GIS APPLICATION FOR WATERSHED BOUNDARY CLASSIFICATION

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ABSTRACT : There were development of GIS in the function of many program computer softwares which could manipulate for geographic information in many aspects particularly classification or sketch of watershed boundary. The attained information will be useful for irrigation planning, hydrogeology, flooding protection, soil and water conservation etc. The objective of this study is to classify watershed boundary by GIS. This study was conducted by using of program computer software (IDRISI) for watershed boundary classification of Loei province Thailand. Watershed area were classified at different 3 levels : small watershed (area threshold = 50), medium watershed (area threshold = 100) and large watershed (area threshold = 200). The result of this study show that IDRISI can easily be applied to classify watershed boundary, data correction and use together with other program computer softwares well.

1. INTRODUCTION

The Northeast of Thailand roughly comprises one-third of total land area in the whole country. During the last 4 decades, the land area in this region has dramatically changed in such a way that the forest cover was reduced from 52 % in 1961 to 12% in 2001 for agricultural land areas (Limpinuntana et al, 1999). Agricultural land-use systems have been developed on marginally poor sandy soils with low moisture holding capacity and fertility of the undulating terrain. The undulating terrain mostly is the typical landscape in the Northeast region. The land use system of the typical undulating terrain was consisted of subsystems of upper upland, lower upland, paddy fields and farm pond. The top of the slope of landscape is the forest (Trelo-ges, 2002). Field crops and paddy fields are situated lower down of the slope respectively. Whilst farm pond is at the foot slope. A watershed boundary, is the key factor for agricultural production, is controlled by undulating landscape. In the former times, mapping experts roughly draw to set up the watershed boundary by hand-free which spend long time, non-accuracy and trouble for correction. Geographic Information Systems (GIS) now have many function to be able to filing with many geographic issues particularly watershed boundary classification which the number of watershed was classified by number of district, village or etc. Besides of this, we use this method to conduct the national watershed development planning for site selection fitting the budget including to small scale irrigation development in rural areas.

2. OBJECTIVES

- To use the program computer software (IDRISI) for watershed boundary classification.
- To analyze various sizes of watershed by GIS method.

3. MATERIALS AND METHODS

3.1 Materials

3.1.1 Loei province was selected to be research site based on using landscape and land use as the hypothesis in order that the results can be applied to other typical areas in the Northeast.

