STREAMLINED GENERALIZATION TOOL FOR PLANETARY SURFACE MAPPING USING ARCGIS MODELBUILDER SOFTWARE ON MULTISPECTRAL DATASETS. F. Baum[1] and M. Zanetti[1], [1]Washington University in St Louis, and the McDonnell Center for Space Sciences, St Louis, MO 63130. (Francis.J.Baum@wustl.edu; Michael.Zanetti@wustl.edu).

Introduction: We have developed an ArcGIS ModelBuilder workflow for the streamlined production of polygon features representing individual planetary map units using supervised image classification and native tools in the ESRI ArcGIS (10.1 and greater [1]) Spatial Analyst toolbox. The goal of this tool is to simplify the production of polygon shapefiles based on areas identified through image classification of a multispectral dataset by combining commonly used tools in the Generalization toolset and the Conversion Toolbox's From Raster toolset. We also aim to demonstrate the effectiveness of using the ArcGIS ModelBuilder software [2] to aid geologic mapping of planetary surfaces and to create automated geoprocessing workflows that greatly reduce the manual steps and time needed to create map units from raster images for aid in geologic interpretation. Here we present a description of the ModelBuilder workflow and an example output from our tool using Clementine UV/VIS Ratio RGB composite images of lunar mare units.

Methods: Our tool, (RasterToGeneralizedPolygons, or R2GP) will take any raster image loaded into ArcGIS and convert it into generalized polygon shapefiles based on user defined regions created through prior image classification methods. R2GP uses currently existing tools in the Generalization Toolset, which requires a Spatial Analyst licence [2], and combines them into one tool that will filter outlying pixels, clean and smooth unit boundaries, remove small contiguous regions that are classified differently than their surroundings [3] and create a polygon shapefile of the defined units. The ModelBuilder workflow streamlines 7 individual tools (Majority Filter, Boundary Clean, Region Group, Set Null, Nibble, Raster to Polygon, Smooth Polygon) into one tool which iteratively removes small regions of increasing size. The shapefile output can then have attributes assigned and be used with other geoprocessing tools. The R2GP tool generalizes the map into large contiguous units, but can remove small regions that may be geologically interesting, and thus the output is a compromise between scientific interpretation and readability/speed.

The first two steps in the R2GP process (Majority Filter and Boundary Clean) are used to generalize the edges of zones in the raster. Majority Filter replaces pixels in a raster based on the majority of their eight contiguous neighboring pixels, and Boundary Clean is used to smooth the raster's ragged edges at zone interfaces and allows zones with larger cell values to have a higher priority to expand into zones with smaller cell values. Region Group and Set Null work together to define an exclusion mask of small areas that can be excluded from polygon creation. Then Nibble replaces corresponding cells of the exclusion mask with values of the nearest neighbors to remove these small areas from the raster just before all the raster areas are converted to smooth polygons (using RasterToPolygon [4] and Smooth Polygon [5] tools).

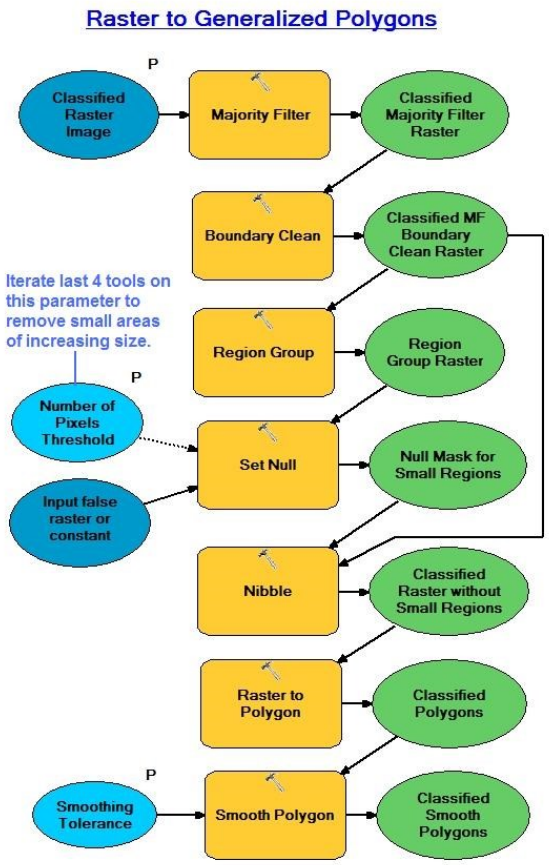

Figure 1: ArcGIS ModelBuilder workflow for Raster2GeneralizedPolygons, a tool developed to automate feature polygon creation from classified-image rasters

Applications: Producing polygon features representing different geologic map units has several practical applications that are advantageous over continuing to work with the raster image from which the polygons were derived. The polygon's vector data structure produces much smaller file sizes than

raster images, especially when the regions of primary interest have large, homogeneous boundaries and shapes such as those found on lunar and planetary surface imagery. These smaller files can more easily be shared with remote colleagues. Also, the use of polygon features, and even line or point features derived from the polygons, are well supported by other GIS geoprocessing tools that provide spatial and topological calculations. These tools use vector data which makes it easier to determine if a region is on the left or right side of a specific boundary or if a feature (point, line or polygon) is inside or outside a polygon region. Polygons derived from one raster image can be displayed as a layer on top of other raster images of the same area to aid in further geological or geophysical interpretations. Finally, a vector data structure includes an attribute table in which multiple descriptive values can be created, populated, and stored for each polygon feature in the dataset. Multiple visually-appealing and scientifically useful maps can be created by coloring or symbolizing the polygon features based on their various attribute values.

