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We hope you will find this Data Viewer interesting and a starting point for many lesson plans. Please contact Steve Palladino, if you have any questions about these materials, want to contribute ideas for lessons, or need more information. If you would like to be added to the NCGIA Secondary Education Project mailing list, send your address (and other general information) to:

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The NCGIA would like to thank Dr. Ron Eastman, Mr. John Auble, and The IDRISI Project for making the IDRISI data display modules available for this educational resource. If you are interested in the complete IDRISI GIS software package contact:

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AFRICAN DATA VIEWER

Version 2.0

This disc contains a variety of data sets for the African continent. These include population density, elevation, vegetation, basic climatic characteristics, and various factors affecting agricultural potential. This data was collected by the United Nations Environmental Program as part of a Global Resource Information Database. Some of this data has been used in the NCGIA university level GIS laboratory exercises.

This disk is primarily designed to introduce pre-collegiate students to the GIS data display environment and to African data. It is one of the products of the NCGIA Secondary Education Project. A subset of the IDRISI GIS software is used to view these data sets. The full software package which allows for computer-based data input, management, and analysis is available from The IDRISI Project (see facing page.)

Italics are used in this document to indicate the entries that must be made by the user of the program or the name of the key that must be depressed.

More detailed information on these sets of African data can be found in:

Global Resource Information Database, "The GEMS/GRID/UNITAR Africa Database", United Nations Environmental Programme, GRID-PAC, P.O. Box 30552, Nairobi, Kenya.

UNEP (1992), World Atlas of Desertification, Edward Arnold Publishers, London.

TO BEGIN

MINIMUM REQUIREMENTS

To view these data sets you will need an IBM or compatible computer with an EGA or VGA color monitor and 3.5" high density floppy drive. You will also need a hard drive with at least 2.5 Megabytes(MB) of free space (6.2MB will allow you to view all of the files). Recommended: a mouse and a 80286 based CPU or higher.

DISK CONTENTS

Insert the AFRICAN DATA VIEWER disk into your 3.5" floppy drive and survey the contents of the directory.

There should be:

> a README.BAT and a README.TXT file;
> a PKUNZIP.EXE file;
> a directory with PROGRAM files;
> and four compressed files:
> > AFRICA1.ZIP,
> > AFRICA2.ZIP,
> > AFRICA3.ZIP,
> > VECTOR.ZIP.

The README.TXT file contains the text of this manual and can be viewed by using the DOS "type" command. *[type README]*

The PROGRAM directory contains the IDRIS1 modules that display the data.

AFRICA1.ZIP contains various data sets on soil degradation (see specifics on the next page).
AFRICA2.ZIP data includes population density and annual average climatic factors.
AFRICA3.ZIP includes various data sets on the physical characteristics of Africa.
Each of these AFRICA zip files includes a batch file to view the data in slide show mode.

VECTOR.ZIP contains political boundary and water feature information that can be laid on top of any of the other data sets for orientation and analysis.

TO INSTALL

Create a directory for these files on your hard drive [e.g., C:\AFRICA\]. Change directories into this new directory. Use the following command to copy the IDRISI Program files from your floppy drive to your hard drive: C:\AFRICA>*copy A:\program*. ** This will use about 0.2MB of space on your hard drive. [If your floppy drive is B, replace the A with B]

Now you will need to use the included PKUNZIP.EXE file to uncompress the ZIP files in order to view the data. If all of the files are uncompressed they will require about 6.0 MB of hard disk storage. The VECTOR files take up about 0.3 MB of disk space, the AFRICA1 files 2.3MB, the AFRICA2 files 1.7MB, and the AFRICA3 files 1.7MB. If you have limited disk space, you can uncompress just the AFRICA data sets that will fit.

To uncompress the files. Switch into your floppy drive. Enter the following command: A:\>*pkunzip* VECTOR C:\AFRICA [where italics is your entry, A: represents the letter of your floppy drive (could be B: or ?), and C:\AFRICA is your hard drive directory for the data (If you have created a different directory to store the files, you will need to replace C:\AFRICA with the correct directory path).]

Keep repeating this process replacing VECTOR with AFRICA1 and the rest of the ZIP files until all the files are uncompressed or you are out of disk space. [Note that you should not include the ZIP extension when uncompressing the files.]

