unique photo names. The photo database table provides the attribute information for each photo, however this information is not displayed in the Google Earth© viewing window for each photo. It can be accessed separately through a table browser (Excel, MapInfo, Arc Info) and used to provide the end-user with site attributes.

3.3 Photo Bank

All photos must be in .jpeg format, and be organized into one master folder. An example set of 12 photos from 4 geographic locations are provided in the Inputs/Photobank folder with associated input files located in the Inputs folder. The names of the photos in the Photobank folder must match exactly the names of the photos as they appear in the photo database table. As an example column B in the Photo.dbf table in the Inputs folder contains the same name as the photo in the Photobank folder.

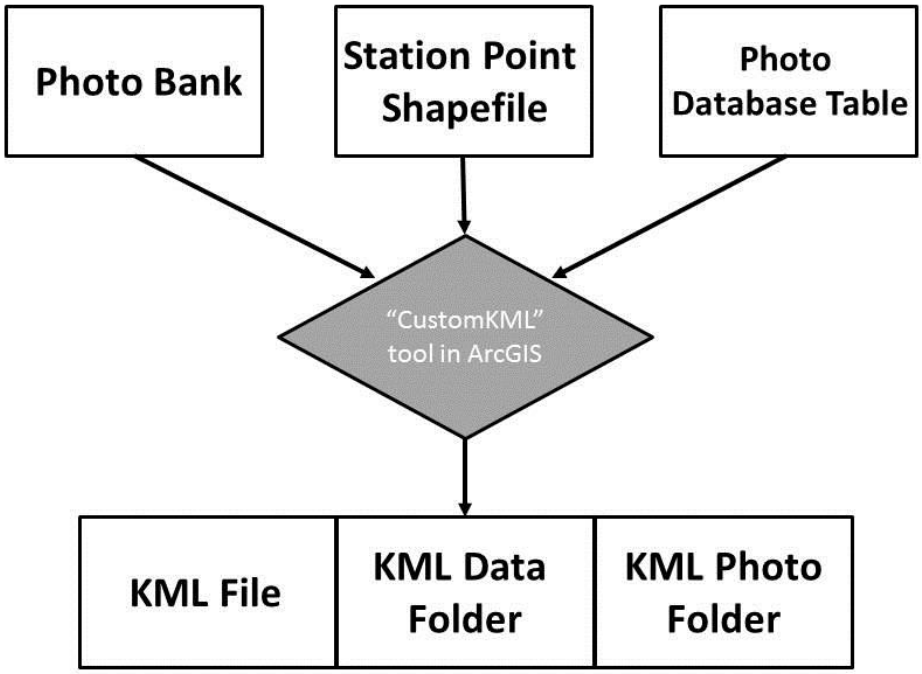

Figure 1. Workflow diagram of the minimum required input files to populate the script tool (photo bank, a station shapefile and a database table of photos).

4.0 KML photo toolbox Parameters

The KML photo toolbox is a script tool that converts shapefiles with associated images, into a dynamic output allowing the images to be displayed at their geographic locations in Google Earth©, "CustomKML".

4.1 Querying data using the "CustomKML" tool

The CustomKML tool requires a minimum of six input parameters; Select Station Features (shapefile), Select Photo Table (database file), Station ID field, Photo ID field, Photo Folder Location, and KML Output Location, along with optional input parameters based on auxiliary information to be viewed in the output .kml file (Figure 2).

The “Use Selected Objects” toggle isolates a manual selection of points from the shapefile’s attribute table or spatial extent. The “Select by Location” option allows the user to select an area of interest within the data set, using a polygon shapefile (Figure 3). The optional “Filter Photos” SLQ query can be used to select data with specific attributes, or combinations of attributes from your data set (Figure 2).