Availability: We plan to make the tool available for public use. If you are interested in obtaining a copy the R2GP tool or having us run the tool for you to produce polygons for specific raster images (in case you don't have the ArcGIS Spatial Analyst licensed software), please contact Francis Baum (Francis.J.Baum@wustl.edu).

References: [1] ESRI ArcGIS 10.1 Software & Spatial Analyst License. [2] ArcGIS Help: What is ModelBuilder? [3] ArcGIS Help: Generalization of classified raster imagery. [4] ArcGIS Help: Raster to Polygon (Conversion). [5] ArcGIS Help: Smooth Polygon (Cartography).

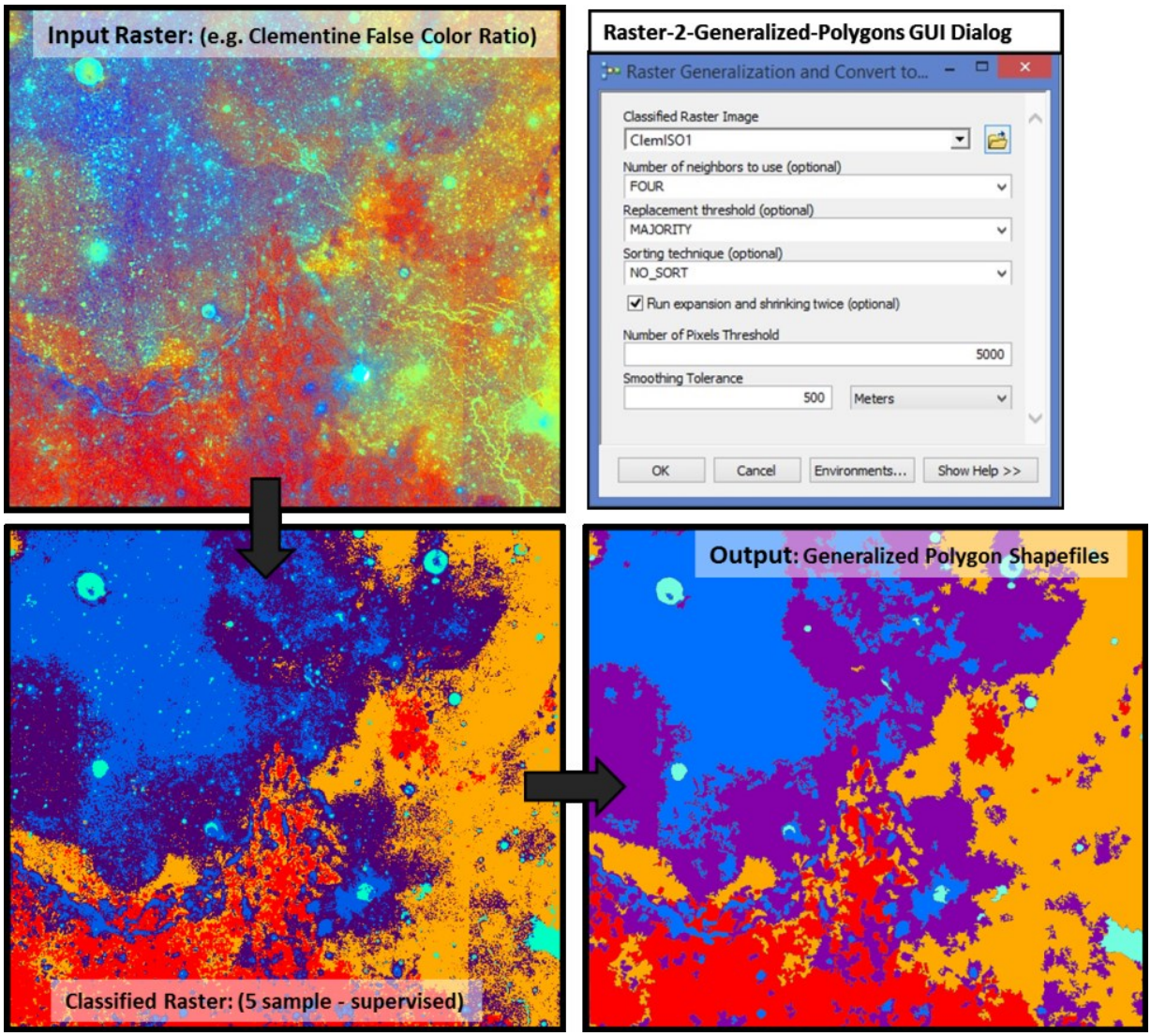

Figure 2: ArcGIS ModelBuilder software workflow for Raster2GeneralizedPolygons tool. Tool exports generalized and smoothed polygon shapefiles from any user defined classified raster input. Region Group, Set Null, and Nibble sub-tools can be iterated based on user defined inputs and are exported as separate outputs so that the user can choose the best compromise between map readability and scientific value.