



GuidosToolbox Workshop

Part 3: GTB program features

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The workshop will address the following topics:

GWS 1: Introduction/motivation for new ways of image analysis

GWS 2: Pattern Analysis (M)SPA

GWS 3: GuidosToolbox: program features and processing options

GWS 4: Hands-on examples using training data:

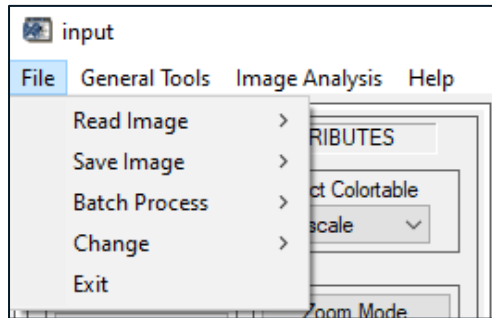
- a) Data preparation, MSPA, Google Earth overlays, batch process
- b) Distance, fragmentation, network, restoration, change, ...



(GTB Manual: https://ies-ows.jrc.ec.europa.eu/gtb/GTB/GuidosToolbox_Manual.pdf)

File:

File management,
Batch-processing,
Change analysis...



General Tools:

Pre-processing,
generic image filters,
GIS software...

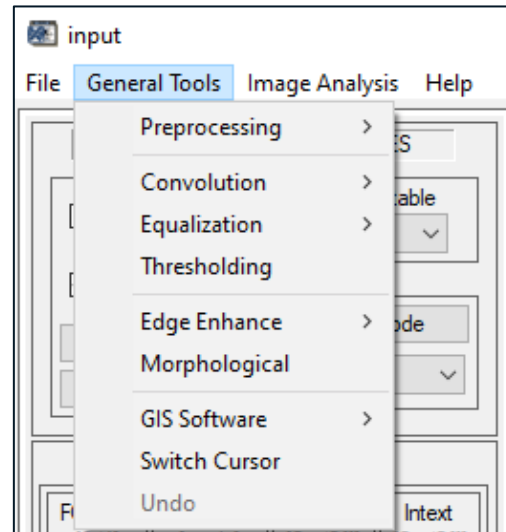
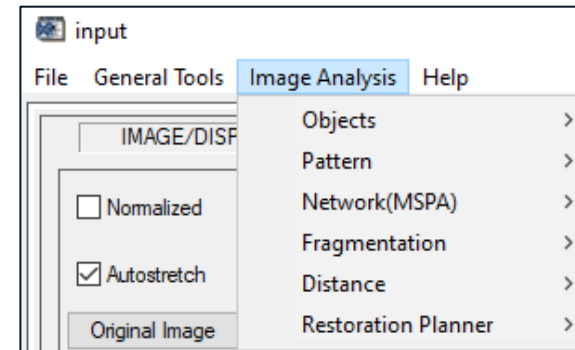


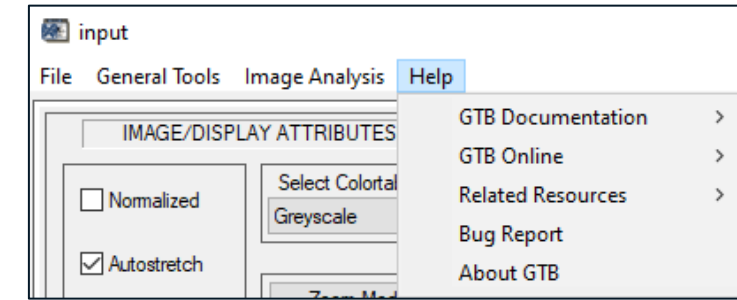
Image Analysis:

Dedicated thematic
image analysis tools...



Help:

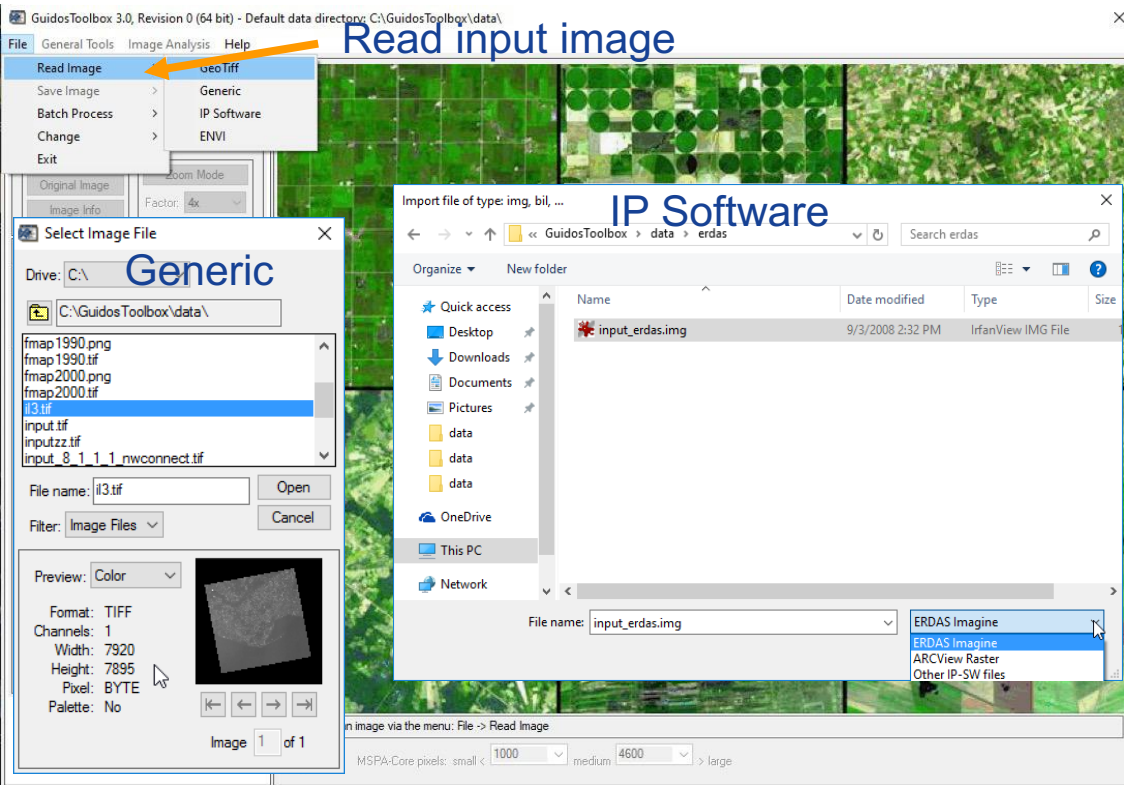
Program documentation, GTB
product sheets, workshop
material, further resources ...