DATA SETS

When you have uncompressed the .ZIP files the following files should appear in your directory (the VECTOR and AFRICA files will have the extensions .img, .doc, .pal):

PROGRAM directory files:

IDRISI.env   -tracks the parameters set with the *environ* command

COLOR.exe   -this is the main command used to display the data

ORTHO.exe   -this allows you to view selected data in 3-D

ENVIRON.exe -sets the IDRISI parameters

LIST.exe   -lists the image and vector files available for viewing

VECTOR.ZIP files:

COUNTRY   -political boundaries of African countries

COASTS   -African coastline

RIVERS   -major rivers in Africa

LAKES   -major lakes in Africa

Contents of AFRICA1.ZIP

SEVERITY   -overall soil degradation severity (color)

NONDEGR   -areas not affected by soil degradation (color)

WATERSEV   -water erosion severity (color)

WINDSEV   -wind erosion severity (color)

CHEMICAL   -chemical deterioration severity (color)

PHYSICAL   -physical deterioration severity (color)

AGRI   -areas affected by agricultural practices (color)

FOREST   -areas affected by deforestation (color)

GRAZING   -areas affected by over-grazing (color)

EXPLOIT   -over-exploitation of vegetation for domestic use (color)

RATE   -rate of the most important degradation processes (color)

CONTENTS OF AFRICA2.ZIP

POPDENS   -population density (# per square km) (color)

AFTMPANN   -average annual temperature (color a)

AFPRCANN   -average annual precipitation (color a)

AFPETANN   -average annual potential evapotranspiration (color a)

AFGVIANN   -average annual global vegetation index (color a)

CONTENTS OF AFRICA3.ZIP

VEG   -vegetation patterns without agriculture (color)

LANDUSE   -vegetation and agricultural landuse (color)

SOILTEX   -large resolution soil texture (color)

RAINJAN   -average January precipitation (color a)

RAINJUNE   -average June precipitation (color a)

RAINYEAR   -average annual precipitation (color a)

TEMPJAN   -average January temperature (color a)

TEMPJUNE   -average June temperature (color a)

TEMPYEAR   -average annual temperature (color a)

WIND   -average windspeed (color)

WATER   -percent surface water (color)

ELEV   -elevation and bathymetry (color a)

3D-ELEV   -elevation and bathymetry [Use with Ortho]

3D-RAIN   -average annual precipitation [Use with Ortho]

3D-TEMP   -average annual temperature [Use with Ortho]

Batch files:

SLIDES1   -slide show of data in AFRICA1 files

SLIDES2   -slide show of data in AFRICA2 files

SLIDES3   -slide show of data in AFRICA3 files

<div align="center">**VIEWING AFRICAN DATA**</div>

PREPARATION:

Before you attempt to view the files you will have to check the data path in the environment module. To do this type *environ* at the DOS prompt in the directory with all the uncompressed files (i.e., C:\AFRICA). You should get a menu titled "IDRISI: Operating Environment".

If your directory with the uncompressed African data is not on your C: drive, you will need to select *1* and change the default to the appropriate drive. If your directory is not \AFRICA, you will need to select *2* and change the data path to the full path of your own directory. [Be sure to include the back slash, e.g., \AFRICA]

Once you have checked and, if necessary, changed these parameters you can quit the environment module. You will only need to do this again when you have just uncompressed the files or have changed the location of the data, otherwise it should be fine.

PREVIEW:

The files can be viewed in two modes, batch file "slide show" or interactive. The batch mode provides a preview of the data sets. It is activated by typing in the name of the batch file (i.e., SLIDES1) at the DOS prompt in the data directory. A particular slide show will only be available if its data has been uncompressed (e.g., SLIDES2 is only available if you uncompressed AFRICA2.ZIP).

The batch file will display the series of maps listed previously with a five second interval between them. If you would like to pause on a particular map, you will need to hit the *break* key. To reactivate the batch file, press the return or *enter* key. The batch files are good for reviewing the files before a more detailed examination.

INTERACTIVE VIEWING

The second mode is to select a specific file from AFRICA1, AFRICA2, or AFRICA3 and view it using the color module. These files are listed on the previous page with the appropriate command listed in parenthesis (*color* or *color a*).

You can also use the *list* command to see which files the program recognizes as being available. To use this command, type *list* at the prompt. It should provide a list of available images followed by vector files which can be overlaid on these files.

Once you have decided which image you would like to view, you can use one of the color commands to view it. (*color* is for images with a maximum of 16 different values in the image and color a is for those with more than 16.)

Try viewing some of the images using the following commands. Start by typing *color* or *color a*. The program will then ask a series of questions:

First you must type in the name of the file you wish to view.