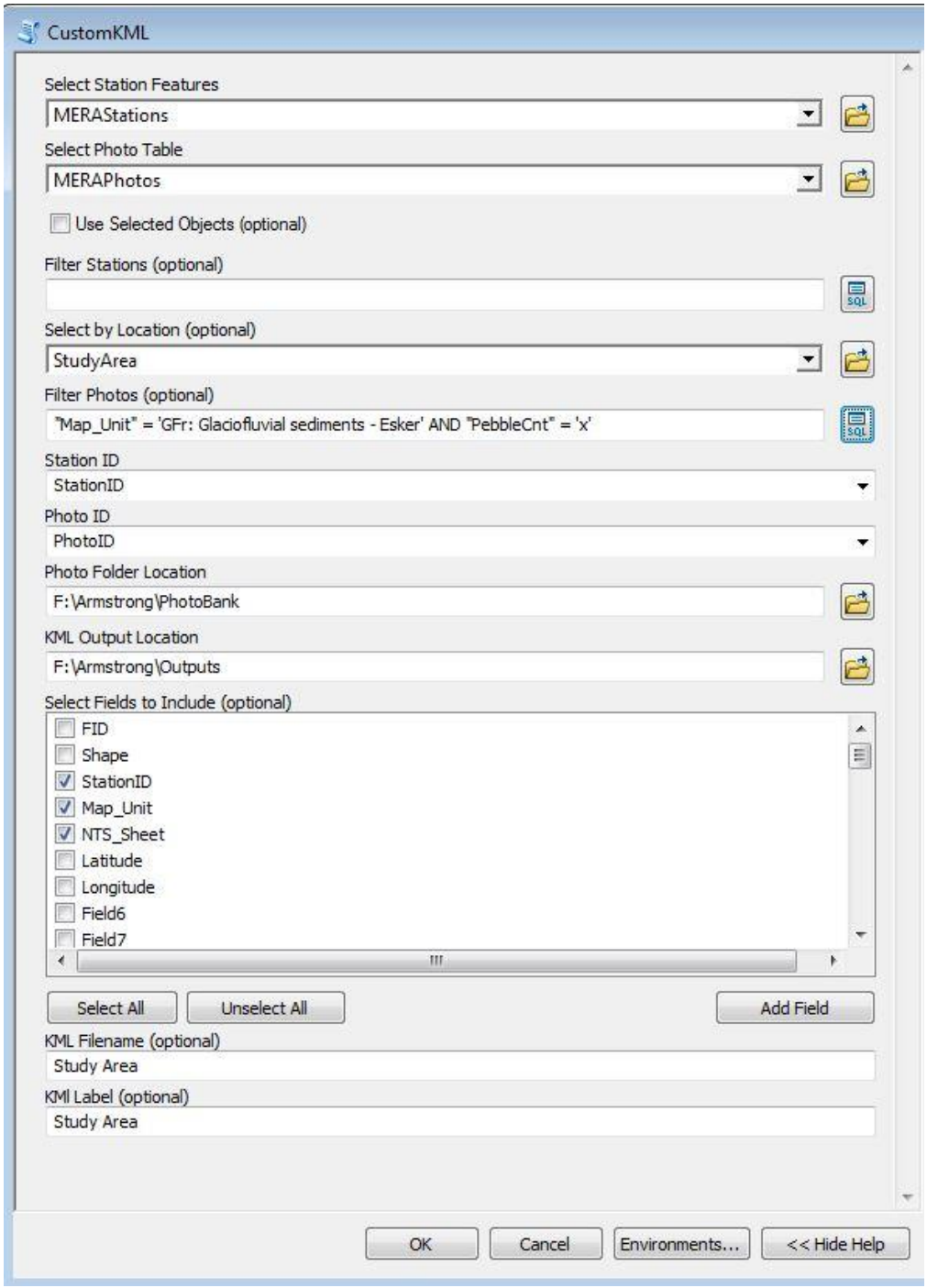

Figure 2. Main CustomKML tool window.

