

How to use IDRISI Selva

(An introduction)

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Presentation outline

1. Background about IDRISI Selva
2. Data format, display and map composition
3. IDRISI Selva Modules
4. A closer look at some modules
5. Remarks

1. Background about IDRISI Selva

- **The IDRISI Legacy**

- was named after Abu Abd Allah Muhammed al-Idrisi (1100-1166 A.D.)
 - a cartographer and geographer of major significance during the medieval period.

- **IDRISI Selva**

- a version 17 of IDRISI; **Selva** means ‘dense tropical forest’
- an integrated raster-based GIS and Image Processing software
 - provides nearly 300 modules
 - for the analysis and display of digital spatial information
- a complete GIS analysis package
 - for basic and advanced spatial analysis
 - surface and statistical analysis, **decision support**, and change and time series analysis

1. Background about IDRISI Selva

- **IDRISI Selva**

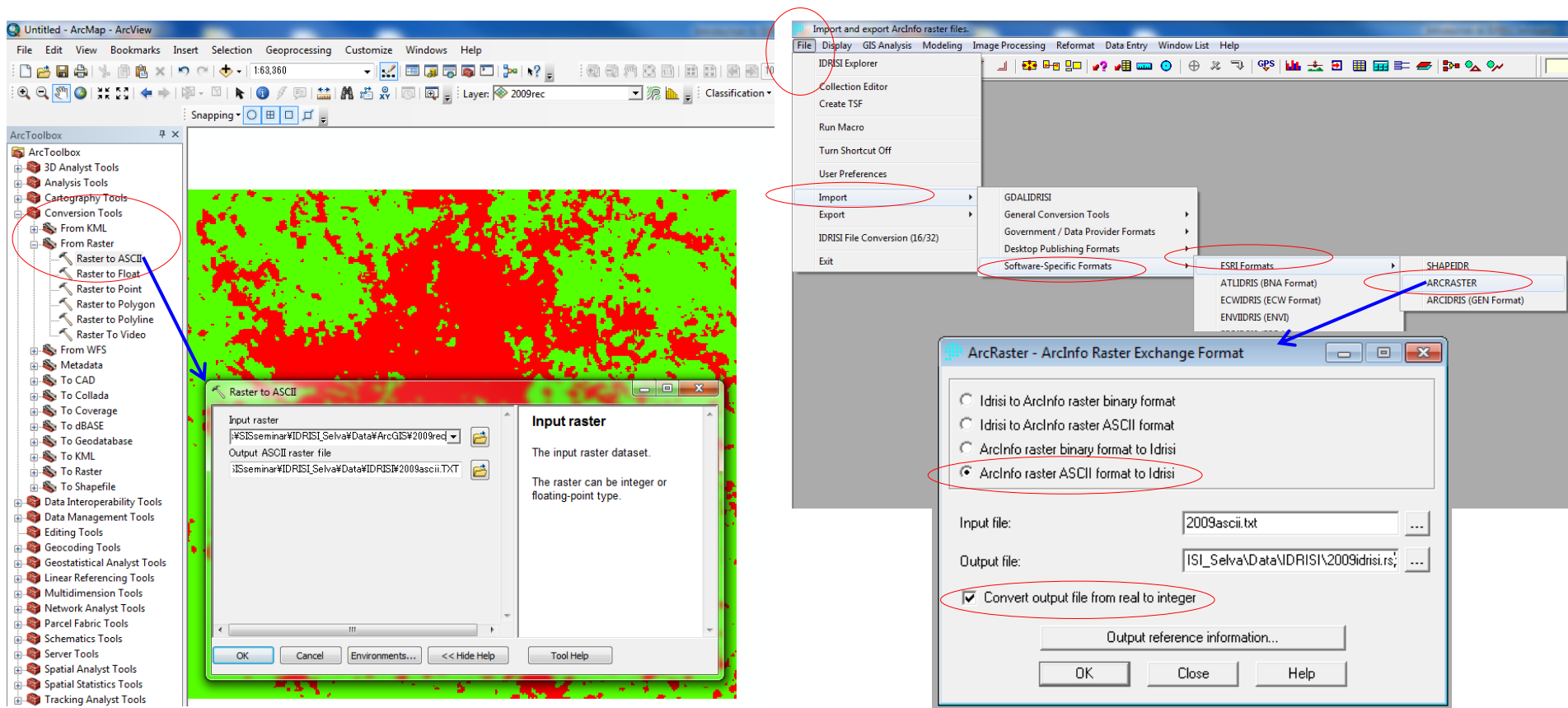
- provides a platform for integrated modeling environments
 - Earth Trends Modeler
 - for image time series of environmental trends
 - Land Change Modeler
 - for land change analysis and prediction, a critical component for REDD projects
- provides complete utilities for:
 - importing and exporting GIS data
 - a comprehensive set of documentation and tutorials

2.a. Data format

- Raster file - *.rst
- Vector file - *.vct
- *Conversion: ArcGIS format → IDRISI format*
 - ArcGIS **grid** file → IDRISI **raster** file
 - Convert the grid file into an ASCII file (text file)
 - Done in ArcGIS
 - Import the ASCII file into IDRISI
 - ArcGIS **shapefile** → IDRISI **vector** file
 - Import directly into IDRISI

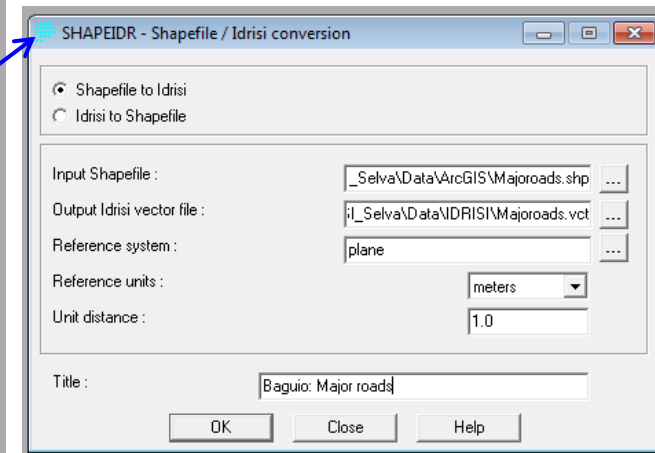
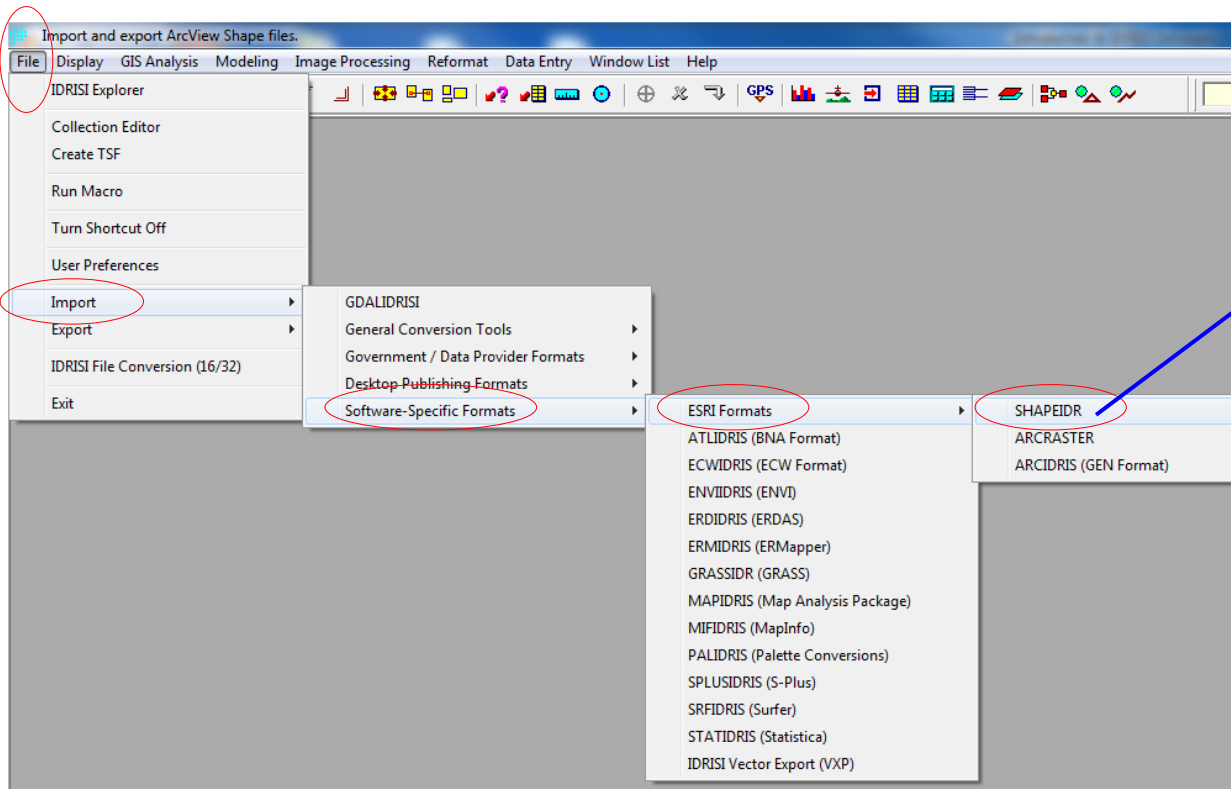
2.a. Data format