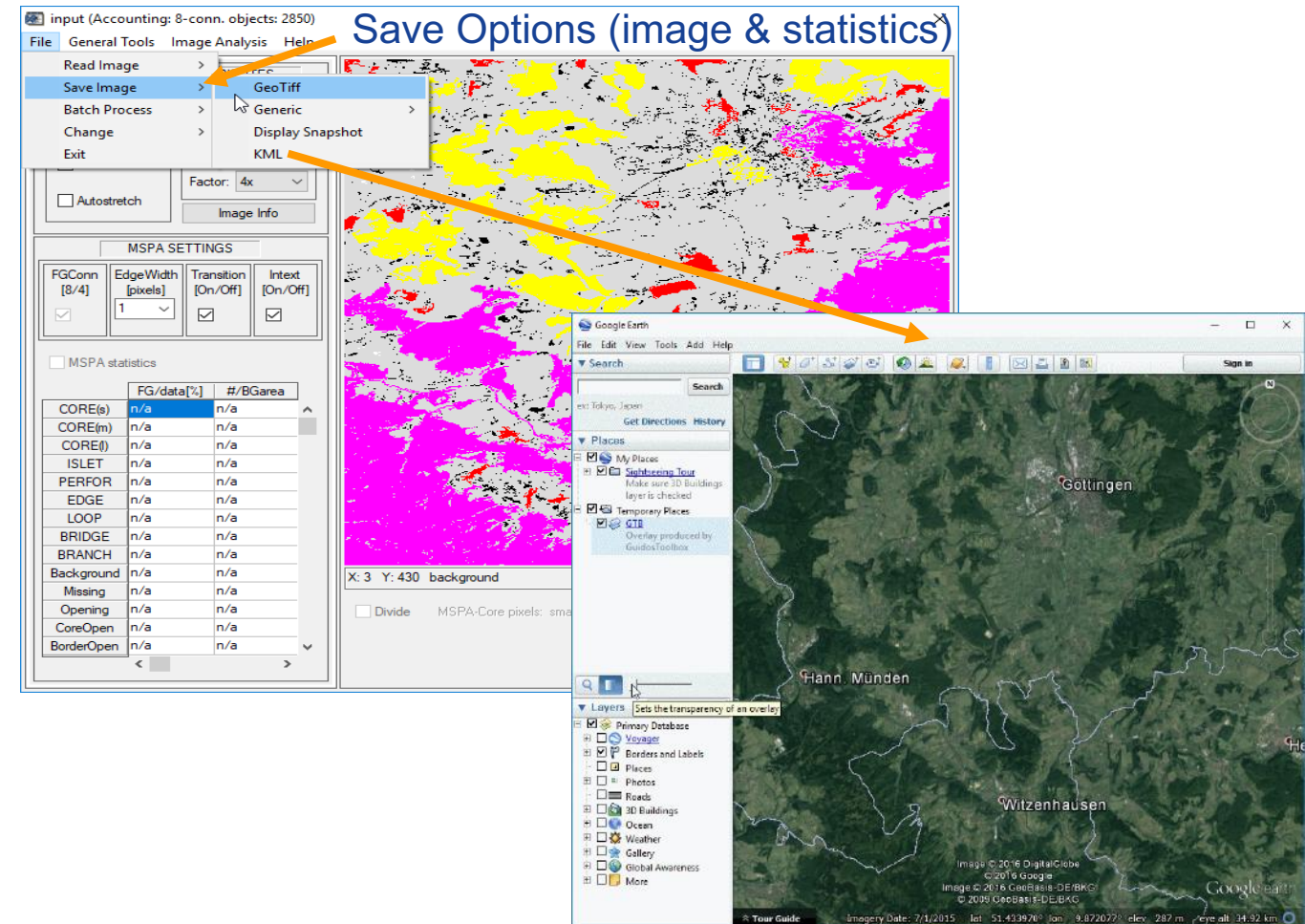
- **Input:** categorical raster maps, binary/grayscale masks, land cover, resistance maps, ...
- **Output:** thematic feature maps and statistics, Google Earth image overlays, ...