3.1.2 Watershed boundary was identified based on position elevated from mean sea level on the landscape.

3.1.3 Topographic map scale of 1 : 250,000.

3.1.4 Program computer software IDRISI.

3.1.5 Computer : the specific qualification at least RAM 128 MB, CPU 733^{+} MHz and hard disk 20^{+} GB.

3.2 Methods

3.2.1 Program computer software (IDRISI) will process in following to Figure 1.

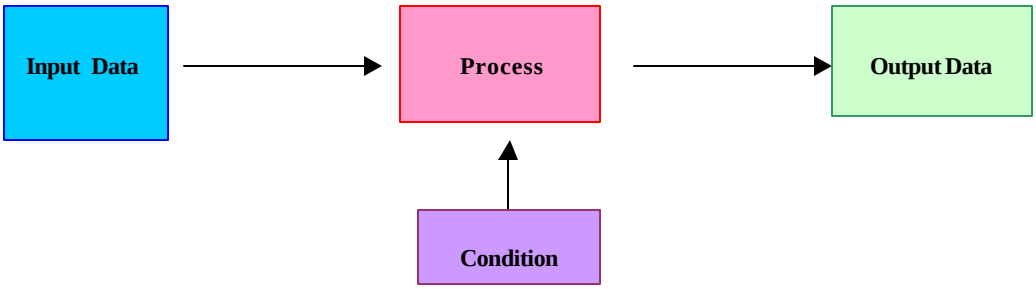


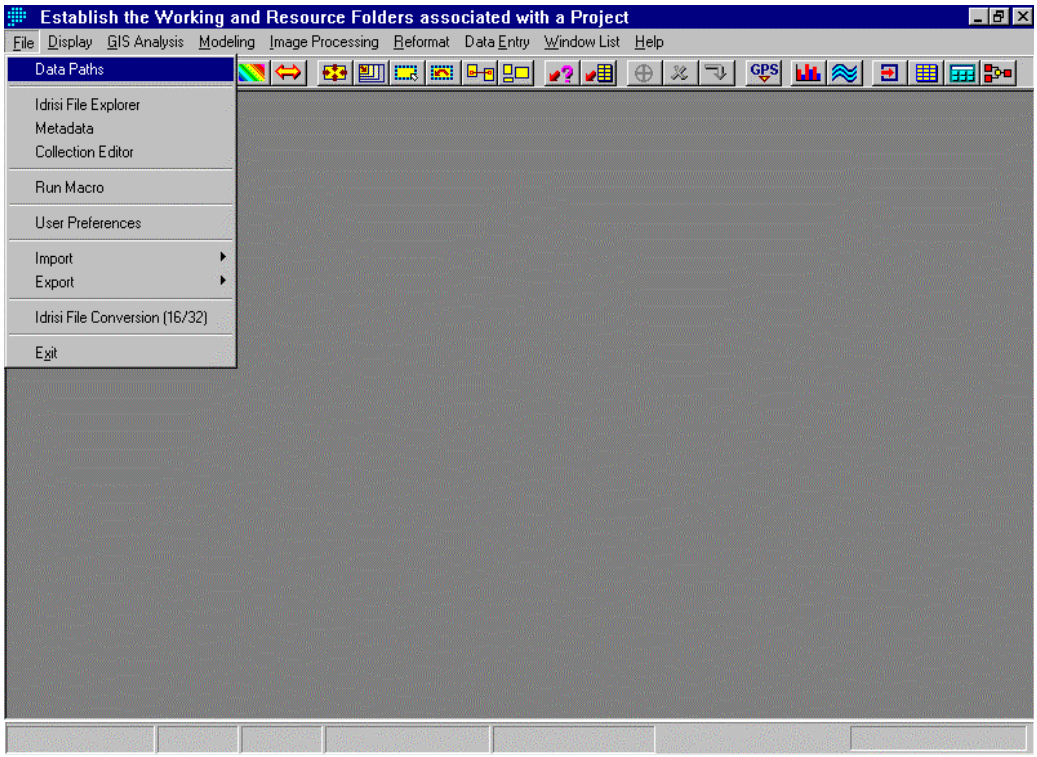
Figure 1. IDRISI flow chart

3.2.2 Input data

The input data was the contour lines which had the elevation data from mean sea level. These data in this step, were prepared by Arcview program, were input in shapefile format (lo-con. shp).

3.2.3 Processing data

1. The data filing was mostly kept in the folder file by the command of File/Data Paths (Figure 2 and then Figure 3).



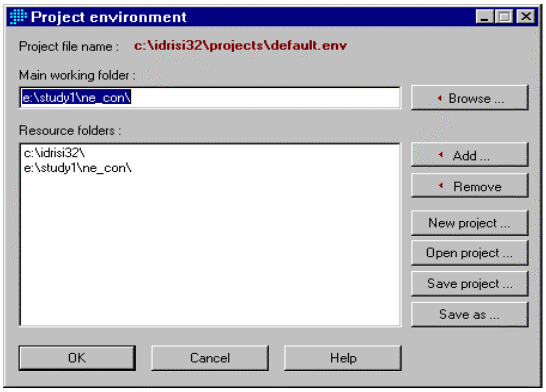


Figure 3. The window of data file source.

2. Type these following parameters:

2.1 Main working folder : input our processing folder name.

2.2 Resource folder : input which have our program and data input in shapefile format.

3. Process data in shapefile format into IDRISI by using Command File/ Import/ Software Specific Formats / ESRI Formats / SHAPEIDR (Figure 4 and then Figure 5).