- *Conversion: ArcGIS format → IDRISI format*
 - ArcGIS **grid** file → IDRISI **raster** file



2.a. Data format

- *Conversion: ArcGIS format → IDRISI format*
 - ArcGIS **shapefile** → IDRISI **vector** file

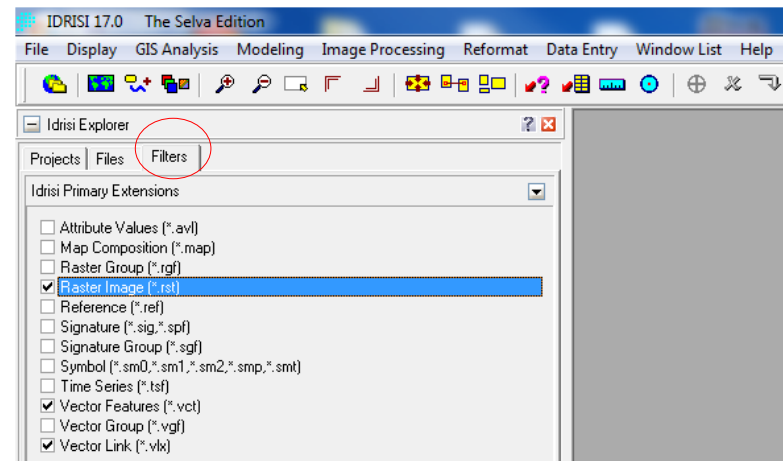
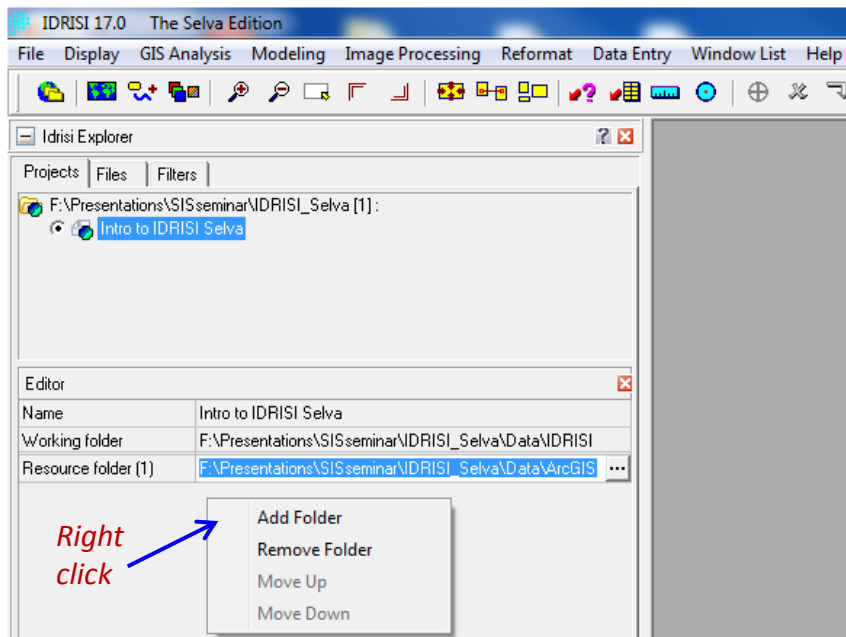
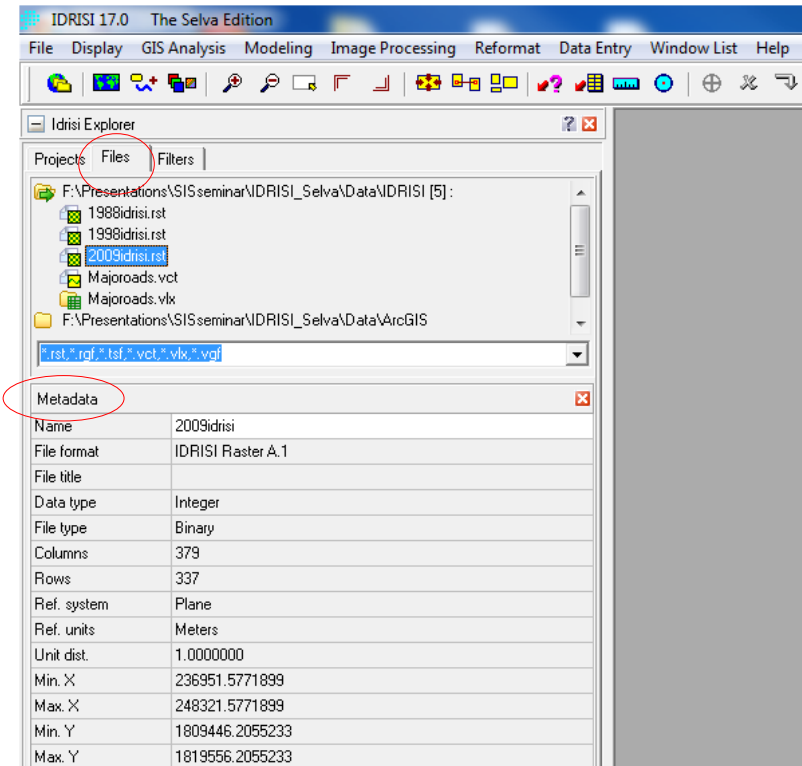
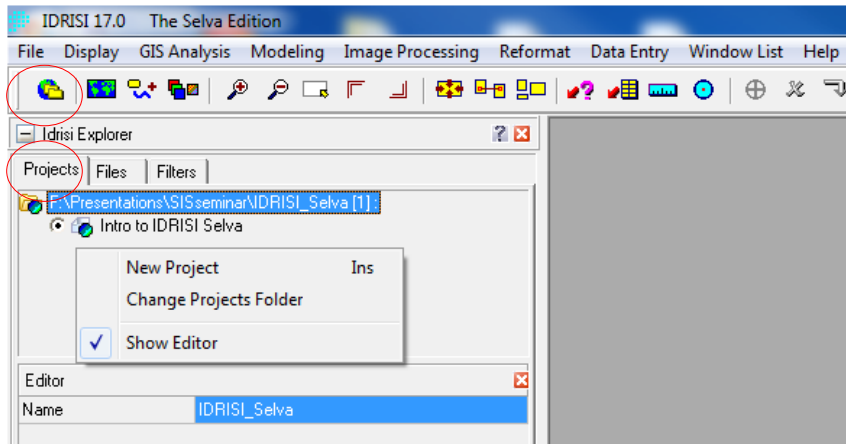


