User's Manual – GRABS

California Department of Fish and Game and California Interagency Wildlife Task Group. 2004. Grouping Resources Algorithm for Biological Data Sets (GRABS). Programming by Dr. Robert J. Laacke, United States Forest Service (ret.).

Overview

GRABS (Grouping Resources Algorithm for Biological data Sets) has as its primary purpose grouping data pixels into uniquely numbered discrete groups (surprise!), sometimes called raster polygons, and analyzing them for use in spatial analyses for the California Wildlife Habitat Relationships (CWHR) System.

GRABS takes as input a band-interleaved (*.bil or raster) file containing a habitat feature of interest to an analyst (e.g. a stand of Coastal Oak Woodland 4M). Known as the **Focus Feature File**, this input file may be prepared by the user in any standard Geographic Information System (GIS).

GRABS identifies unique groups within the file and calculates area, perimeter, and complexity within each group. The program also analyzes the outside edge of each group, or its juxtaposition with the surrounding area. GRABS has the capacity to collect and record data on up to five additional feature types relative to the primary feature of focus for the analysis. It delivers two products:

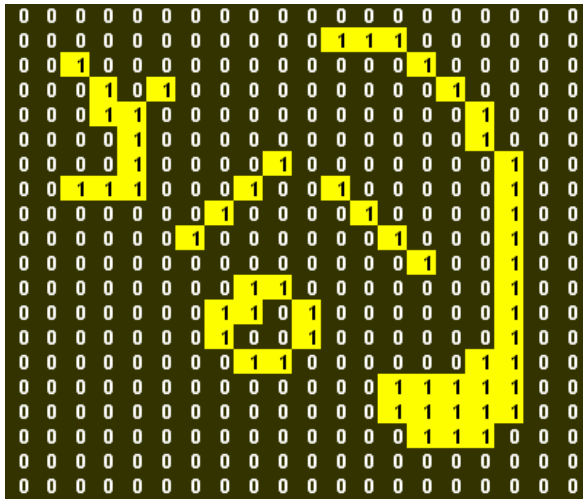

Figure 1

1.) The first (Figure 1) is a version of the original focus feature file with each of the original data points (ones) numbered with a unique value representing the group to which it belongs. This file, like the original, is a raster file in band-interleaved format.

2.) The second (Figure 2) is a text file containing all of the available information about each group, similar to an attribute file that contains all of the information about each polygon in a vector-based GIS. In the example in Figure 2, Polygon 31 has no data for the first three pieces of information recorded (placeholders for reproduction, cover, and feeding values for a wildlife species of interest). However, the following are known:

a) The area is 191,826 m2.
b) The perimeter is 3,832.644 m.
c) The complexity value is 225.328.
e) There are two edge type features with which an edge has been identified.
f) Twenty-six percent (26.282) of the group's potential edge is with an unknown condition.

Twenty-seven percent (27.756) of the potential edge is with edge feature type 3.
Forty-five percent (45.962) of the potential edge is with edge feature type 4.

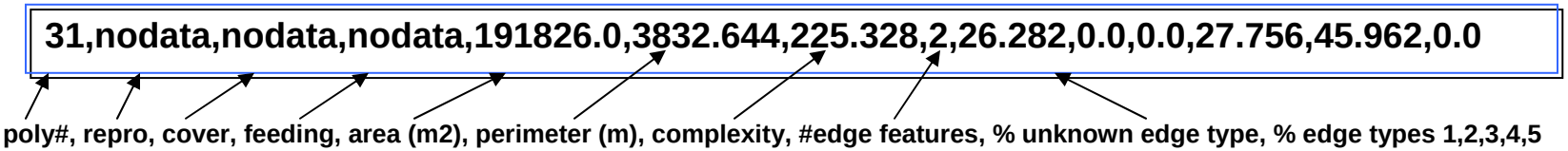

Figure 2

Using GRABS

Figure 3

1) Figure 3 shows the opening screen for GRABS. To begin, perform a single left-click in the space entitled "NAME OF FOCUS FEATURE FILE" and navigate to and identify your input file. As soon as a focus feature file is identified, GRABS produces default file names for each file either needed by the program or produced by it. These names are displayed in the three subsequent edit fields and can be changed by the user.