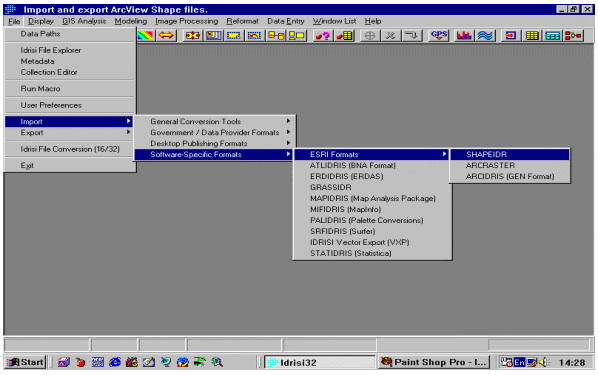


Figure 4. Using command of input data.

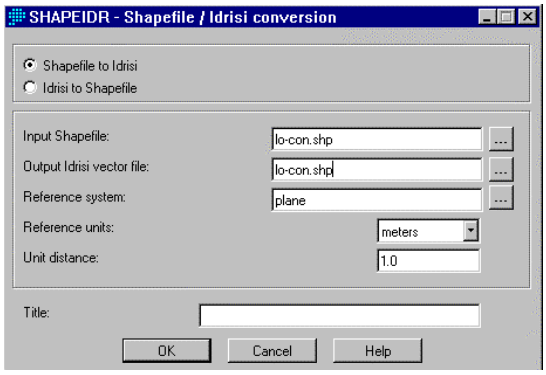


Figure 5. The command window of input data.

4. Type these following parameters :

4.1 Input shapefile in the file name of processing (lo-con.shp) which must be in vector.

4.2 Output : put file name which will be output (lo-con. shp).

5. Build the database in the form of numerical elevation by TIN method (Triangulate Irregular Network) .To command GIS Analysis/ Surface Analysis/ Interpolation/ TIN Interpolation / TIN (Figure 6) and then show the window in Figure 7.

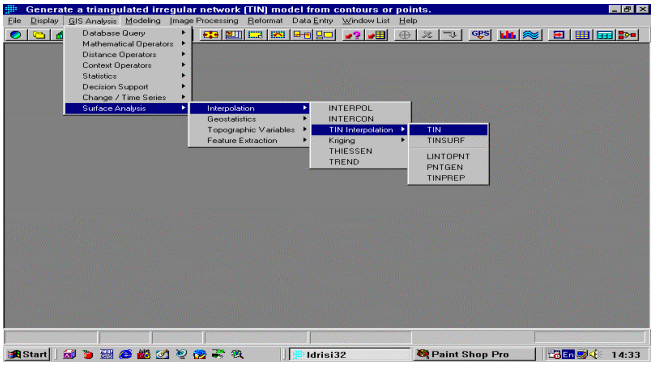


Figure 6. Build the database method of TIN.

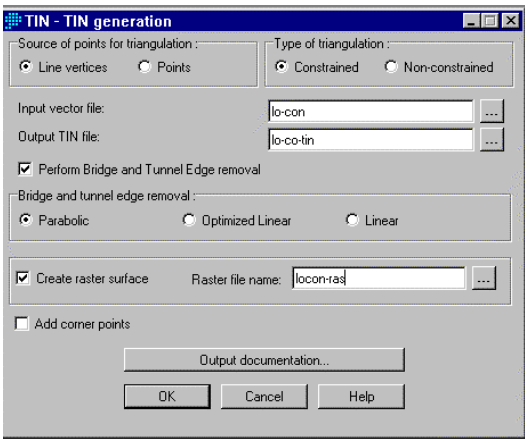


Figure 7. The window of TIN database.