2.a. Data format

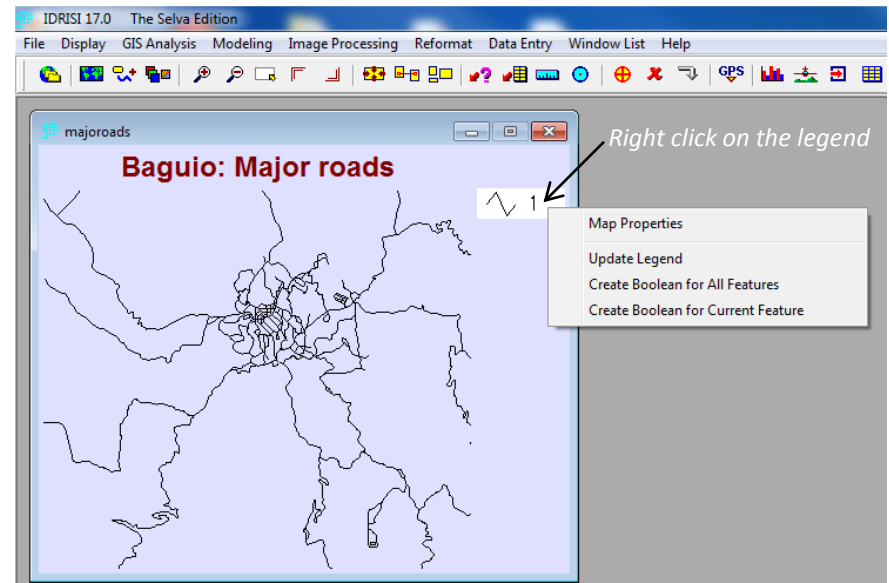
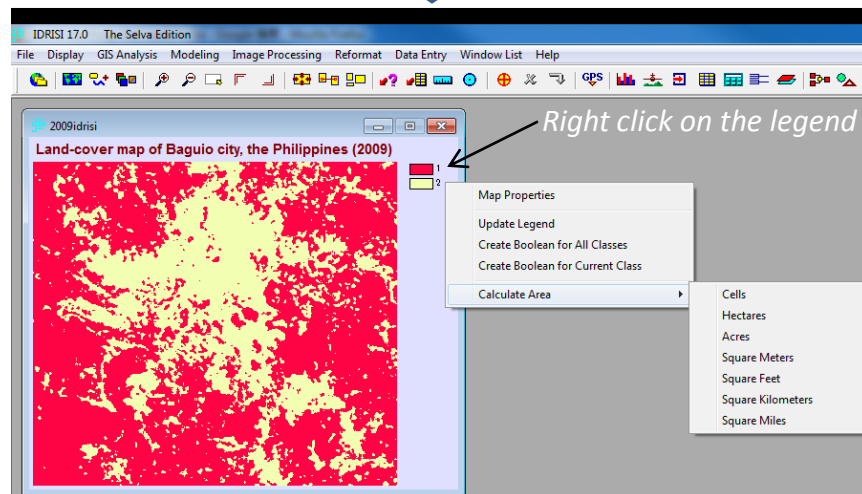
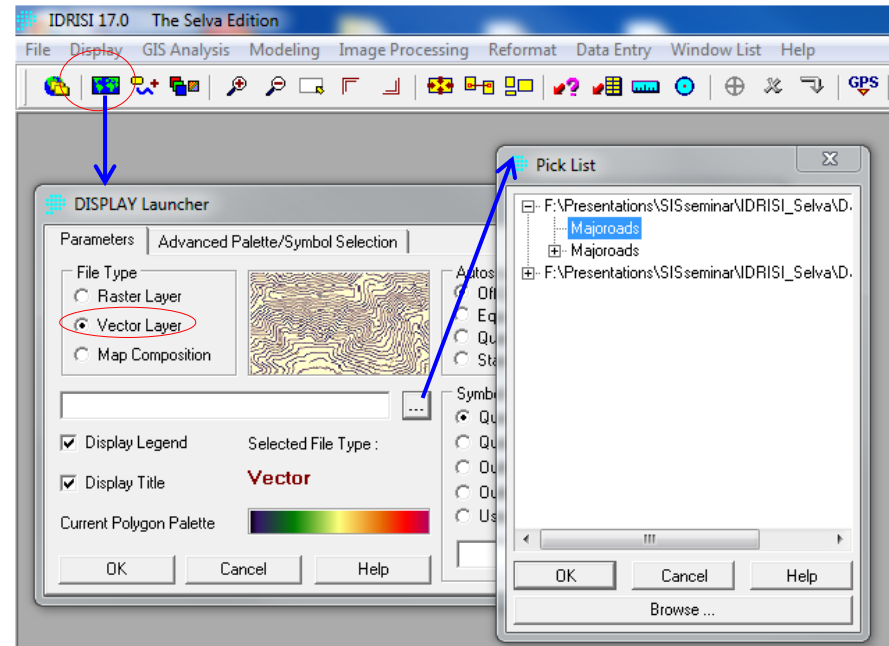
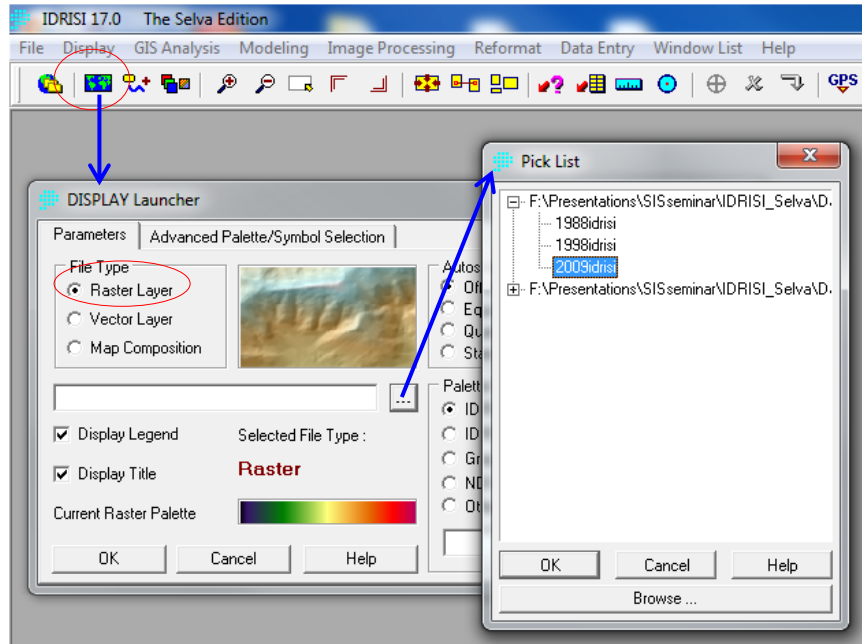
Note:

- When using ArcGIS 10
 - no need to convert IDRISI **raster** file into ArcGIS **grid** file
 - ArcGIS 10 is able to read and process IDRISI raster file
- IDRISI **vector** file → ArcGIS **shapefile**
 - reverse the process presented in the previous slide

2.b. Data display



2.b. Data display



2.c. Map composition

The screenshot displays the IDRISI 17.0 The Selva Edition interface. The main map window shows a map with two layers: '2009idrisi' (red and yellow) and 'majorroads' (black lines). A right-click context menu is open over the legend, with 'Update Legend' highlighted. An arrow points from this menu to the 'Edit Legend' dialog box, which shows 'NonBuilt' as the current legend caption. Another arrow points from the 'Update Legend' menu item to the 'Map Properties' dialog box. The 'Map Properties' dialog box has tabs for 'Legends', 'GeoReferencing', 'Map Grid', 'North Arrow', 'Scale Bar', 'Text Inset', 'Graphic Insets', 'Titles', 'Background', and 'PlaceMarks'. The 'Legends' tab is active, showing a list of legends. Legend 1 is for '2009idrisi' and Legend 2 is for 'majorroads'. Legend 3 is for 'none'. Legend 4 is for 'none'. Legend 5 is for 'none'. The 'Composer' window is also visible, showing the map composition area with the '2009idrisi' and 'majorroads' layers. Arrows point from the 'Composer' window to the 'Map Properties' dialog box and to the 'Update Legend' menu item. A text box on the left says 'Automatically opens when displaying data'. Another text box on the left says 'To examine layer properties'. A third text box on the left says 'To add layer'.

Right click on the legend

Map Properties

- Update Legend
- Create Boolean for All Classes
- Create Boolean for Current Class
- Calculate Area

Edit Legend

Update current legend caption :
NonBuilt

OK Cancel

Composer

- 2009idrisi
- majorroads

Auto-Arrange

Map Properties

Legends

- Legend 1: Visible, Layer: 2009idrisi, Border, Background Color, Select Font, Hide Scroll
- Legend 2: Visible, Layer: majorroads, Border, Background Color, Select Font, Hide Scroll
- Legend 3: Visible, Layer: none, Border, Background Color, Select Font, Hide Scroll
- Legend 4: Visible, Layer: none, Border, Background Color, Select Font, Hide Scroll
- Legend 5: Visible, Layer: none, Border, Background Color, Select Font, Hide Scroll

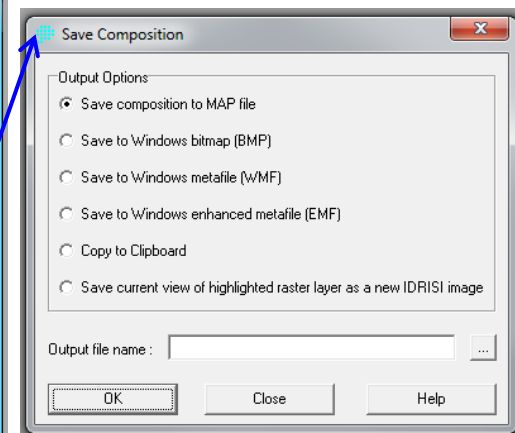
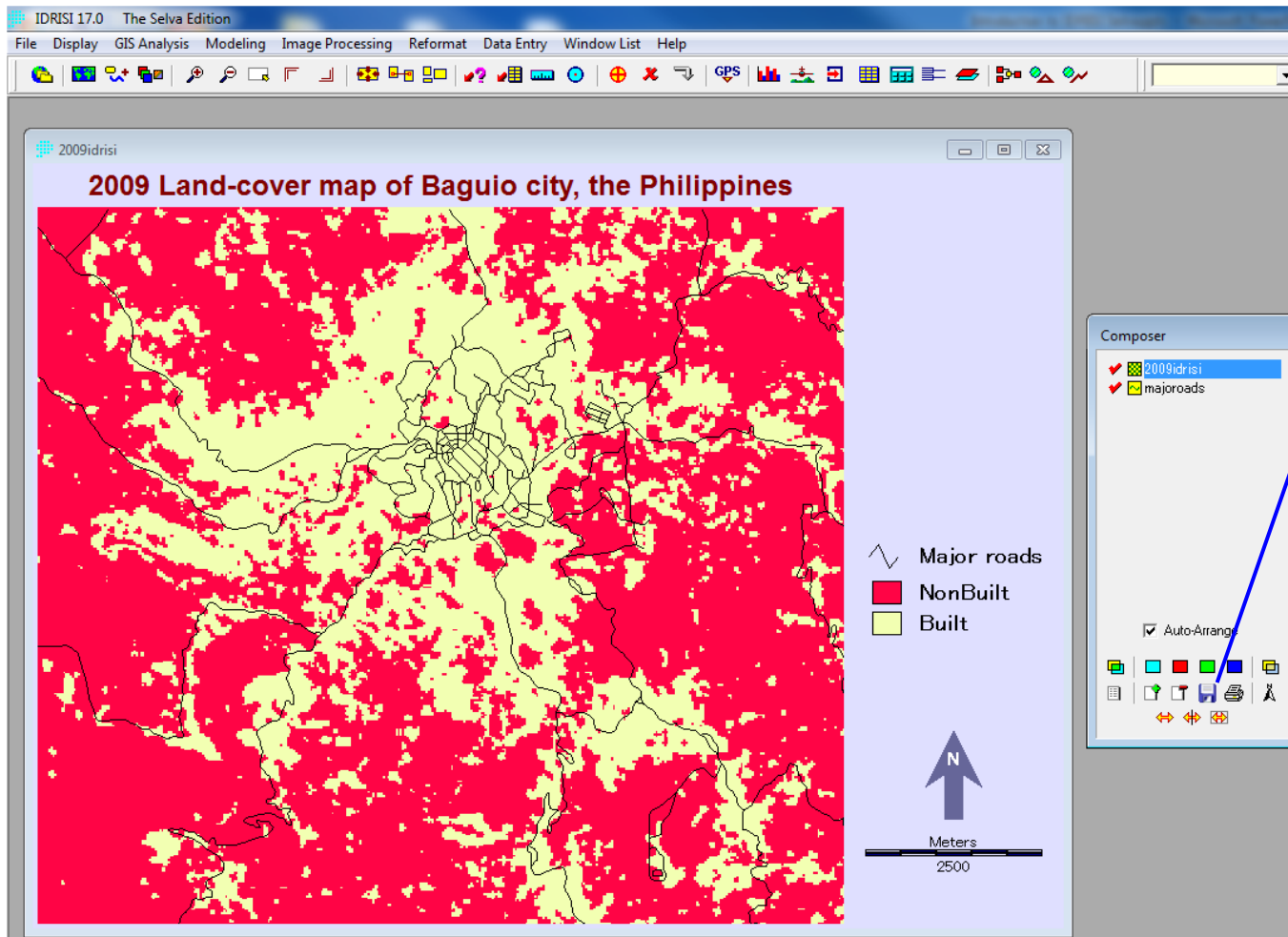
OK Close Help

