The CEDRA Corporation's

COMMAND OF THE MONTH

A monthly information bulletin April 2012

FEATURED COMMAND

Creating Polygons of Equal Area

Application Description

Recently we were asked if we had a command that would subdivide a polygon into parts of a specific area value. Literally, a few days later, the exact same question was asked.

Now, our [Grid a Quadrilateral] tool will subdivide a polygon into a specific number of rows and columns, but the user has no control over the area of the polygons that are created.

So that, unfortunately, the answer was no. However, when the same question is asked twice in a such a short period of time, we immediately think that there must be a need for such a command.

The CEDRA Solution

To address the application described above, the [Split Polygons Equal Area] command within the {CEDRA-Polygon-Tools} toolbar, shown in Figure 1, was developed. This command enables the user to subdivide a polygon or set of polygons into a number of parts of equal area.

Subdivide Polygons Equal Area Overview

The [Split Polygons Equal Area] command operates on the current active layer. That is to say, the user must select or highlight the layer in the Table of Contents prior to activating the command.

Furthermore, if a specific feature or set of features are to be processed, the user should select the feature(s) prior to activating the command. If the layer does not contain a selected set, then all features in the layer are processed.

Once the command has been activated, a multi-input dialog box is presented to the user with a number of parameters. These parameters include the ability to specify: (a) the number of parts or polygons to be created, or (b) a specific area value. If an area value is specified, the command determines the number of polygons to be created by dividing the area of the polygon by the area value specified by the user.

> ***Command Of The Month bulletin***
>
> *This month's issue discusses how to subdivide a polygon or a set of polygons into new polygons that have the same area value.*

For example, if a polygon has an area of 12 and the user specifies a unit polygon area of 5, the command will create 2 polygons, with each polygon having an area value of 2.4. As such, the area value that the user specifies is in reality, a minimum area value.

Furthermore, the user is also able to specify a clip angle in degrees. In so doing, the polygons that are created will have inclined edges, rather than purely horizontal and vertical edges.

Since the subdivision process is an iterative process, the user is able to specify a tolerance value and a maximum number of trials.

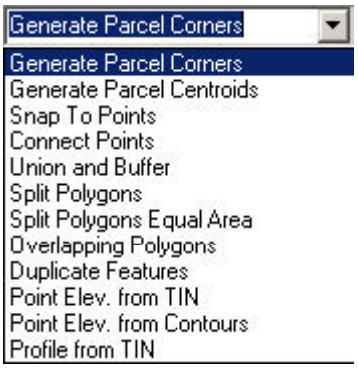

Figure 1
CEDRA-Polygon-Tools Toolbar

The user also has the option of transferring attributes from the source polygon to the polygons that are created. The user can transfer one or many attributes. A list dialog box is presented, from which, the user selects the attribute(s) to be transferred.

The polygons that are created are stored in the current active layer.

Once the command has subdivided the polygon(s), the command remains active thereby enabling the user the ability to subdivide the polygons which have just been created. This approach eliminates the need for the user to select the polygons which were just created and then reactivate the command.

Subdivide Polygons Equal Area Operation

To use this menu command, the user should:

➤ **1** **Scroll** down in the **Table of Contents area**, and **select** the **layer**

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Figure 2
No Layer Selected Warning

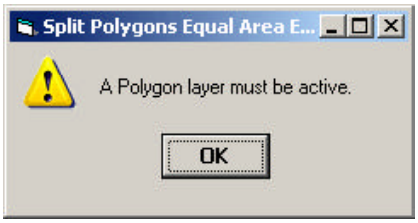

Figure 3
No Polygon Layer Selected Warning

Figure 4
More than 1 Layer Selected Warning

that contains the feature(s) to be processed.

➤ **2** **Select** with the *Select Features from Active Layers* tool the **features** to be processed. If all features in the active layer are to be processed, this step can be skipped

➤ **3** **Scroll** down in the **CEDRA commands** menu combo box, and **select** the [**Set Working Directory**] command. **Navigate** to the folder where any new data is to be stored and then **click** the **OK** button.