6. And then, type these following parameters:

6.1 Input : type file name (lo-con. shp).

6.2 Output TIN : new file name which have finished database (lo-con-tin).

6.3 Raster file name : type file name to be raster (locon-ras).

6.4 Enter to process database and then show the window as Figure 8.

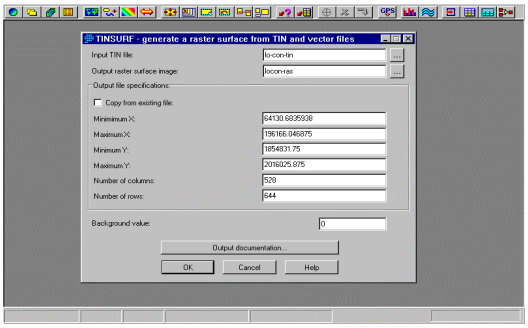


Figure 8. The second window of TIN database.

7. Type the number of column (pixcell number in x-axis) which was calculated from this following formula.

The number of column (528) = maximum x – minimum x

8. Type the number of row (pixcell number in y-axis) which was calculated from this following formula and then will be showed in Figure 9.

$$\text{The number of row (644)} = \frac{\text{maximum y} - \text{minimum y}}{250}$$

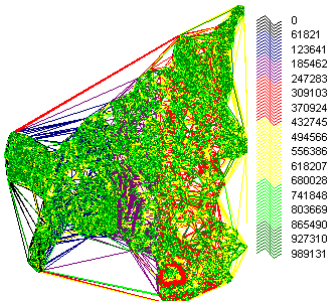


Figure 9. The result of TIN database

9. To command GIS Analysis/ Surface Analysis/ Feature Extraction/ WATERSHED for watershed boundary classification (Figure 10) and then will show the window in Figure 11.

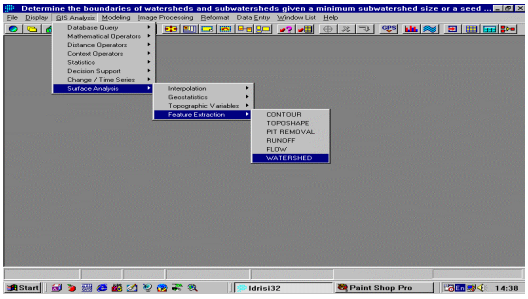


Figure 10. The command step of watershed boundary classification.

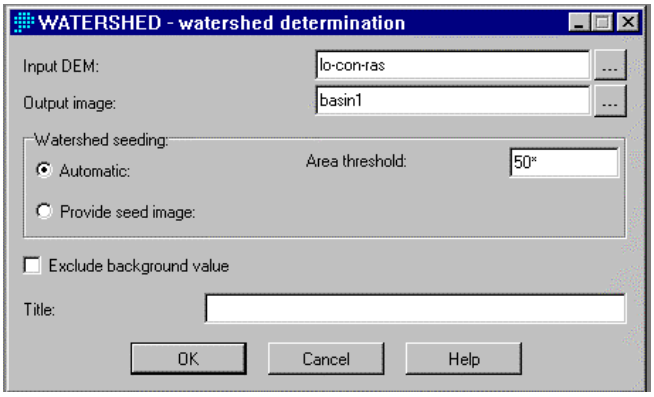


Figure 11. The watershed determination.

10. Type this following parameters:

10.1 Input DEM : type file name, in this case must be rasterfile (lo-con-ras).

10.2 Output file : Type file name which would like to present (basin 1).

10.3 Area threshold : type polygon number (50,100 and 200 units) which can calculate to be the area size (1 pixcell = 250x250 m). We can classify the watershed boundary determination in 3 levels