Automatically opens when displaying data

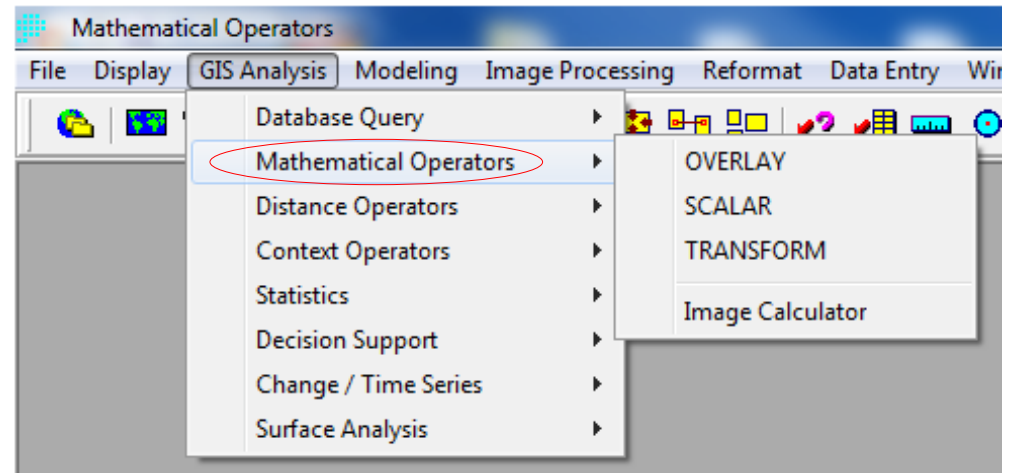
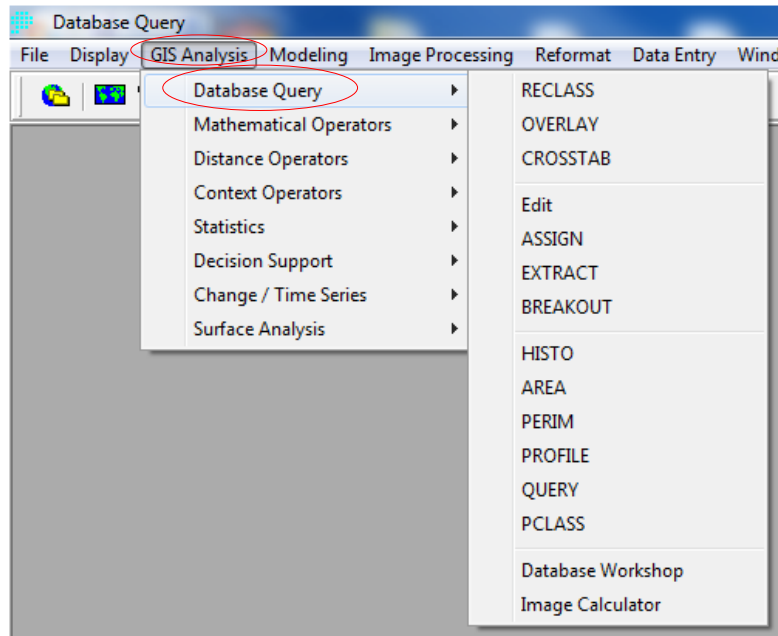
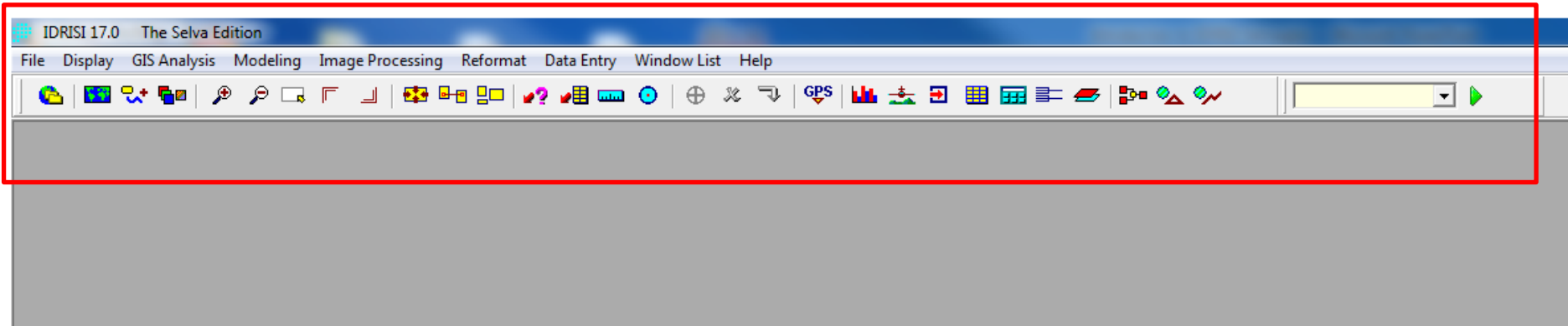
To examine layer properties