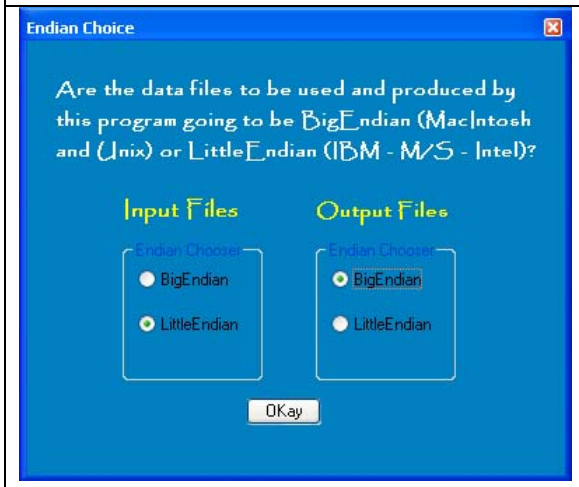

Figure 4

2) When the "Identify Operating System" window pops up (Figure 4), use the radio buttons to select either IBM/Microsoft/Intel or MacIntosh/Unix or for both input and output files. Version 2.0 of GRABS is written in the REALBasic* language and is provided in versions for both Microsoft and Macintosh operating systems so that analysis results can be used across platforms. Once you have made your selections, left click on the "Okay" button to proceed.

3) You will next be asked if you want to define groups using diagonal connections, that is, connections at the corners of pixels only (Figure 5). The user has been left to judge whether or not features that only contact at a corner should be included in a single group. Selecting "yes" to allow diagonal connections will result in fewer, and larger, groups (Figure 6). Selecting "no" will result in more numerous, but smaller, groups (Figure 7). Once you have made your selection, left click on the "Continue" button to proceed.