1. Small watershed area (Area threshold = 50)
2. Medium watershed area (Area threshold = 150)

3. Large watershed area (Area threshold = 200)

11. From figure 10, click menu bar namely display and then will show the window in Figure 12.

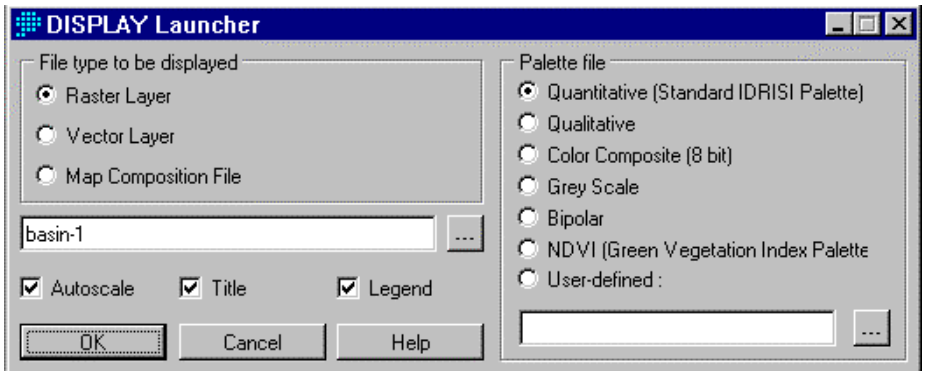


Figure 12. The window of Display Launcher.

12. Type these following parameters in File type to be displayed:

12.1 Raster Layer which is the file in Grid (basin-1)

12.2 Vector Layer which is the file in Vector (lo-con. shp)

12.3 Map Composition File which is the file of many overlays.

12.4 Palette file is file for colour selection which normally use Quantitative (Standard IDRISI Palette) and then will present the window in Figure 13.

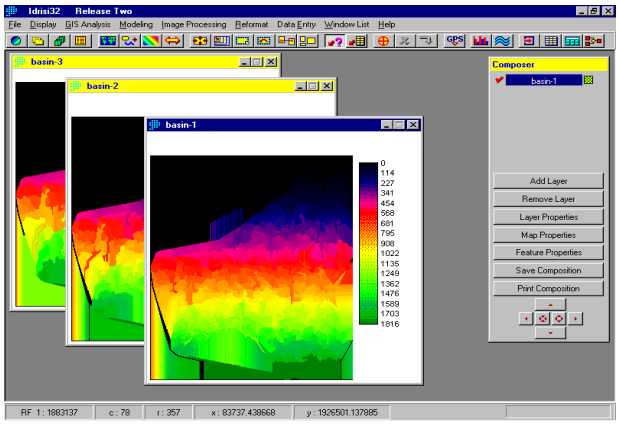


Figure 13. The 3 pictures of command using in Display.

13. On the right side in Figure 13, there is the tool bar of Composer menu in the following to Figure 14.

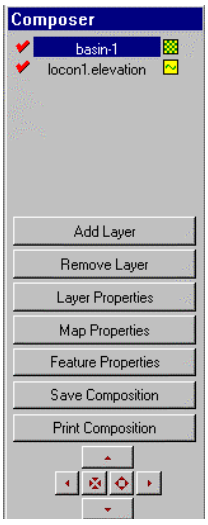


Figure 14. The tool bar of Composer menu.

14. For subcommand of Add Layer, use for overlay some files, click at tool bar to show the window in Figure 15.

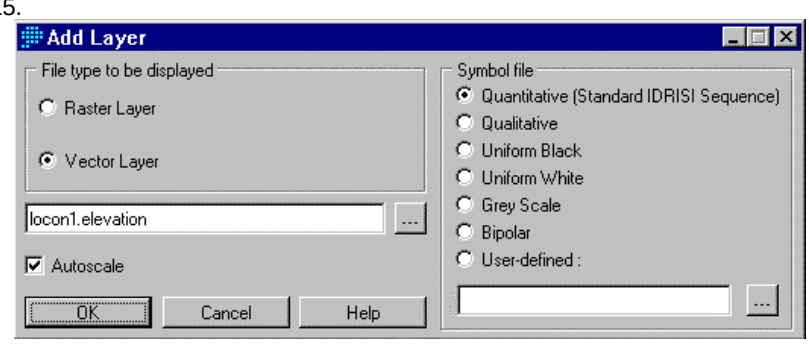


Figure 15. The window of subcommand of Add Layer.