Read Image: Various **raster image** input formats, default: GeoTiff

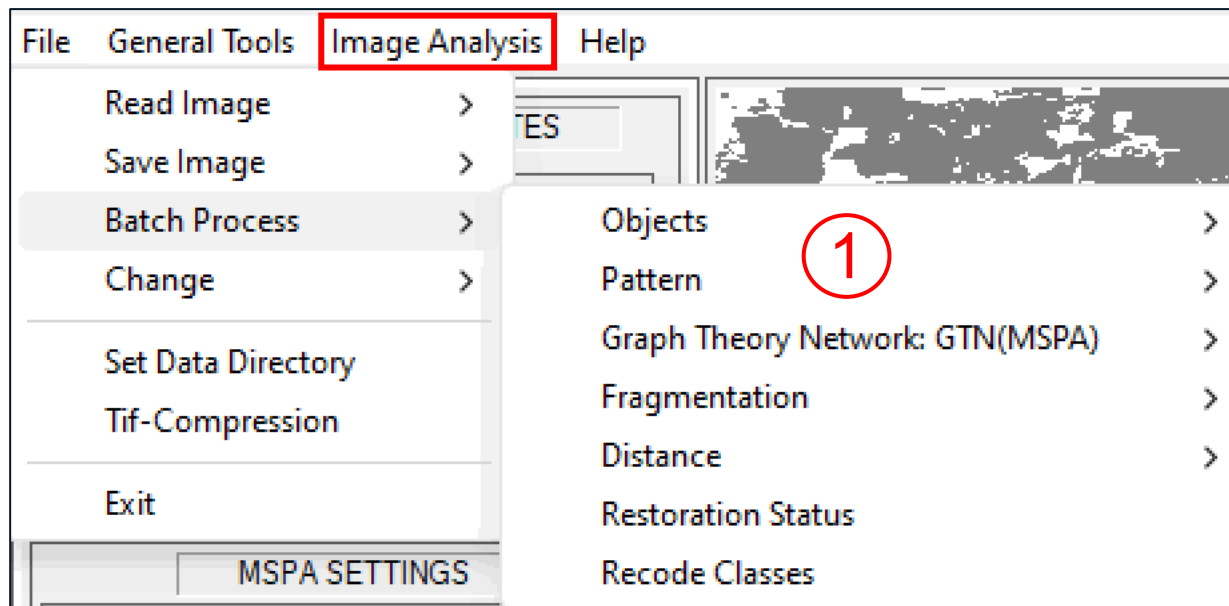


Save Image: Various **raster image** output formats, default: GeoTiff



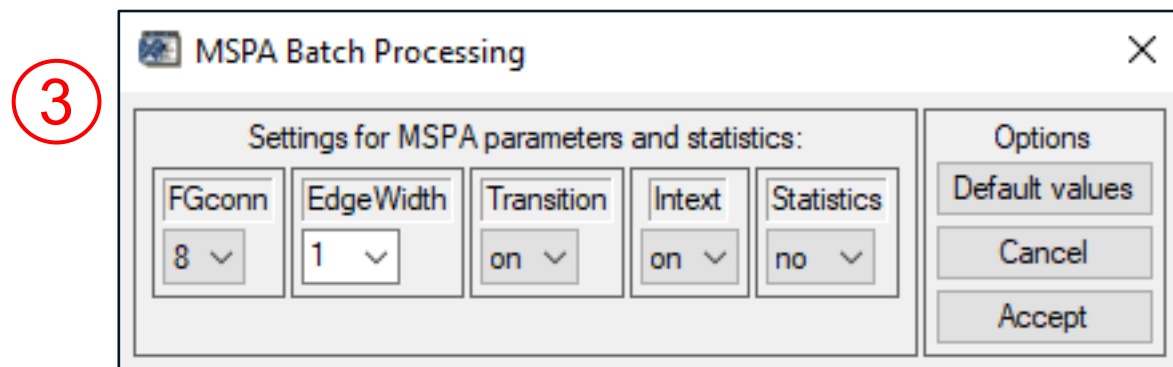


Batch Process: Similar options as in *Image Analysis* menu section



1. Select batch processing type
2. Select folder with your input images:
3. Set processing options
4. Results in parent folder: *batch_type*

| Name | Date modified | Type |
|-------------------|-------------------|-------------|
| InputImages | 7/31/2018 3:12 PM | File folder |
| batch_FAD | 7/30/2018 4:52 PM | File folder |
| batch_LM_27 | 7/30/2018 4:52 PM | File folder |
| batch_ACC | 7/30/2018 4:51 PM | File folder |
| batch_FOS-APP2_7 | 7/30/2018 4:14 PM | File folder |
| batch_Recode | 7/30/2018 1:32 PM | File folder |
| batch_Euclidean | 7/30/2018 1:31 PM | File folder |
| batch_Dominance | 7/30/2018 1:30 PM | File folder |
| batch_FAD-APP5 | 7/30/2018 1:29 PM | File folder |
| batch_FOS-APP2_23 | 7/30/2018 1:28 PM | File folder |
| batch_FOS-APP5_27 | 7/30/2018 1:27 PM | File folder |
| batch_FOS_7 | 7/30/2018 1:26 PM | File folder |