➤ **4** **Scroll** down in the **CEDRA commands** menu combo box, and **select** the [**Set Active Layer**] command. If the polygons to be created are to be stored in an existing layer, **select** the **Picking Existing Layer** option, followed by clicking the **OK** button. **Select** the layer from the list, then **click** the **OK** button.

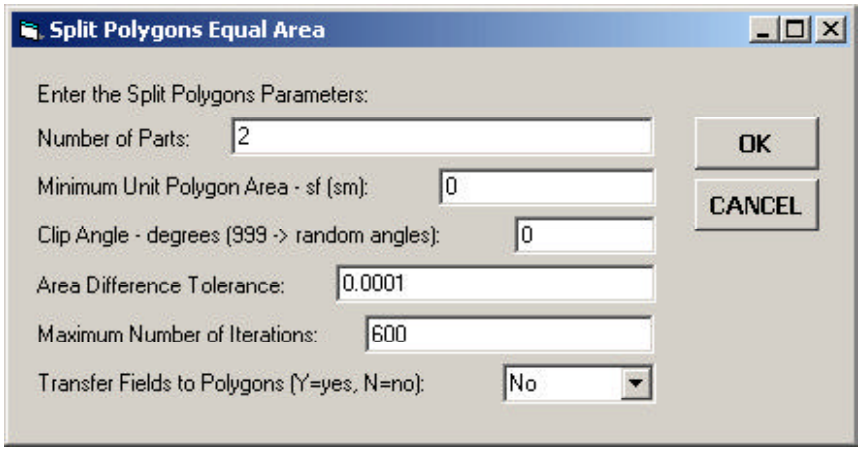

Figure 5
[Split Polygons Equal Area] Parameter Specification Dialog Box

If a new layer is to be created, **select** the **Entering New Layer Name** option, followed by **clicking** the **OK** button. **Enter** the desired new layer name, then **click** the **OK** button.

➤ **5** **Scroll** down in the **{CEDRA-Polygon-Tools}** menu combo box, and **select** the **[Split Polygons Equal Area]** menu command. If an appropriate layer is not selected, one of the warning messages shown in Figures 2, 3 and 4 will be displayed. If a polygon layer is selected, the multi-input dialog box of Figure 5 will be displayed. Additionally, the command will display in the status bar area, the number of features that will be processed, see Figure 6.

Figure 6
Number of Features to be Processed

➤ **6** **Enter** in the *Number of Parts:* data field the number of polygons to be created, or

➤ **7** **Enter** in the *Minimum Unit Polygon Area - sf (sm):* data field the minimum area of a polygon to be created.

If the user specifies values for both the Number of Parts and Minimum Unit Polygon Area parameters, a warning message will be displayed. The user must enter a nonzero value for one of these two parameters, not both.

➤ **8** **Enter** in the *Clip Angle:* data field the angle in degrees of the clip window to be used in generating the new polygons.

➤ **9** **Enter** in the *Area Difference Tolerance:* data field the tolerance value to be used in determining if the required area value has been satisfied.

➤ **10** **Enter** in the *Maximum Number of Iterations:* data field the maximum number of iterations that should be performed in order to satisfy the area value.

➤ **11** **Scroll** down in the *Transfer Fields to Polygons (Y=yes, N=no):* data field, and **select** the **y** or the **n** option to indicate if any attributes from the polygon(s) being subdivided are to be transferred to the new polygons.