15. Type the file which we select to overlay and must be only Vector Layer (locon 1. elevation) and then show the window in Fi

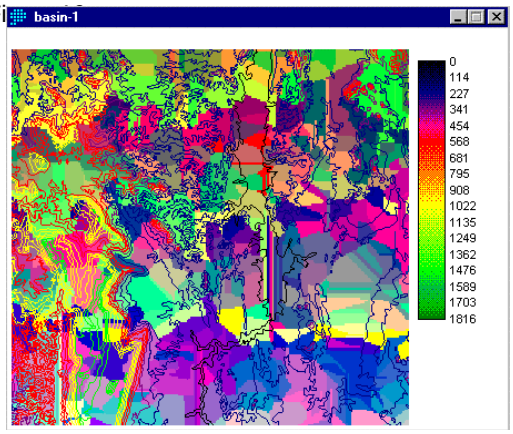


Figure 16. The overlay of Layer.

16. For Remove Layer, use in the case of need to delete Layer, which there were some files overlay together, out from the files. We select at the heading of Composer (Figure 18) and then will show the previous file prior to overlaying.

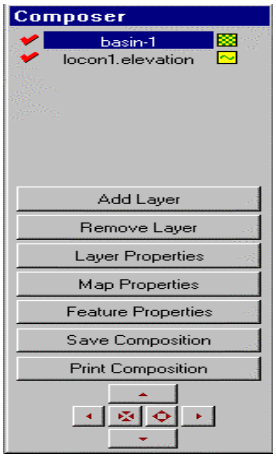


Figure 17. The window of Remove Layer.

17. For Layer Properties, show the details of data and adjust the colour (Figure 18).

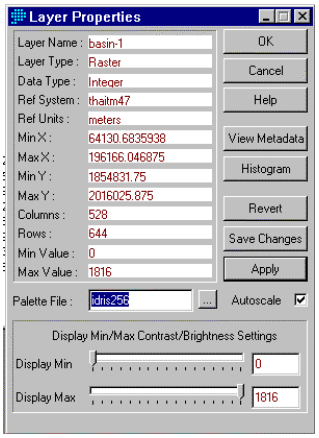


Figure 18. The window of Layer Properties.

18. For Map Properties, show the details of map which are finer than Layer Properties (Figure 19).

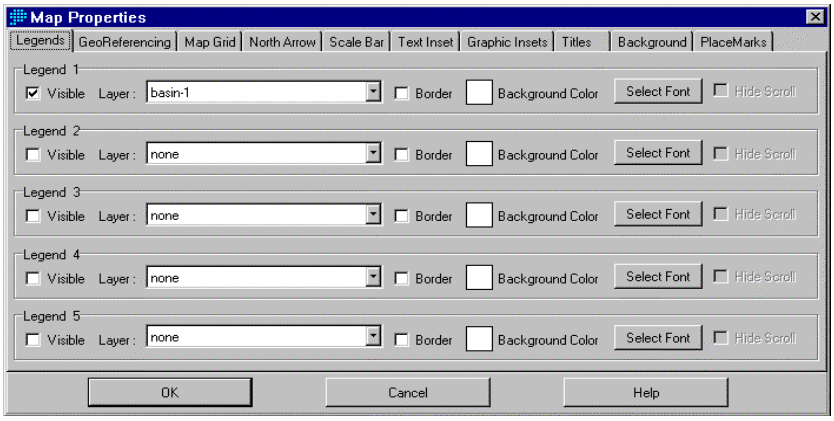


Figure 19. The window of Map Properties.

19. For Feature Properties, display the interesting area data (Figure 20).

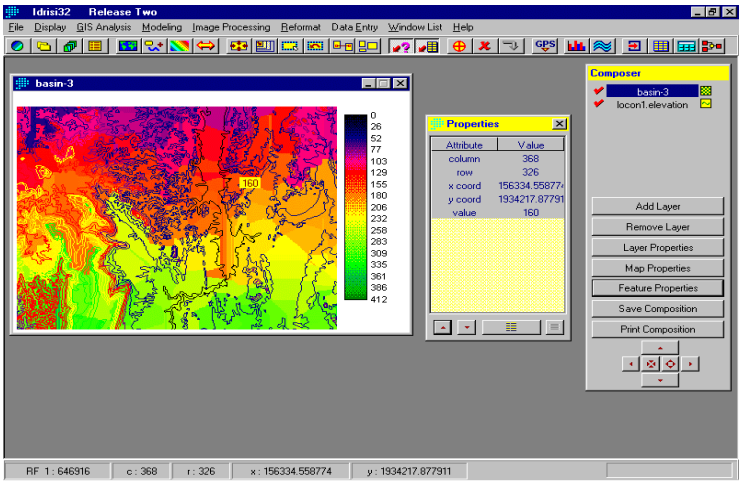


Figure 20. The window of Feature Properties.