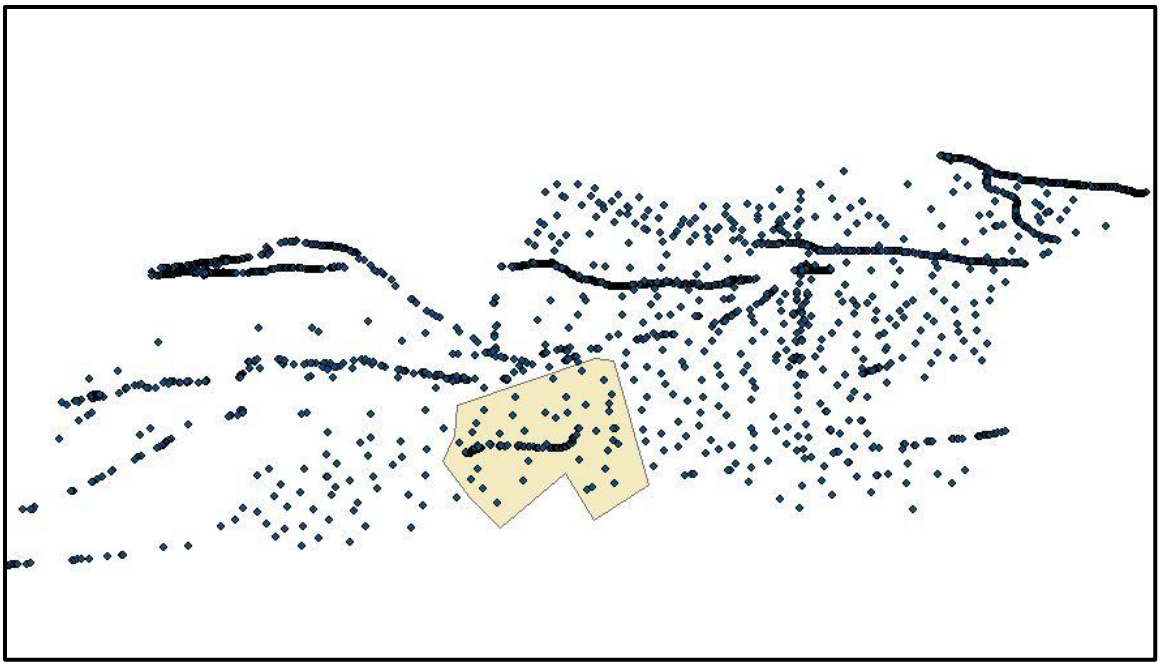

Figure 3. Example of "Select by Location", using "StudyArea" polygon shapefile.

The optional "Select Fields to Include" allows the user to include attributed station information to Google Earth's© viewing window.

The optional "KML Filename" field allows the user to indicate the desired name for the .kml file as it appears in Windows Explorer©.

The "KML label" field allows the user to indicate the desired name for the .kml file as it appears in the table of contents of Google Earth©.

The output folder contains 3 objects; "KMLData" folder, "KMLPhotos" folder, and a .kml file. Do not rename or move any of these output components. The resulting .kml can be edited in Google Earth© if desired, to include information about the contents of the .kml, or to explain the query to the end user.

5.0 Special Considerations

- If editing in Google Earth©, ensure to save as .kml files, and not as .kmz files.
- ArcMap requires file names or field titles to be less than or equal to 10 characters in length.
- Photo names cannot contain special characters or hyphens. Underscores may be used.
- Use no special characters as field titles. Parenthesis, tilde ~ or degree symbols ° will cause tool failure.
- If data in the data table was truncated on import to ArcMap, use the .xls file type and reimport it to ArcMap.
- The tool does not override previous outputs, therefore old outputs must be deleted, or a new output location must be selected, if the tool needs to be rerun.

6.0 Summary

With the potential to acquire large number of photographs with digital cameras, a script tool has been developed to streamline the process from image capture to geographically locating and displaying the images in Google Earth©. The tool automates and standardizes the creation of metadata associated with photographs.

7.0 Acknowledgements

This activity was undertaken as part of a Mineral and Energy Resource Assessment (MERA) of the proposed Thaidene Nene National Park Reserve in the area of the East Arm of Great Slave Lake. The initial coding of the CustomKML toolbox was carried out under contract to Open Spatial Solutions, Ottawa, Ontario. We greatly appreciate the support received from Danny Wright, the MERA Program manager and the review of the toolbox and this document by Sean Eagles, Geological Survey of Canada.

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