➤ **12** **Click** at the **OK** button to confirm the entries and selections, or

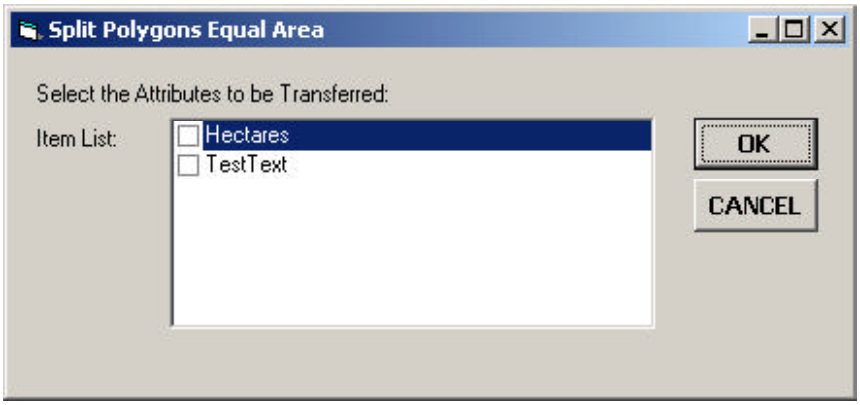

Figure 7
Attributes to be Transferred List Box

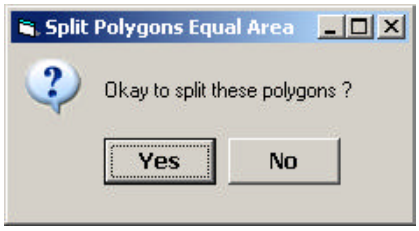

Figure 8
Repeat Subdivision Query

Figure 9
Number of Polygon Created and Area

click at the **Cancel** button to abort the command.

Having clicked at the *OK* button, the program will either begin the process of subdividing the polygon(s) or present a list dialog box similar to that shown in Figure 7.

If the user selects the N option for the Transfer Fields to Polygons parameter, proceed to Step 15.

If the user selects the Y option to the Transfer Fields to Polygons parameter, the user should:

➤ **13** **Click** in the square to the left of the attribute(s) to be transferred, see Figure 7. A check mark in the square denotes that the attribute is to be transferred to the new polygons.

➤ **14** **Click** at the **OK** button to confirm the selections,
or
click at the **Cancel** button to abort the command.

The command will now begin the process of subdividing the polygon(s). A message will appear in the status bar area informing the user as to the status of the command.

Upon completion of the subdivision process, the query message box shown in Figure 8 will be presented along with a message in the status bar area indicating the number of polygons that were created, see Figure 9. In addition to the number of polygons that were created, the command displays the area of each of the polygons in sf (acres) or sm (hectares).

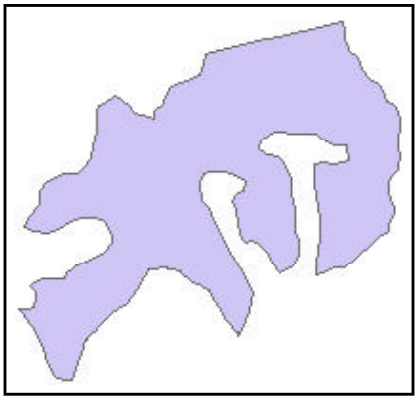

Figure 10
Feature to be Subdivided

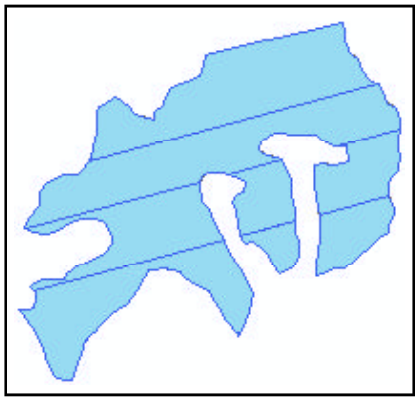

Figure 11
Subdivided into 4 Parts with a Clip Angle of 15°

➤ **15** **Click** at the **Yes** button to indicate that the newly created polygons are to be subdivided,
or
click at the **No** button to terminate the command.

If the Yes button is selected, the dialog box of Figure 5 reappears with the values from the previous run being the new default values.