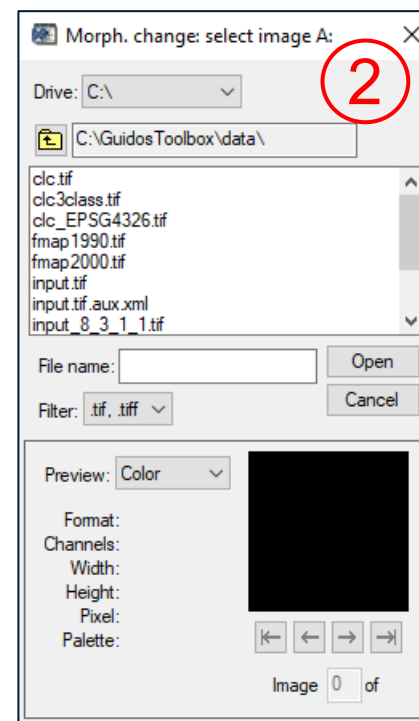
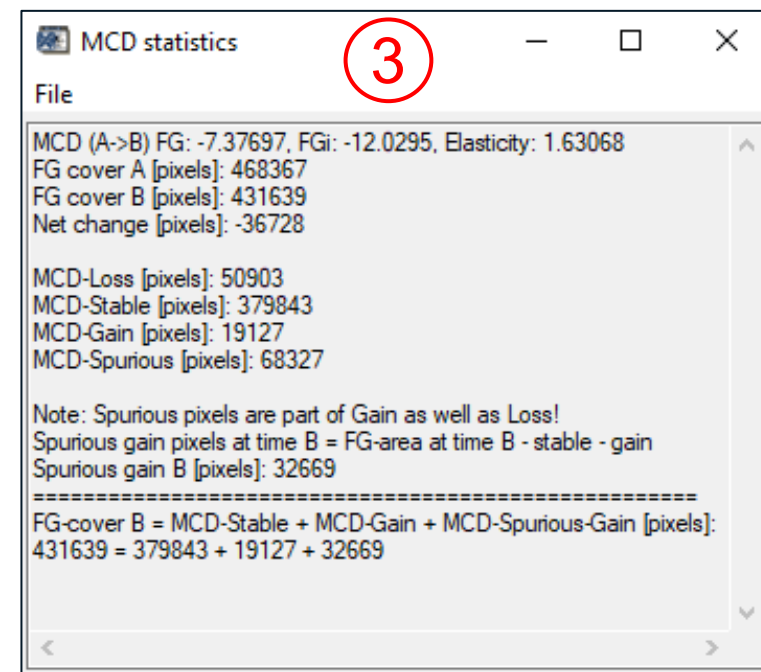


Change: Similar options as in *Image Analysis* menu section

3

1

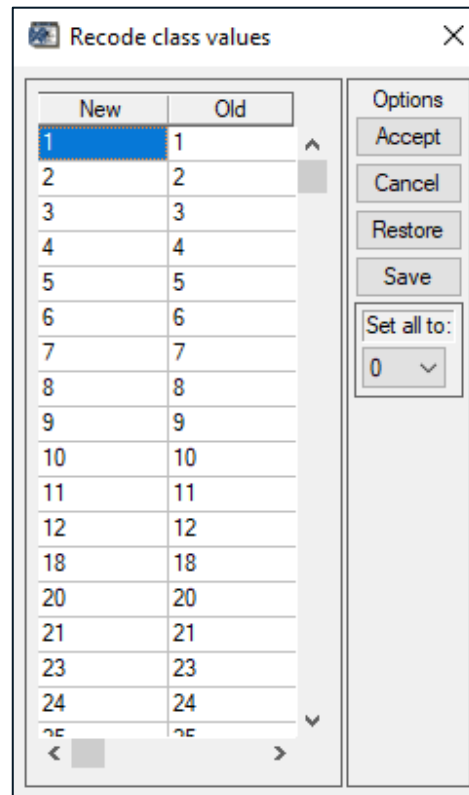
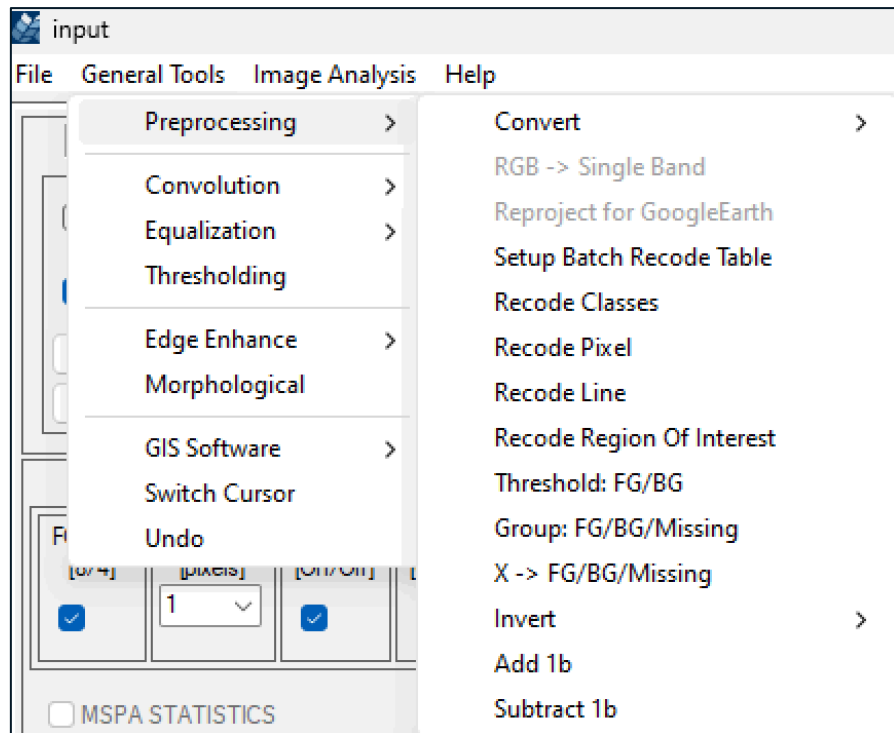
1. Select change type
2. Select two matching input images
3. Results in GTB





Setup/modify your image.