20. If we would like to magnify of focusing on particular area, we are able to click on the menu bar at Zoom Window (Figure 21). And then, select the focusing area which will show the window in Figure 22.

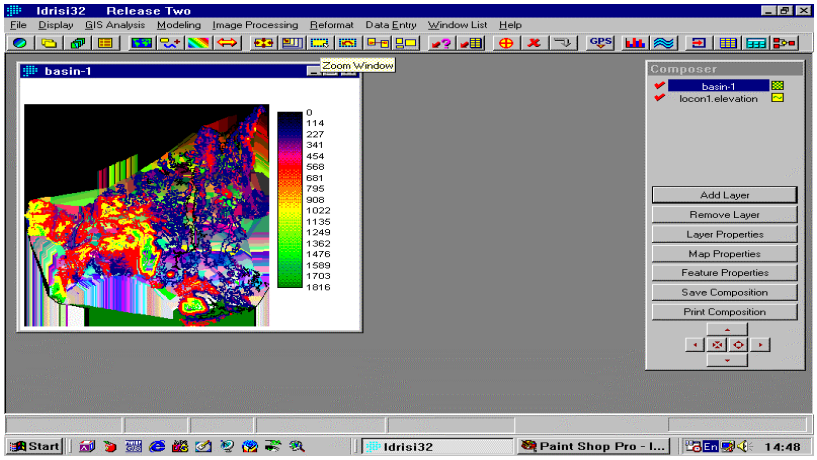


Figure 21. The command of Zoom Window.

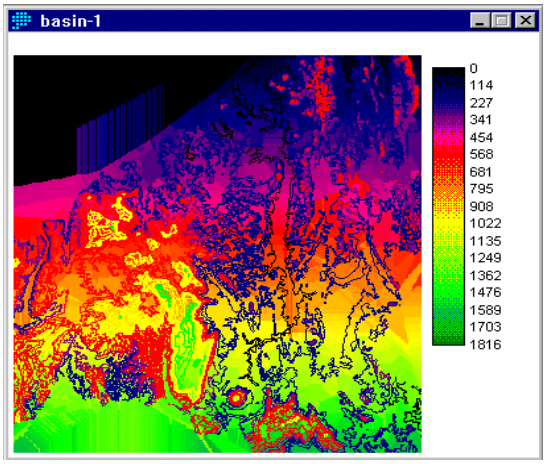


Figure 22. The result of Zoom Window using.

21. If we would like to cancel the Zoom Window, we can click on the menu bar at Restore Original Window (Figure 23). It will show the previous window before zooming.

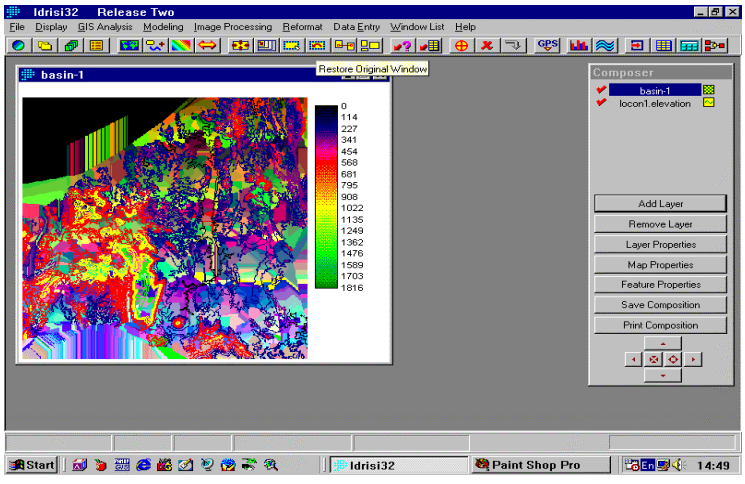


Figure 23. The window of Restore Original Window.