If the No button is selected, the command terminates. If the user wishes to undo the operation the {Edit} [Undo Split Polygons] command can be executed.

Shown in Figure 10 is a polygon that is to be subdivided into 4 equal area polygons.

Shown in Figure 11 is the result of the subdivision process using a clip angle of 15°.

A clip angle of 0° is along the X axis while a clip angle of 90° is along the Y axis. Positive angles are measure counterclockwise from the X axis

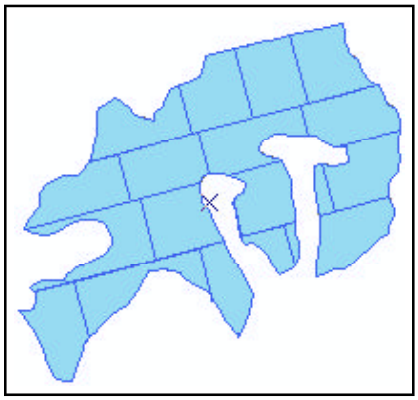

Figure 12
Second Subdivision into 4 Parts with a Clip Angle of 105°

Shown in Figure 12 is the result when the polygons in Figure 11 are further subdivided into 4 more equal area polygons using a clip angle of 105°.

Shown in Figure 13 is the attribute table for the polygons shown in Figure 12. Note the area values under the ARA column. Although not identical, all area values are within the area difference tolerance value of 0.0001.

FID	Shape*	ARA	SQR_ARA
0	Polygon	5325.7634	0.1223
1	Polygon	5325.7635	0.1223
2	Polygon	5325.7635	0.1223
3	Polygon	5325.7636	0.1223
4	Polygon	5325.7635	0.1223
5	Polygon	5325.7636	0.1223
6	Polygon	5325.7635	0.1223
7	Polygon	5325.7636	0.1223
8	Polygon	5325.7636	0.1223
9	Polygon	5325.7634	0.1223
10	Polygon	5325.7635	0.1223
11	Polygon	5325.7635	0.1223
12	Polygon	5325.7635	0.1223
13	Polygon	5325.7635	0.1223
14	Polygon	5325.7634	0.1223
15	Polygon	5325.7636	0.1223

Figure 13
Subdivided Polygons Attribute Table

Notes

a. The user must specify a nonzero value for either the Number of Parts parameter of the Minimum Unit Polygon Area parameter, not both.

b. A clip angle of 999 denotes that a random clip angle is to be used for each polygon that is created. For example, if a polygon is to be subdivided into 5 parts, the clip angle used for creating the first part could be 20°, 75° for the second followed by other various angles for the remaining parts. Under this mode of operation, the command determines the clip angle that is used for each polygon that is created.

c. Negative values can be entered for the clip angle.

d. There is no limit to the number of attributes that can be transferred.

e. There is no limit to the number of times a polygon can be subdivided.

f. One approach to subdividing a polygon is to divide the polygon into 2 parts at a specific angle. After which, the newly created polygons can be subdivided again into 2 parts using an angle that has 90° added to the original angle. For example, a polygon can be subdivided into 2 parts using an angle of 0°. The new polygons can then be subdivided into 2 parts with an angle of 90°. This process repeats alternating the two different clip angle values. This process was used in generating the polygons shown in Figure 12.

Summary

As mentioned at the beginning of this article, requests for this functionality spurred the development of this new command. Although we have not come across for this type of functionality, there obviously are others out there who do require this functionality. As such, we try to be as responsive as possible to implementing functionality requested not only from our users but from potential users as well.

The implementation of the [Split Polygons Equal Area] menu command is a very recent enhancement.

Users with a software support agreement should check with The CEDRA Corporation on how to obtain a software update so as to be able to utilize this new functionality.

As always, users who have a need for functionality that is not presently available in CEDRA software should feel free to forward these requests to CEDRA, as well as, any other comments or suggestion you may have.

If you have a request for Command Of The Month, feel free to phone, fax or e-mail your request to The CEDRA Corporation.