Use any of these options, or combine them with other General Tools, for a custom setup of your image.



- Convert data type
- Tri-band to single layer
- Reproject for Google Earth
- Setup batch recoding
- Recode image classes or regions
- Threshold to binary image
- Assign FG/BG/Missing
- Invert class assignment
- Shift class value up or down

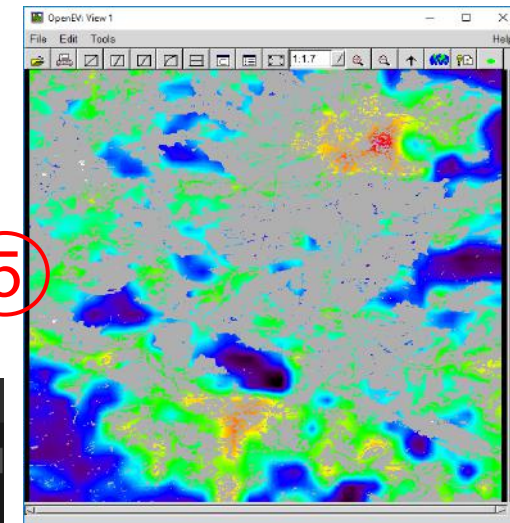


Setup/modify your image.

Choose from a variety of image filters:

- Convolution filters
- Custom, user-defined filter ^①
- Equalization, Interactive Tresholding ^②
- Edge detection and enhancement
- Morphological Toolbox ^③
- GIS Software:
 - GTB-Terminal ^④
 - OpenEV Viewer ^⑤

The screenshot shows the 'clc' software interface. The 'General Tools' menu is open, displaying options like Preprocessing, Convolution, Equalization, Thresholding, Edge Enhance, Morphological, GIS Software, Switch Cursor, and Undo. The 'Convolution' submenu is also open, showing options like Median, Boxcar, Lee, Sigma, Hilbert, and User-Defined. A 'Define kernel' dialog box is visible, showing a grid of values and options for kernel size, type, and parameters. A histogram window is also open, showing a distribution of pixel values. A 'Drag colorbars...' dialog box is also present.





Accounting: Group objects in up to 6 user-defined area classes

2) Resulting map and statistics

1) Define area size-classes

Accounting dialog box showing base settings and area thresholds for up to 6 area classes.

Base Settings: Foreground Connectivity: 8, Pixel Resolution [m]: 100.00, Show Bg3 in pink: color 0