RESULTS AND DISCUSSIONS

Study on GIS application on watershed boundary classification, the results are showed at 3 levels.

1. Small watershed area (Area threshold = 50) (Figure 24).

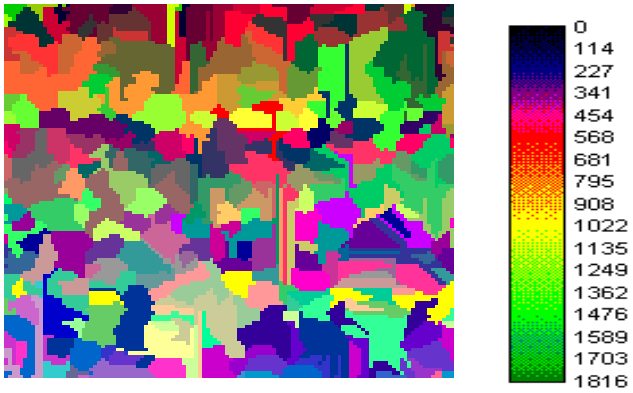


Figure 24. The watershed boundary of small watershed area.

2. Medium watershed area (Area threshold = 100) (Figure 25).

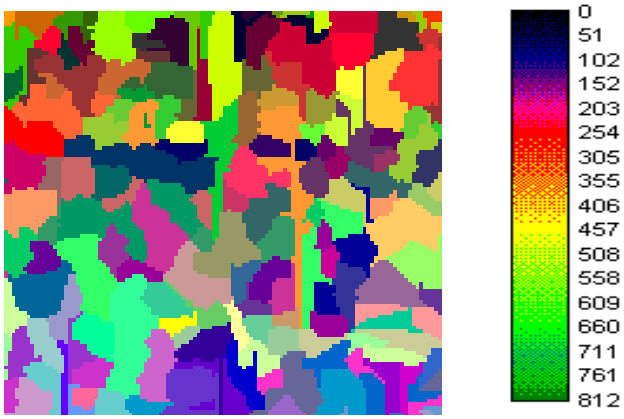


Figure 25. The watershed boundary of medium watershed area.

3. Large watershed area (Area threshold = 200) (Figure 26).

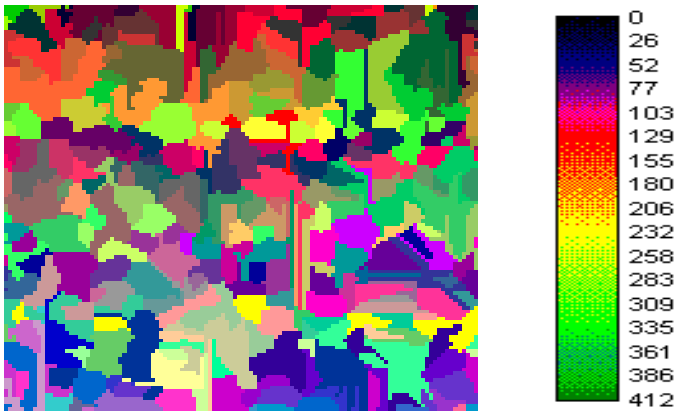


Figure 26. The watershed boundary of large watershed area.

CONCLUSIONS

From Figure 24-26, they show that the program computer software (IDRISI) is appropriately adopted to classify the watershed boundary. This program software can calculate on the size of watershed area, bring other data to overlay, correct some error data and display water flow direction in the watershed area. But if the data files are too big, the program will operate very slow. For limitation, this program must use the computer has capacity at least RAM 128^{+} MB, CPU 733^{+} MHz and hard disk 20^{+} GB.

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