Next you will need to type in a number for a color palette. For all of the files you will select "4". It will then ask you for the name of the palette file. Just enter the same name as the file you want to view.

Next it will ask if you want a legend. Enter either *1* or *2* depending on whether you want to see the legend or not (if you just hit return it will choose "yes" as a default.)

Finally, to answer the question of displaying the factors by hand type in *n* (or just press *return*).

Example: Type: *color*
Enter file name: FOREST
Palette desired: *4*
Enter palette name: FOREST
Do you wish a legend: *1* (for yes)
Set display factors: *n*

Following these actions, the map should be displayed. When you are done viewing the map, press the *Esc* key and you should be back at the DOS prompt.

INTERACTING WITH THE DATA

While viewing files in the interactive mode you can overlay rivers, lakes, coastlines, and country boundaries on the map, zoom-in on a portion of the map, and check the value of the mapped characteristic at any place on the map.

[The values in the legend of files viewed with the command *color a* are computed automatically. These files also have a predefined legend that may be easier to interpret. To view the predefined legend values, do die following while viewing a file: Type *L.* The program will ask for a legend category. Type *16*. It will then ask for a caption. **Do not** enter any text, just press return. A new legend should appear.]

Overlaying Vector Files

To overlay vector files type a *v* when viewing a map. In the lower left-hand corner of the screen you will be asked for the name of the vector file (see list, previous page). If you want rivers, type *rivers* and return. It will ask for a color code. You can choose one of the colors in the legend (0 is the top box, 15 the bottom).

If there are less than 16 legend boxes, you can experiment with the numbers without a corresponding box. For example, try *15* which is the color used for the type. For the country boundaries type "country" and then "0" which is the color of the background.

Finding Coordinates and Data Values

If you would like to determine the value for the mapped variable or just want to get a relative location, you can type if c" or "x" while viewing a map. This will give you a crosshair which has its position (row/column followed by x/y) listed in the lower left-hand corner. If you would like to find the value for a particular point press the left mouse button. The value is displayed in the lower left also. To free up the crosshair press the left mouse button again. To get out of this mode, press the right mouse button.

[The values in some of the data sets are nominal (i.e., they correspond to which legend box color they are, from zero at the top to 15 at the bottom). Others have interval values which can show greater than or less than, but with unfamiliar units. Some have measured values such as precipitation (mm) which are divided into interval classes.]

Changing Colors

You can change and create colors by typing *k*. If 16 colors are already displayed, you will have to change one of the existing colors. If there are less than 16 colors in the legend, count the boxes, starting with 0, then pick a number greater than the number of boxes. Remember if you pick 15 (the largest possible) you will be changing the type color.

When you type *k*, a color value scale appears in the lower left hand comer. It tells how much red, green, and blue are in the present color. The maximum value for any of these three colors is 63. To change the amount of any of these three hues, type the first letter of the color (r, g, or b) then use the up and down arrow keys to adjust the amount of color up or down.

When you are satisfied with the color, press *k* again. This can be repeated for all of the 16 possible colors in the legend. [If you do not have a legend item or vector file using the color that you just changed, you will not see what you have done. Try displaying a vector file with one of the colors then use k to changed it.]

When you are done viewing the data set and press *esc* the program will ask you for the new name for a palette file. If you would like to save your new colors, type in a new name for the palette. The next time you view the image, you can enter the new palette name. If you would like to switch color palettes while viewing an image, press p. It will ask for the name of the palette you would like to use.

Zooming-In

To zoom-in when viewing a map, type "w". You will get a crosshair. Move the crosshair with the mouse to the upper left point of the area you would like to view close up. Click the left mouse button and move the mouse to create a box around the area desired. Click the right mouse button and the enlarged area should be drawn.

If you had multiple vector files on the map, only the last one drawn will be redrawn when you zoom in or out.

If you want to zoom back out to the whole map, type "w" and press the right mouse button without moving the mouse.

ACTIVITIES

This data can be incorporated into a wide variety of courses and specific learning units in the classroom. Besides simple univariate explorations and analyses carried out by viewing a single data set, two or more data sets can be viewed in sequence to provide simple bivariate/multivariate examinations.

If the full IDRISI GIS software program (not included on this disk) is employed, multivariate analysis can be carried out much more efficiently and precisely using various GIS data analysis techniques.