Accounting Settings: Reset, Save, Restore, Cancel, Accept

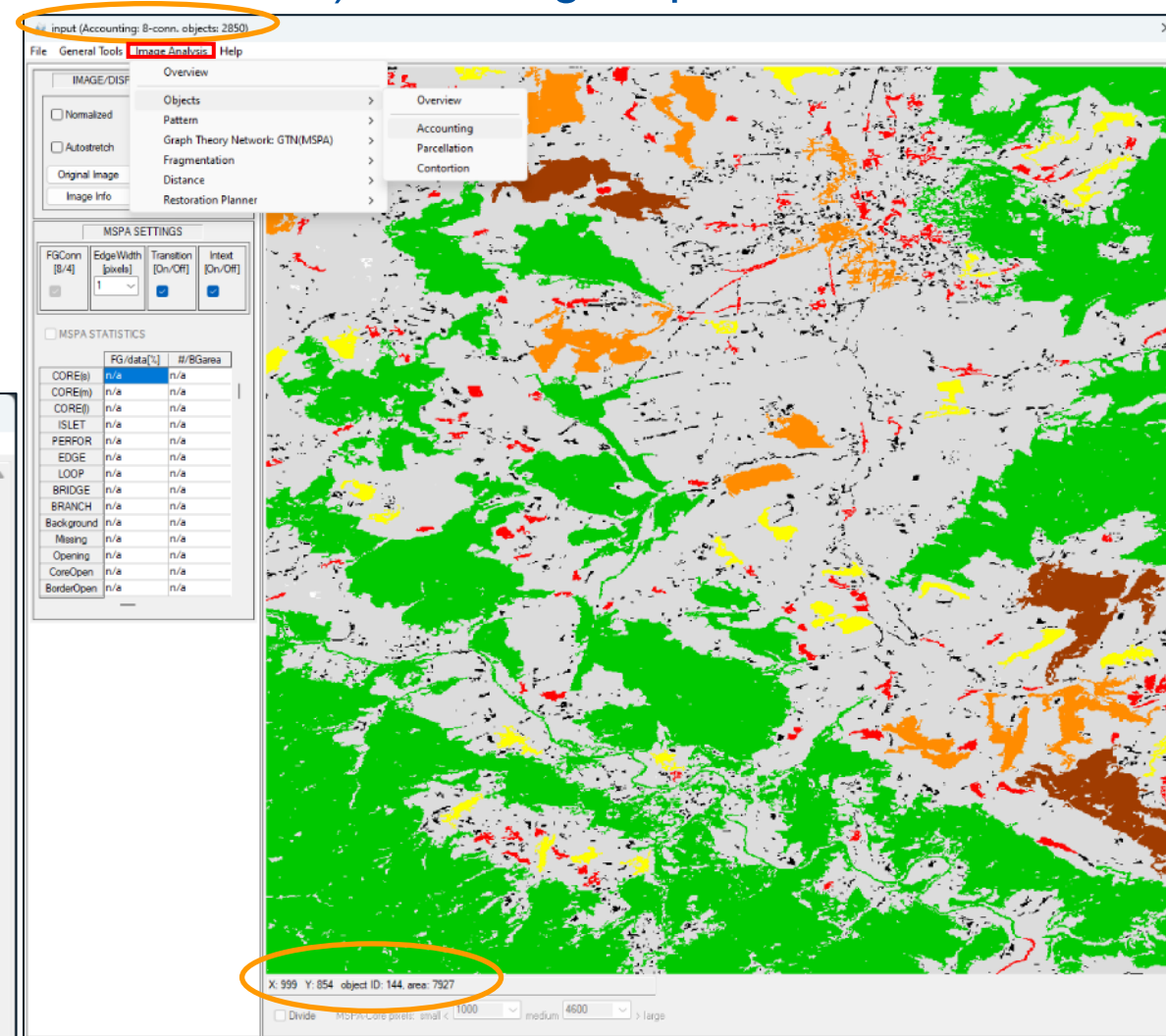
| Classes: | Class 1: | Class 2: | Class 3: | Class 4: | Class 5: | Class 6: |
|-----------|----------------|------------|-------------|-------------|--------------|--------------|
| Pixels: | 1 -> 50 pixels | 250 pixels | 1000 pixels | 5000 pixels | 10000 pixels | 10000 pixels |
| Hectares: | 50.0000 ha | 250.000 ha | 1000.00 ha | 5000.00 ha | 10000.0 ha | 10000.0 ha |
| Acres: | 123.552 ac | 617.763 ac | 2471.05 ac | 12355.2 ac | 24710.5 ac | 24710.5 ac |

gdalinfo: Pixel Size = (0.000304569054901,-0.000304569054901)

acc.txt

Accounting size classes result using:
input
Base settings: 8-connectivity, pixel resolution: 100.00 [m]
Conversion factor: pixel_to_hectare: 1.00000, pixel_to_acres: 2.47105

| Size class | # Objects | Area[pixels] | % of all objects | % of total FGarea |
|---|-----------|--------------|------------------|-------------------|
| Size class 1: [1 - 50] pixels; color: black | 2668 | 19953 | 93.6140 | 4.6565848 |
| Size class 2: [51 - 250] pixels; color: red | 129 | 13094 | 4.52632 | 3.0558473 |
| Size class 3: [251 - 1000] pixels; color: yellow | 30 | 13867 | 1.05263 | 3.2362482 |
| Size class 4: [1001 - 5000] pixels; color: orange | 13 | 30322 | 0.456140 | 7.0764779 |
| Size class 5: [5001 - 10000] pixels; color: brown | 3 | 21796 | 0.105263 | 5.0866998 |
| Size class 6: [10001 ->] pixels; color: green | 7 | 329458 | 0.245614 | 76.888142 |
| Sum of all classes: | 2850 | 428490 | 100.000 | 100.00000 |
| Median Patch Size: | 5 | | | |
| Average Patch Size: | 150.347 | | | |
| Standard Deviation: | 4143.11 | | | |
| Largest object: | 214811 | | | |