To add layer

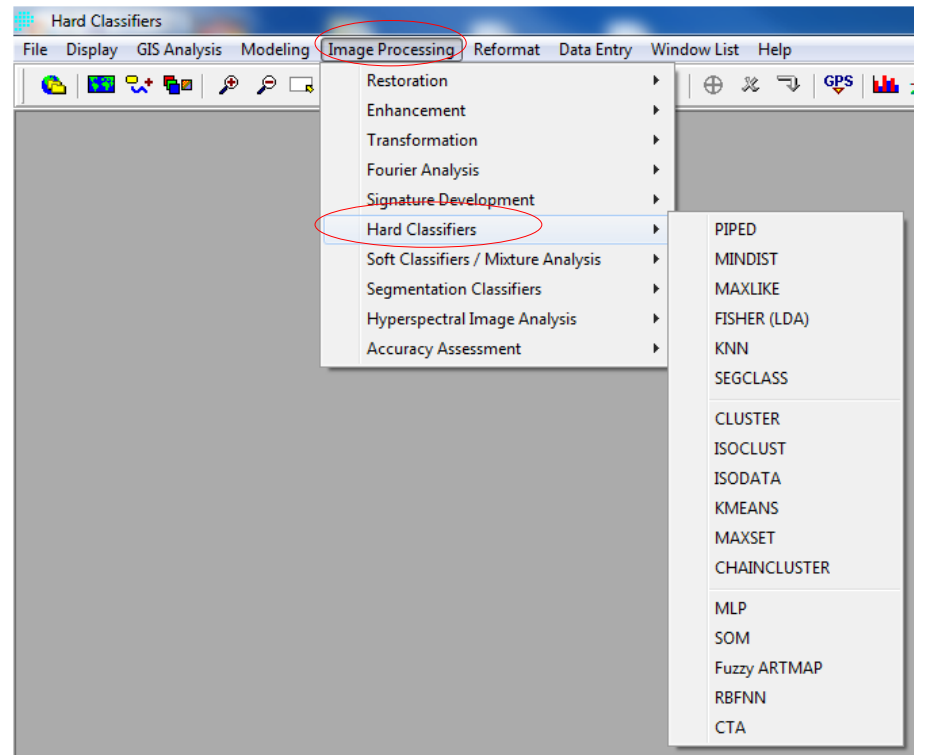
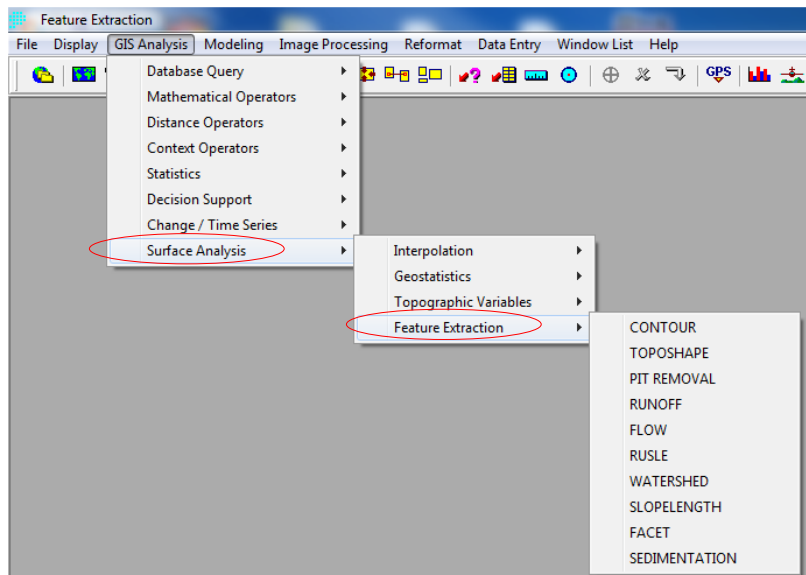
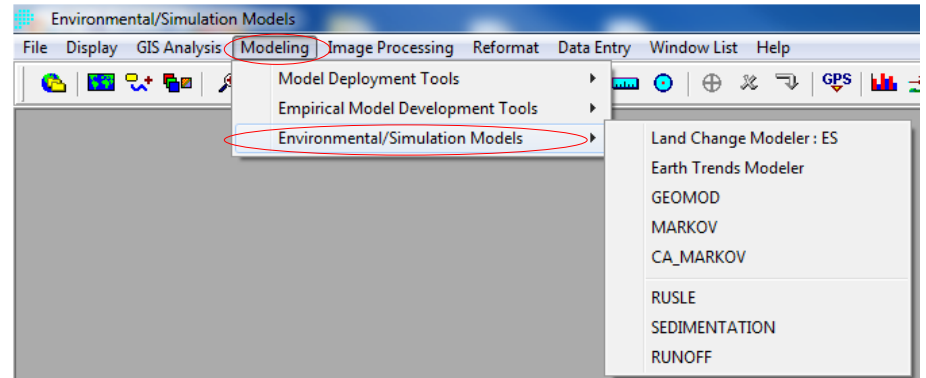
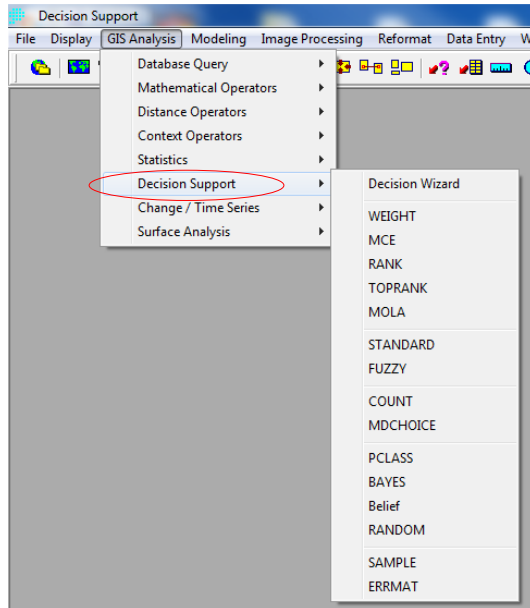
2.c. Map composition



3. IDRISI Selva Modules



3. IDRISI Selva Modules

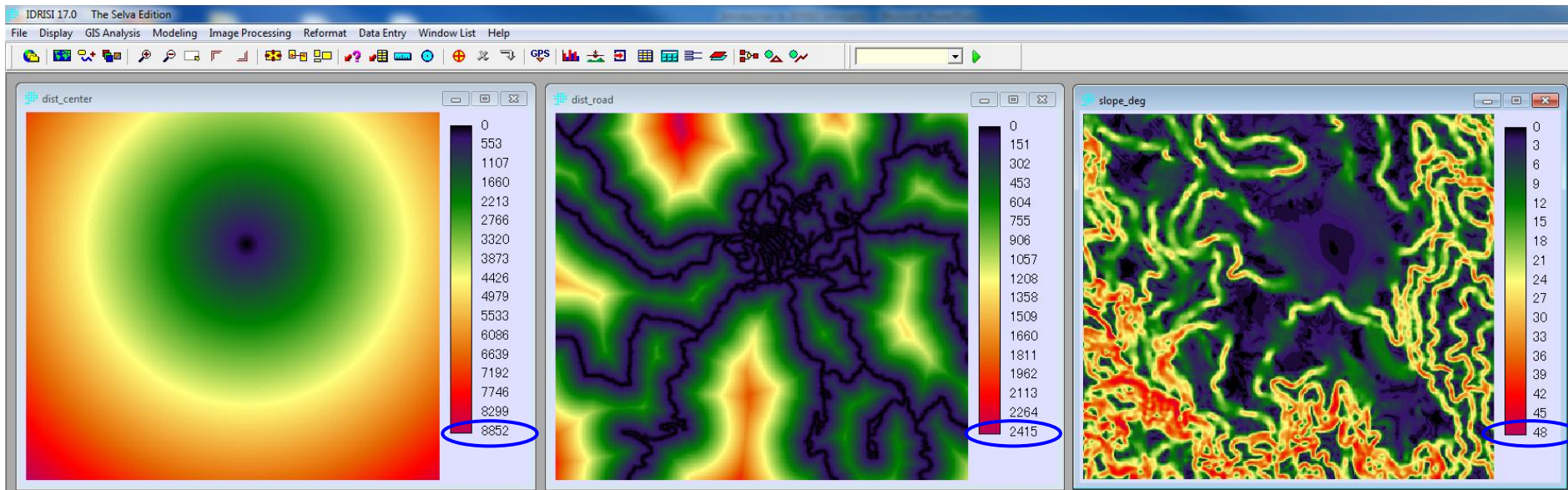


4. Decision Wizard: A closer look

Example:

- **Hypothetical goal** – Find suitable sites for housing projects
- **Factors** – distance to city center; distance to road; and slope (no constraints)
- **Relative weights** – to be determined using Analytic Hierarchy Process (AHP)
- **Assumption:** the area is not yet urbanized and large part of it is still available for housing and urban development.
- **Modules:** Decision wizard [**Multi-criteria Evaluation (MCE)**, **Fuzzy**, **Weight**, **AHP**] and **Reclass**

Factors



Distance to city center (m)

Distance to road (m)

Slope (degrees)

4. Decision Wizard: A closer look

Decision Wizard

File Display **GIS Analysis** Modeling Image Processing Reformat Data Entry Window List Help

- Database Query
- Mathematical Operators
- Distance Operators
- Context Operators
- Statistics
- Decision Support**
 - Decision Wizard**
 - WEIGHT
 - MCE
 - RANK
 - TOPRANK
 - MOLA
 - STANDARD
 - FUZZY
 - COUNT
 - MDCHOICE
 - PCLASS
 - BAYES
 - Belief
 - RANDOM
 - SAMPLE
 - ERRMAT
- Change / Time Series
- Surface Analysis

1 Multi-Criteria/Multi-Objective Decision Wizard

Introduction:

This wizard will step you through the multi-criteria evaluation and, optionally, multi-objective allocation decision processes. The wizard will save to a file all the parameters needed to run the IDRISI modules. Click the Help button for more information on each screen.

We encourage you to read the Decision Support chapter of the IDRISI Guide to GIS and Image Processing Volume 2 before using the wizard. The MCE section of the IDRISI Tutorial illustrates a worked example.

Multi-criteria evaluation is a process in which multiple layers are aggregated to yield a single output map. Often this is a map showing the suitability of land for a particular activity. However, it could equally be a map of vulnerability or some other parameter that is a composite of multiple criteria.

Multi-objective allocation is a process in which the most suitable areas for each objective are allocated to that objective. Conflicts between objectives over desired areas are resolved through a compromise solution. This wizard may be used for single objective as well as multi-objective problems.

Help Save as... Close << Back Next >>

2 Multi-Criteria/Multi-Objective Decision Wizard

Specify Decision Wizard File (.dmw)

☐ Open an existing file

☒ Create a new file Land suitability analysis.DMW ...

Note: The decision wizard file is saved each time you advance to the next screen. Use Save As to save the file with a new name.

Help Save as... Close << Back Next >>

3 Multi-Criteria/Multi-Objective Decision Wizard

Specify Objectives:

An objective is an activity and perspective. For example, consider the objective to determine areas most suitable for timber harvesting. One perspective might be to minimize the impact of harvesting on recreational uses while another might be to maximize profit. The two suitability models may be quite different.

Specify the number of objectives for this model and enter a name for each.

Objective name	Number of objectives:
Suitable sites to housing projects	1

Remove objective...