Examples of two specific types of analytical data viewing that can be carried out using the IDRISI GIS modules included on this disk are found below. The first examples use the ORTHO module to view the data in a three dimensional perspective. The second mode is to simply view one data set after (or besides) another. Suggestions of pairs of data to view follow the ORTHO examples.

3-D VIEWING

The use of the ORTHO module to display these 3-D displays is shown below with some suggested examples.

Ortho #1:

Type in the *ortho* command.
You will be asked for: [Enter the values/letters in italics.]
      Name of the surface image: *ELEV*
      Do you wish to drape a second image: *n*
      Change max/min: *n*
      View direction: *0*
      View angle: *45*
      Vertical Exaggeration: *1*

This should produce a 3-D view of Africa and the surrounding water bodies.

If you would like to view the land only, when the ortho program asks you if you want to change the max/min values you can set min to 0 to eliminate the sea floor. For example:

Ortho #2:

Type in the *ortho* command.
You will be asked for:
      Name of the surface image: *ELEV*
      Do you wish to drape a second image: *n*
      Change max/min: *y*
          min: *0*
          max: *3599*
      View direction: *30*
      View angle: *75*
      Vertical Exaggeration: *4*

Notice the new angles from which the continent is viewed. When viewing from a high angle (in this case, 75°), it is helpful to increase the vertical exaggeration of the surface topography.

Now drape one of the images over the topography. In this first drape the color elevation image is simply draped over the 3-D elevation giving greater clarity to the variation of elevation in Africa (and the Middle East).

Ortho #3:

Type in the *ortho* command.
You will be asked for:
      Name of the surface image: *ELEV*
      Do you wish to drape a second image: *y*
      Name of drape image: *3D-ELEV*

Legend & Title: *y*
Palette Desired: *4*
Palette Name: *3D-ELEV*
Change max/min: *n*
View direction: *20*
View angle: *45*
Vertical Exaggeration: *1*

This should produce a wire-frame elevation image with colors from the 3D-elev image draped over it. This is the same image displayed at the end of the SLIDES3 preview.

Next a separate variable will be draped over the elevation. This is useful for visual identification of potential correlations between elevation and the other variable. Try the following drape:

Ortho #4:

Type in the *ortho* command.
You will be asked for:
      Name of the surface image: *ELEV*
      Do you wish to drape a second image: *y*
      Name of drape image: *3D-TEMP*
      Legend & Title: *y*
      Palette Desired: *4*
      Palette Name: *3D-TEMP*
      Change max/min: *y*
         min: *0*
         max: *3599*
      View direction: *0*
      View angle: *45*
      Vertical Exaggeration: *1*

This should produce the 3-D elevation with the average annual temperature on top of it. Students can be asked to identify temperature variations due to latitude and elevation.

Another image that has been prepared to drape over elevation is 3D-RAIN. Any of the images that use the color module can be draped over elevation, but will varying results.

DATA COMPARISON

In addition to using the ORTHO program with various images draped on elevation, students can be asked to view one image after another and attempt to come up with some general hypothesis relating the two data sets. For example, they might be asked to do the following:

View AFPRCANN then view POPDENS. Students can attempt to find a pattern between precipitation amount and population density.

View VEG then view LANDUSE. Students can be asked, where in Africa is most of the agricultural activity and how does that correspond to vegetation type.

View AGRI then view FOREST. Students can be asked if a correlation between agriculturally changed soils and deforestation appear in the two images and how consistent that pattern is.

View GRAZING and RAINYEAR. Here, students can be asked to surmise what relationship grazing has to rainfall amounts.

View WATER and SOILTEX and RAINYEAR. Can any relation between rain, soil texture, and surface water be identified. (Probably no clear correlation can be identified from this data, but the attempt to find a correlation can lead to a variety of interesting hypotheses.)

There are many combinations that could be used to create an infon-native lesson for students. Another strategy is to have students use the vector overlay files as a second variable.

Have the students view POPDENS. Have them add the rivers and lakes vector files by using the v command. They might want to use 0 for the color. Ask them what relationship if any population concentrations have with water features.

One other type of exercise for students is:

Have students view the various rainfall and temperature images. Help them notice the patterns and deduce the reasons for the variations (latitudinal and altitudinal effects, seasonal progression, and effects of prevailing winds and ocean currents).

[Note: When comparing two data sets, it is helpful to have two computers side-by-side each displaying one of the images. With a full GIS program, the data sets could be combined to form a new composite layer showing the coincidence of values from each of the images.]