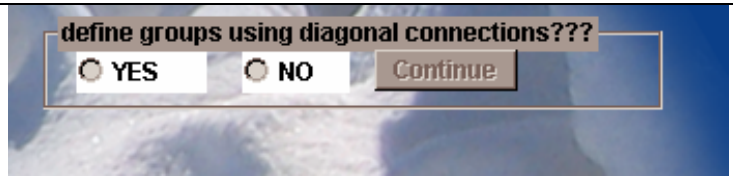

Figure 5

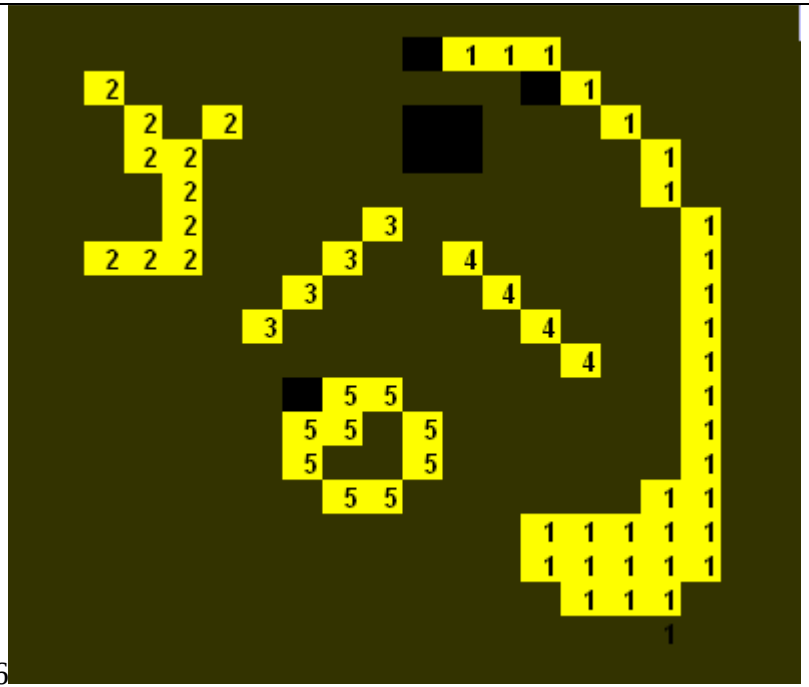

Figure6

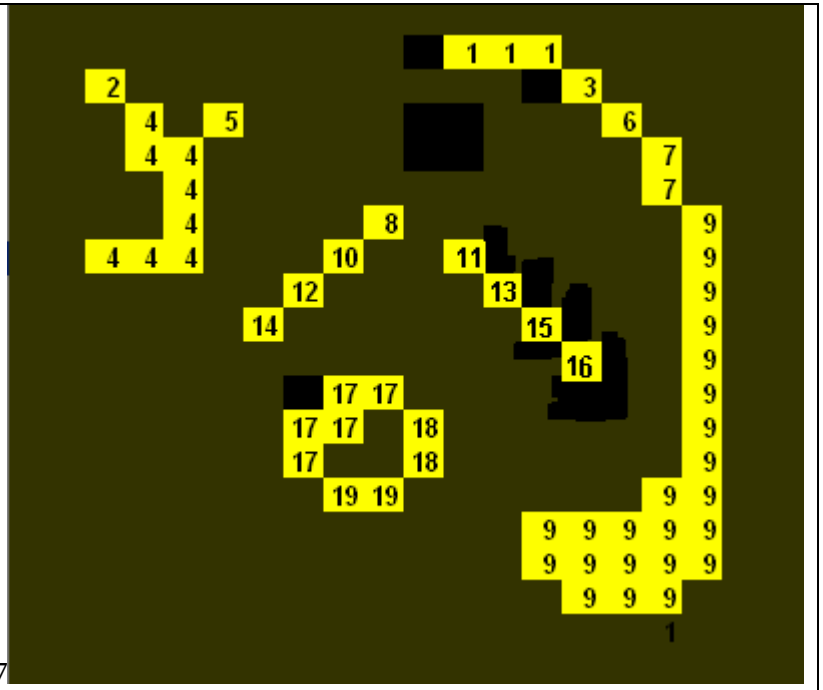

Figure7

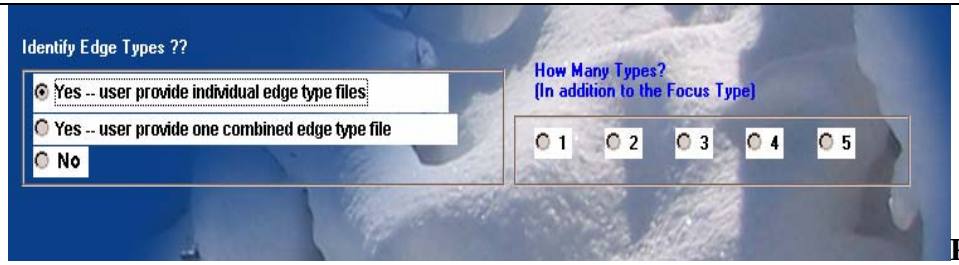

Figure 8

4) The next user option has to do with *identifying edges* and the User has 3 choices:
Yes – user provide individual edge type files. If this is the choice, another window opens with radio buttons to identify how many edge type files the user will supply (Figure 8). Whichever number is chosen an equivalent number of edit fields will appear in the open space below the button group. Filenames can be typed in or acquired by left clicking the edit space and choosing from the open file dialog box. Full filenames, including path, are required.

Yes – user provide one combined edge type file. This choice produces a single edit window for filename entry. File identification can be by typing full filename (including path) or by single left clicking the edit field and using a standard open file dialog box to identify the file.