Help Save as... Close << Back Next >>

4 Multi-Criteria/Multi-Objective Decision Wizard

Criteria:

A criterion is some basis for making a decision that can be measured and evaluated. In this context, each criterion is represented by a raster image layer. Criteria are of two types: constraints and factors.

Constraint:

A constraint serves to limit the alternatives under consideration. Constraints are expressed in the form of Boolean (logical) maps: Areas excluded from consideration have the value 0 and those to be considered have the value 1.

Factor:

A factor is a criterion that enhances or detracts from the suitability of a specific alternative for the activity under consideration. It is therefore most commonly measured on a continuous scale.

Help Save as... Close << Back Next >>

5 Multi-Criteria/Multi-Objective Decision Wizard

Objective 1: Suitable sites to housing projects

Create constraint images outside the wizard using IDRISI modules. The specific sequence of steps you use to create each constraint image will depend on your data. However, ASSIGN and RECLASS are often used to create constraint images.

Note: In constraint images areas to exclude must have the value 0 and those to include must have the value 1.

Specify the number of constraints to be used for this objective and enter the constraint filenames. If your model does not include any constraints, continue to the next screen.

Constraint filename	Number of constraints:
	0

Remove file...

Help Save as... Close << Back Next >>

6 Multi-Criteria/Multi-Objective Decision Wizard

Objective 1: Suitable sites to housing projects

Create factor images outside the wizard using IDRISI modules. The specific sequence of steps you use to create each factor image will depend on your data.

Before they are combined, factors must be standardized to a scale of 0-255 where 0 is not suitable and 255 is perfectly suitable. The wizard will facilitate standardization of quantitative factor images using the module FUZZY on the next screen. All other types of standardization must be done outside the wizard and the resulting factor image names entered here.

Specify the number of factors to be used for this objective and enter the input factor filenames. Select standardization option and enter the output factor file name. The next screen will standardize the factors using FUZZY.

Input factor filename	Output factor filename	Number of factors:
F:\Presentations\GISseminar\Yes	F:\Presentations\GISseminar\Yes	3
F:\Presentations\GISseminar\Yes	F:\Presentations\GISseminar\Yes	
F:\Presentations\GISseminar\Yes	F:\Fuzzy\slope_fuzzy[R...	

Remove file...

Help Save as... Close << Back Next >>

4. Decision Wizard: A closer look

Standardization procedures:

Multi-Criteria/Multi-Objective Decision Wizard

Objective 1: Suitable sites to housing projects

Specify factor standardization:

Factor number: 1

Input factor name: dist_center

Minimum data value: 0.0000

Maximum data value: 8852.0000

Factors to standardize with FUZZY

- dist_center
- dist_road
- slope_deg

Membership Function Shape:

☒ Monotonically decreasing

☐ Symmetric

Membership Function Type:

☐ Sigmoidal

☐ J-shaped

☒ Linear

Control points:

c: 200.0000 d: 8852.0000

Help Save as ... Close << Back Next >>

Multi-Criteria/Multi-Objective Decision Wizard

Objective 1: Suitable sites to housing projects

Specify factor standardization:

Factor number: 2

Input factor name: dist_road

Minimum data value: 0.0000

Maximum data value: 2415.0000

Factors to standardize with FUZZY

- dist_center
- dist_road
- slope_deg

Membership Function Shape:

☒ Monotonically decreasing

☐ Symmetric

Membership Function Type:

☐ Sigmoidal

☐ J-shaped

☒ Linear

Control points:

c: 200.0000 d: 2415.0000

Help Save as ... Close << Back Next >>

Multi-Criteria/Multi-Objective Decision Wizard

Objective 1: Suitable sites to housing projects

Specify factor standardization:

Factor number: 3

Input factor name: slope_deg

Minimum data value: 0.0000

Maximum data value: 48.0000

Factors to standardize with FUZZY

- dist_center
- dist_road
- slope_deg

Membership Function Shape:

☒ Monotonically decreasing

☐ Symmetric

Membership Function Type:

☐ Sigmoidal

☐ J-shaped

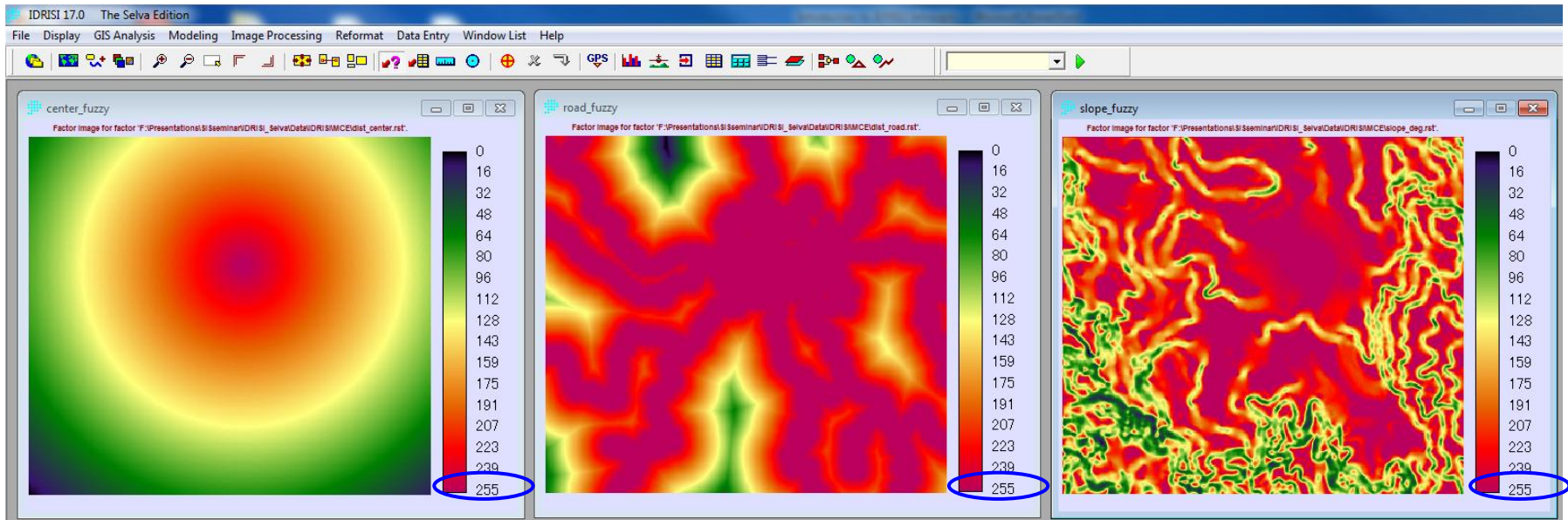
☒ Linear

Control points:

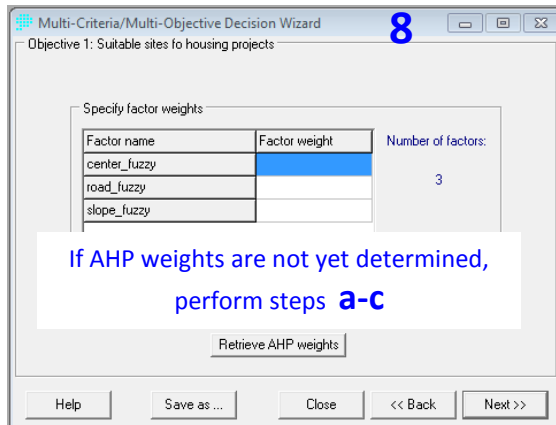
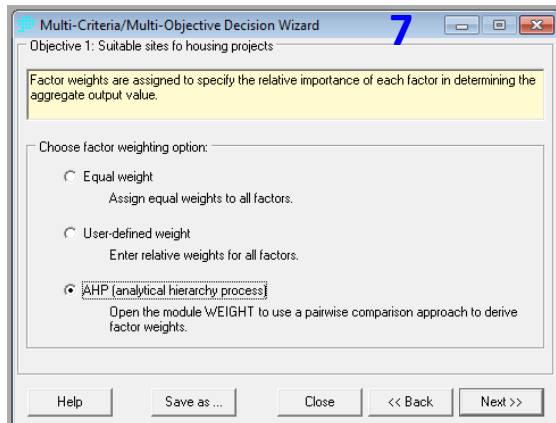
c: 2 d: 48