No This choice moves you directly to the "Start It" button to begin the analysis. Analysis time will be considerably shorter with this option but there will be No data about conditions adjacent to each group in the attribute file.

Upon the User pressing "Start It" at screen bottom, the control window checks to see if the User has chosen to find edges and whether diagonal connections are to be considered in grouping. If any input file parameters are unacceptable the offending file is identified and analysis is halted (See Appendix A on how to prepare your data for use with GRABS.) If all file parameters are acceptable the program continues through a series of routines (See Appendix C for details.). The user may cancel anytime during the running of the program by left clicking the "Forget It" button in the lower right corner of the screen.

Output

Program output includes the following:

1.) A group file. The group file header (*grp.hdr) is amended with metadata concerning the analysis. These data include
   a. Name of the program used to produce it (GRABS).
   b. Feature file used for original data.

c. Date and time of production.

2) An attribute file containing information about each group.

3) A text file (*grpmetadata.txt) containing metadata for the attribute file. These data include:
   a. Day, date, and time of data production and name of program used.
   b. Focus feature file used (name and location).
   c. Group file produced (name and location).
   d. Attribute file produced (name and location).
   e. Name and location of each edge-type feature file used.
   f. Storage format of data (Mac or PC)

To use one or more edge files with your focus feature file, the data sets must be compatible with one another:

1) Rows and Cols of data (must match exactly)
2) X and Y coordinates of upper left hand corner (easting and northing). These numbers must be in agreement within ½ pixel.
3) Data resolution in both x and y directions (must match exactly).

Appendix: What Happens During the Running of GRABS

Group step assigns a unique number to each feature pixel (contains a one) in the focus feature file. This file is written to disk and used later to fill arrays used to identify adjacent pixels (by diagonal choice definition) and assign them a common number. This sequential data file is deleted when no longer needed. Grouping is accomplished by sweeping the data three times to pick up connections and then collapsing group numbers into a sequential series beginning with 1. These numbers are then assigned back to original position (using unique number assigned) and file written to disk as the *grp.bil file. Data storage is now a 4-byte long word (sometimes called a long integer) to accommodate large numbers of groups in large landscapes. During this step the number of pixels in each group is accumulated and filed in the central storage unit attribute array as "raw area" of the group. Now that the total number of groups and the location of every pixel in them are known, the program can proceed.

Pattern Maker produces a pattern file that is used to identify what kind of pixels are at the edge of each focus feature group (eg. diagonal right, diagonal left, end of a vertical line, top of horizontal edge). These designations by edge pixel are then used to identify how to treat the edge dimensions of a raster set -- in other words, to adjust the edge length to account for data points having a rectangular shape.

The ***Perimeter Routine*** uses the pattern file to determine the contribution of each exterior pixel (internal openings are considered to have exterior pixels) to the perimeter for each group. These values are stored in the attribute array in the central data storage unit.

In the ***Dimension Routine,*** raw area is converted to actual area in units and resolution of the focus feature file (eg. square meters); perimeter is converted to actual distance in units and resolution of the focus feature file; shape parameters and complexity value are calculated; and, perimeter, and complexity value are written to the attribute array on the central data storage unit.

If edges are to be found and registered program control is passed to one of two ***Edger Routines***. If the user supplied individual edge feature files control is passed to the ***"make type file" routine*** where the individual edge type files are combined and coded for identification. When completed this file is written to disk and control passed to control window. Program control is then passed to the ***"use type file" routine*** where edge types are identified, proportion of total perimeter they represent is identified for each group and the results are written to the attribute array on the central data storage unit. If the user supplied a single, combined edge type file at the beginning of the program control goes directly to this second step and the user's file used to designate edges.

At this point all necessary data concerning each group has been collected and program control is passed to the ***Admin Routine***. This routine collects the data and writes the attribute array to a comma delimited text file for inclusion in a spreadsheet of user's choice.