Help Save as ... Close << Back Next >>

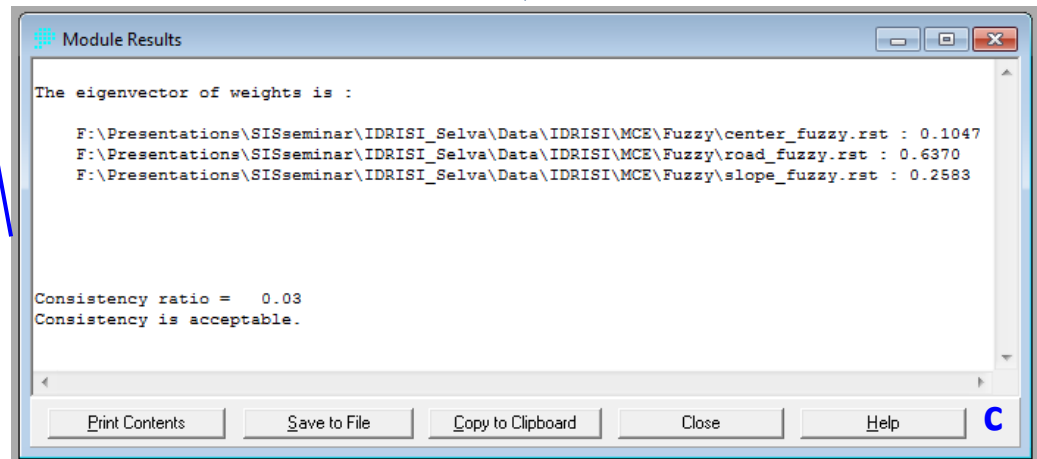
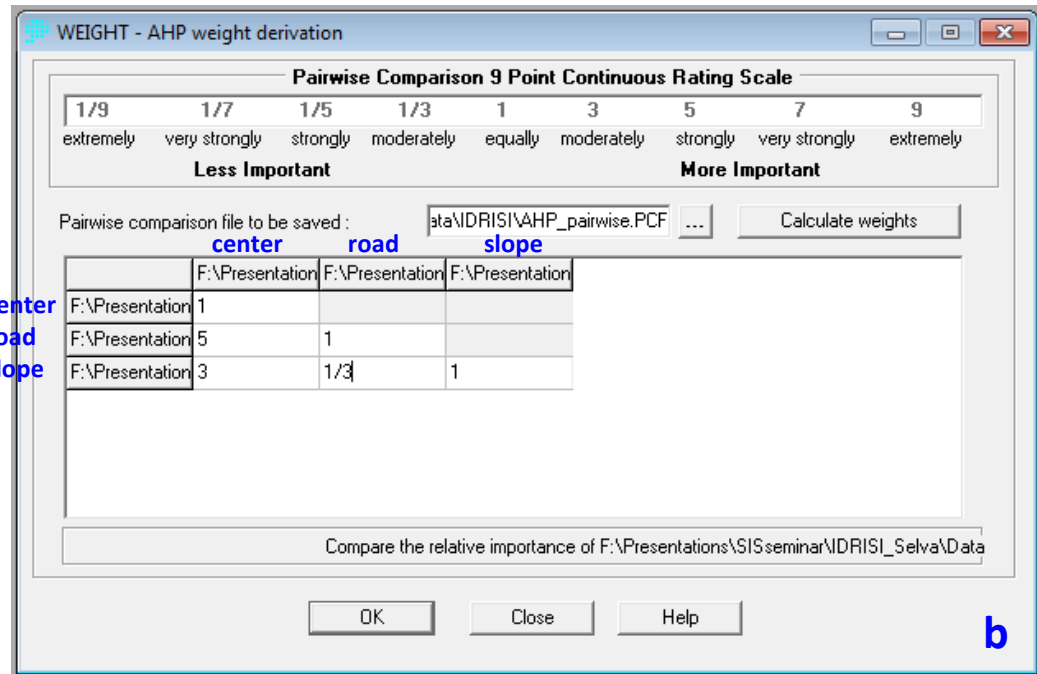
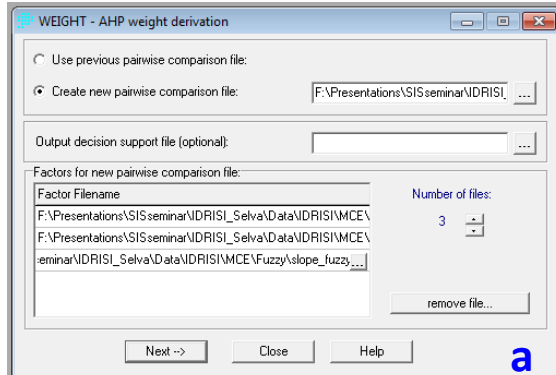
Standardized factors



4. Decision Wizard: A closer look



If AHP weights are not yet determined,
perform steps a-c



4. Decision Wizard: A closer look

Multi-Criteria/Multi-Objective Decision Wizard **8_cont'd**

Objective 1: Suitable sites for housing projects

Specify factor weights

Factor name	Factor weight
center_fuzzy	0.1047
road_fuzzy	0.6370
slope_fuzzy	0.2583

Number of factors: 3

Retrieve AHP weights

Help Save as ... Close << Back Next >>

Multi-Criteria/Multi-Objective Decision Wizard **10**

Summary of decision rule for objective 1: suitable sites for housing projects

☐ Constraints

☒ Factors and weights

☐ OWA weights

0.1047 - center_fuzzy
0.6370 - road_fuzzy
0.2583 - slope_fuzzy

All the parameters you have entered for this objective will be used to aggregate the criteria into a single composite image.

Output image: Suitable sites to housing project ...

Title: MCE results for land suitability analysis for housing projects


Help Save as ... Close << Back Next >>

Multi-Criteria/Multi-Objective Decision Wizard **9**

Objective 1: Suitable sites for housing projects

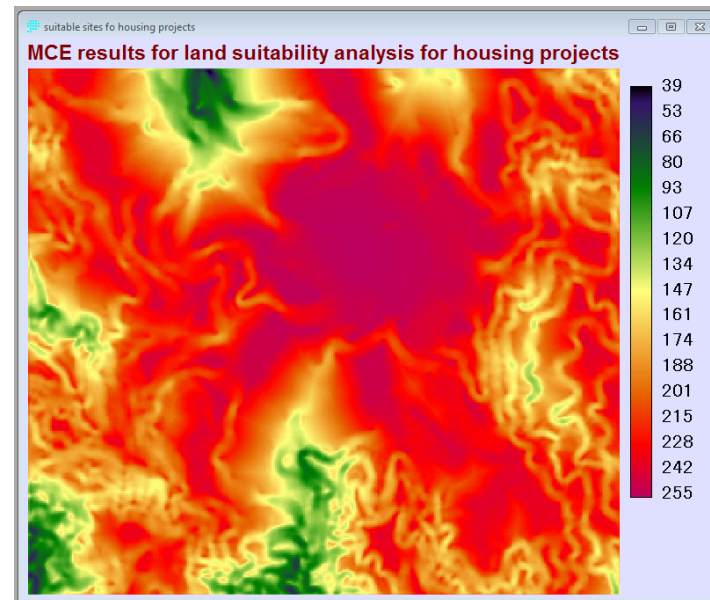
Ordered weighted averaging (OWA):

Ordered weighted averaging may also be incorporated into the criteria aggregation process. Order weights are not applied to factor images as a whole. Rather, they are applied pixel by pixel to the order of suitability scores. The effect of order weights is most easily understood in terms of levels of risk and tradeoff. The possibilities describe the triangular decision space depicted here. Choosing No OWA yields the same result as the OWA option at the top of the triangle.



☒ No OWA ☐ OWA

Help Save as ... Close << Back Next >>



Output

Weighted Linear Combination

MCE procedure/aggregation method

- **Weighted Linear Combination (WLC)**

$$LSI = \sum w_i x_i$$

where:

LSI – land suitability index

w_i – weight of factor i

x_i – standardized value of factor i

4. Decision Wizard: A closer look

Multi-Criteria/Multi-Objective Decision Wizard **11 (optional)**

Objective 1: Suitable sites for housing projects

The aggregate multi-criteria result has been created.

If desired, you may now create a boolean image of the highest values that make up a user-defined area.

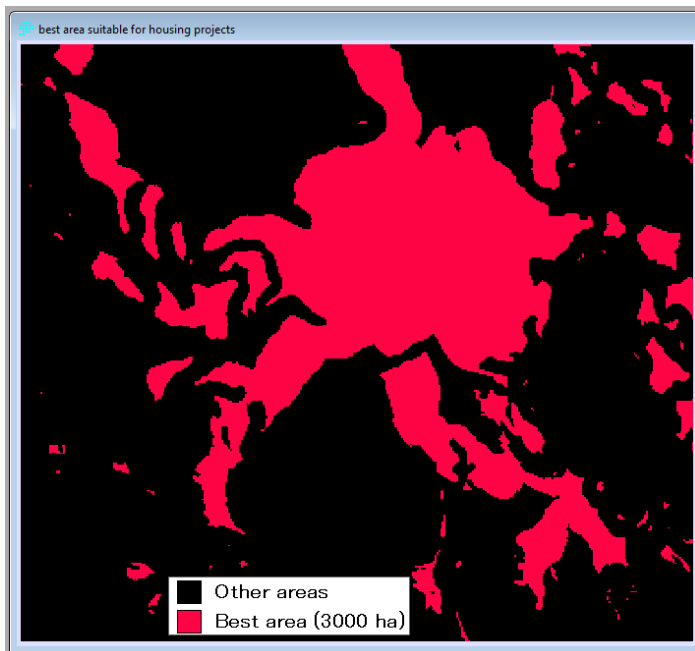
☒ Select best area for this objective.

Study area information:
Total cells: 127723 Resolution: 30.00 m Total Area: 11495.07 Hectares

Objective name	Units	Areal requirements
Suitable sites for housing p	Hectares	3000

Output image: Best area suitable for housing ... Title:

Help Save as ... Close << Back Finish



OR

Outside
the
wizard



Database Query

File Display GIS Analysis Modeling Image Processing Reformat Data Entry Wind

Database Query
Mathematical Operators
Distance Operators
Context Operators
Statistics
Decision Support
Change / Time Series
Surface Analysis

RECLASS
OVERLAY
CROSSTAB
Edit
ASSIGN
EXTRACT
BREAKOUT
HISTO
AREA
PERIM
PROFILE
QUERY
PCLASS
Database Workshop
Image Calculator

RECLASS - image classification / reclassification

Type of file to reclass
☒ Image
☐ Vector
☐ Attribute values file

Classification type
☐ User-defined reclass
☒ Equal-interval reclass

Input file: Suitable sites for housing projects ...

Output file: Suitable sites for housing projects_rec.rst ...

Equal-interval reclass

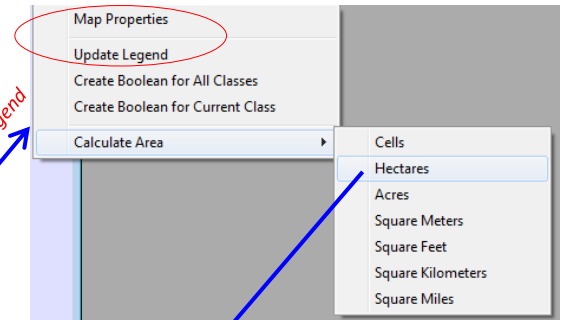
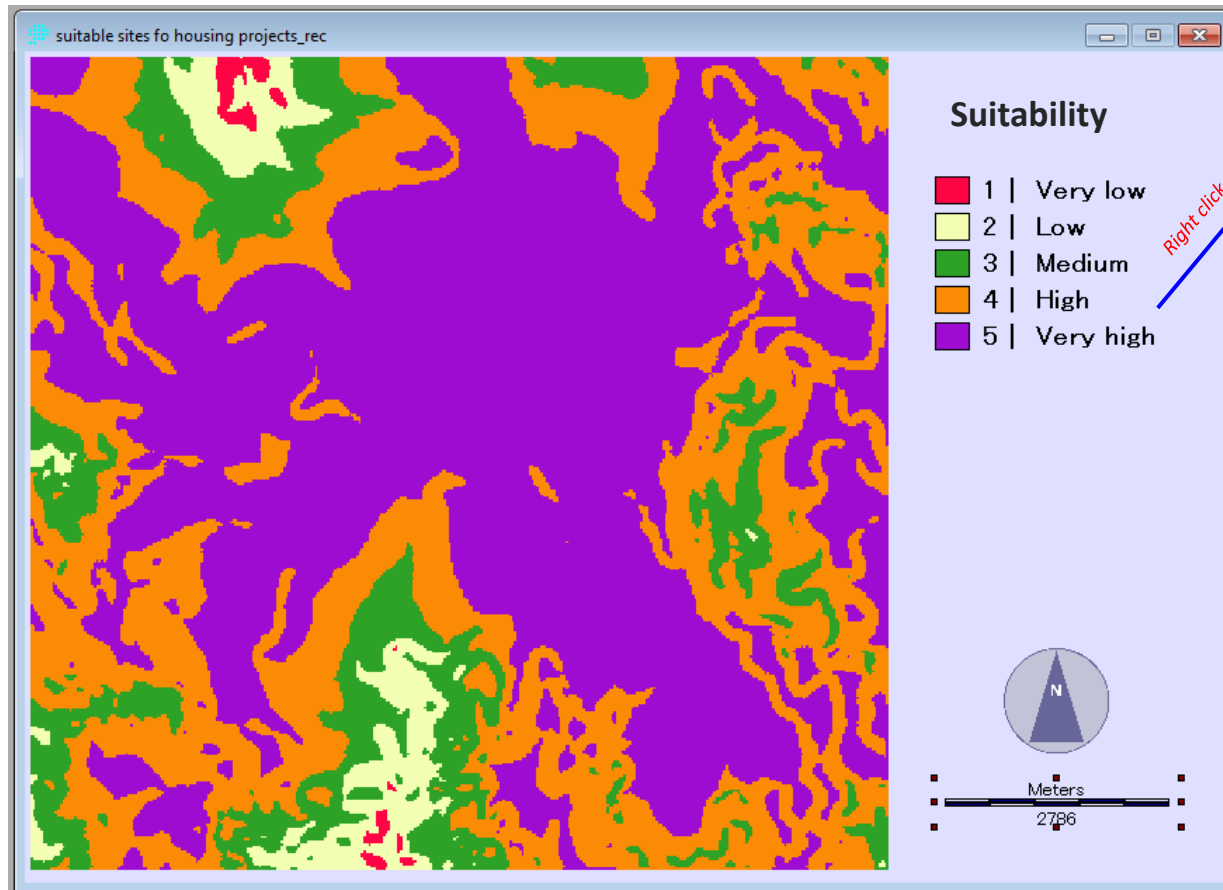
Minimum value to consider: 39

Maximum value to consider: 255

☐ Class width:
☒ Number of classes: 5

OK Close Help

4. Decision Wizard: A closer look



Module Results

Area on file: F:\Presentations\SISs

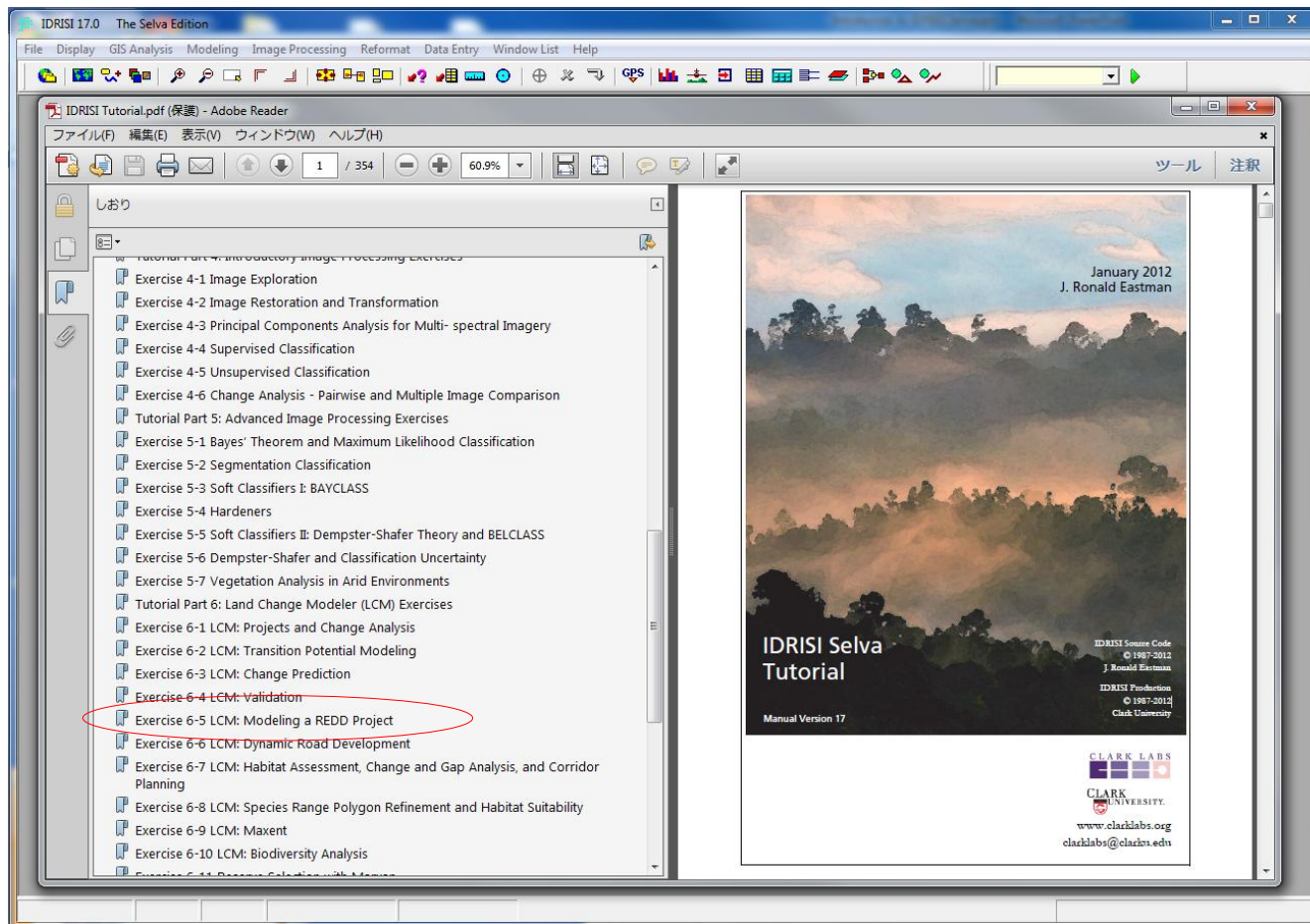
Category	Hectares
1	84.3300000
2	557.3700000
3	1432.4400000
4	3918.2400000
5	5502.6900000

Print Contents

Save to File

5. Remarks

- IDRISI Selva has a lot of modules
 - ample time is needed to explore these modules (prioritize what is needed)
- Nevertheless, the software comes with very useful tutorials.
- If interested, try some of the exercises...



End