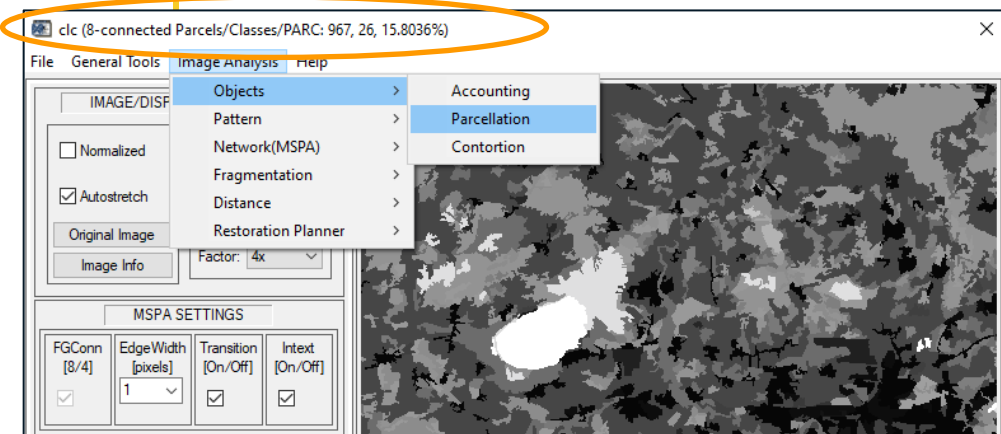
Accounting product sheet



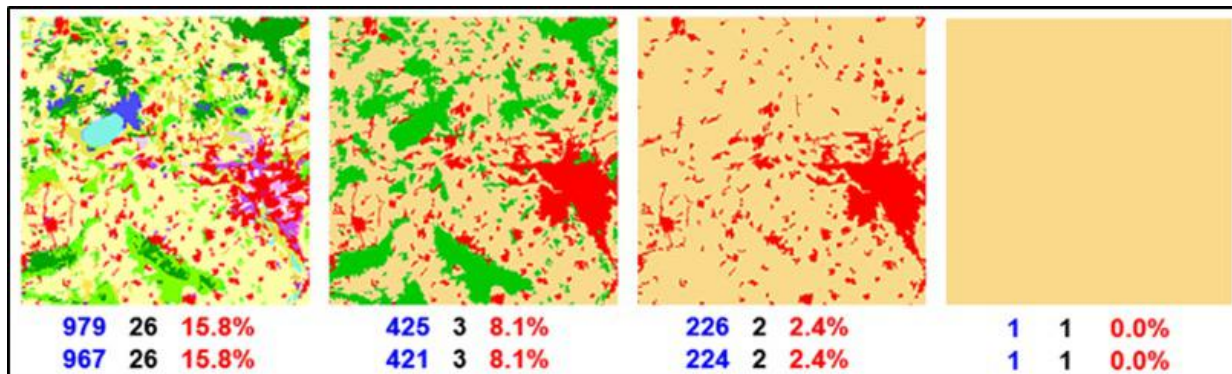
European Commission



Parcellation: Splitting index for each land cover class and the entire image



Parcels / # Classes / Parcellation



Features:

- Summary for all objects & for all classes
- Normalized index
- Detect and measure the dominant parcellation class

Low:

Homogeneous land cover, low fragmentation, few/large land cover classes

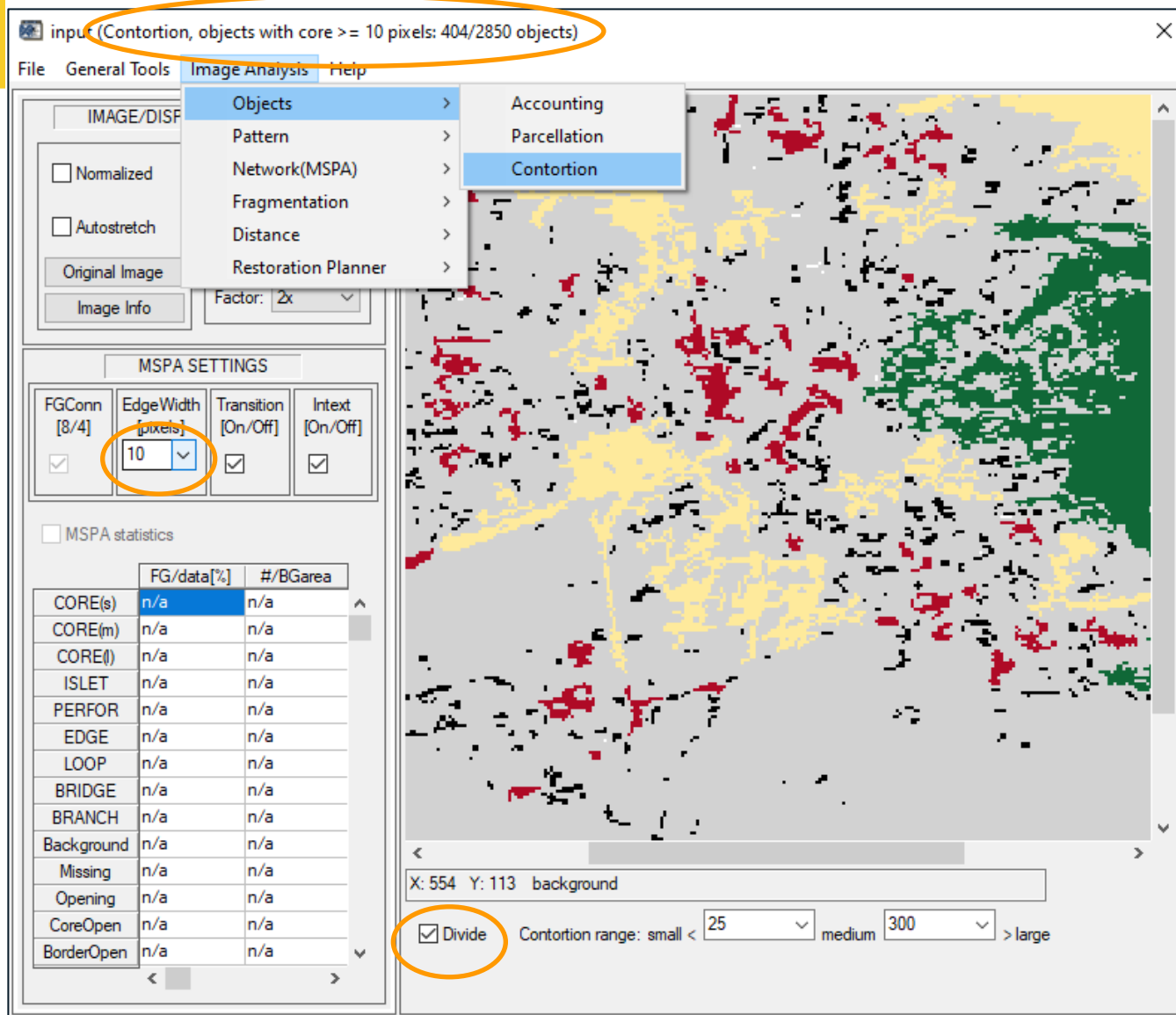
High:

Heterogeneous land cover, Highly fragmented

| Class | Value | Count | Area[pixels] | APS | AWAPS | AWAPS/data | DIVISION | PARC[%] |
|------------------|-------|-------|--------------|------------|-------------|-------------|----------|---------|
| 1 | 1 | 2 | 2792 | 1396.0000 | 1998.3600 | 1.3948 | 0.2843 | 2.4207 |
| 2 | 2 | 201 | 432930 | 2153.8800 | 24287.2000 | 2628.6600 | 0.9439 | 20.8507 |
| 3 | 3 | 35 | 56446 | 1612.7400 | 3655.9400 | 51.5909 | 0.9352 | 19.8106 |
| 4 | 4 | 5 | 6131 | 1226.2000 | 1335.9000 | 2.0476 | 0.7821 | 11.0293 |
| 5 | 5 | 1 | 418 | 418.0000 | 418.0000 | 0.0437 | 0.0000 | 0.0000 |
| 6 | 6 | 2 | 14708 | 7354.0000 | 7779.0500 | 28.6036 | 0.4711 | 4.6105 |
| 7 | 7 | 14 | 10134 | 723.8570 | 783.5970 | 1.9852 | 0.9227 | 18.5281 |
| 8 | 8 | 3 | 1779 | 593.0000 | 701.8210 | 0.3121 | 0.6055 | 6.7325 |
| 9 | 9 | 6 | 6687 | 1114.5000 | 1979.0300 | 3.3084 | 0.7040 | 8.8130 |
| 10 | 10 | 15 | 25139 | 1675.9300 | 4503.9000 | 28.3059 | 0.8208 | 12.4460 |
| 11 | 11 | 28 | 36026 | 1286.6400 | 1773.8400 | 15.9761 | 0.9508 | 21.7950 |
| 12 | 12 | 61 | 2013006 | 33000.1000 | 875187.0000 | 440439.0000 | 0.5652 | 6.0291 |
| 13 | 18 | 139 | 278701 | 2005.0400 | 7531.4400 | 524.7550 | 0.9730 | 26.1377 |
| 14 | 20 | 48 | 80188 | 1670.5800 | 2995.8400 | 60.0575 | 0.9626 | 23.7932 |
| 15 | 21 | 53 | 77036 | 1453.5100 | 2042.6800 | 39.3399 | 0.9735 | 26.2749 |
| 16 | 23 | 108 | 308382 | 2855.3900 | 38797.6000 | 2991.1200 | 0.8742 | 15.0047 |
| 17 | 24 | 111 | 398163 | 3587.0500 | 29455.4000 | 2932.0100 | 0.9260 | 18.8483 |
| 18 | 25 | 93 | 118067 | 1269.5400 | 2976.5900 | 87.8591 | 0.9748 | 26.6402 |
| 19 | 26 | 4 | 6717 | 1679.2500 | 2505.7000 | 4.2077 | 0.6270 | 7.1374 |
| 20 | 27 | 1 | 675 | 675.0000 | 675.0000 | 0.1139 | 0.0000 | 0.0000 |
| 21 | 29 | 1 | 3828 | 3828.0000 | 3828.0000 | 3.6634 | 0.0000 | 0.0000 |
| 22 | 32 | 1 | 1022 | 1022.0000 | 1022.0000 | 0.2611 | 0.0000 | 0.0000 |
| 23 | 35 | 2 | 1577 | 788.5000 | 941.6470 | 0.3712 | 0.4029 | 3.7324 |
| 24 | 36 | 14 | 57507 | 4107.6400 | 22376.6000 | 321.7020 | 0.6109 | 6.8321 |
| 25 | 40 | 1 | 2092 | 2092.0000 | 2092.0000 | 1.0941 | 0.0000 | 0.0000 |
| 26 | 41 | 18 | 59849 | 3324.9400 | 32760.4000 | 490.1690 | 0.4526 | 4.3618 |
| 8-conn. Parcels: | | 967 | 4000000 | 4136.5049 | | 450657.9072 | 0.8873 | 15.8036 |



Contortion: Measure the regularity of object perimeters



Features:

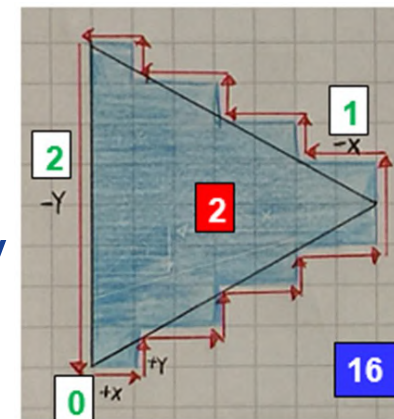
Low count: regularly shaped objects (agricultural fields, buildings, etc.)

Anthropogenic

High count:

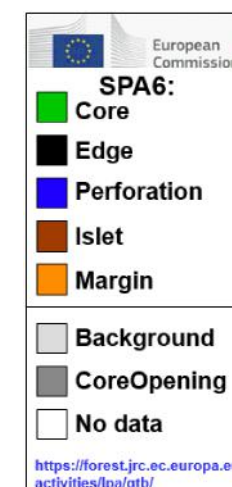
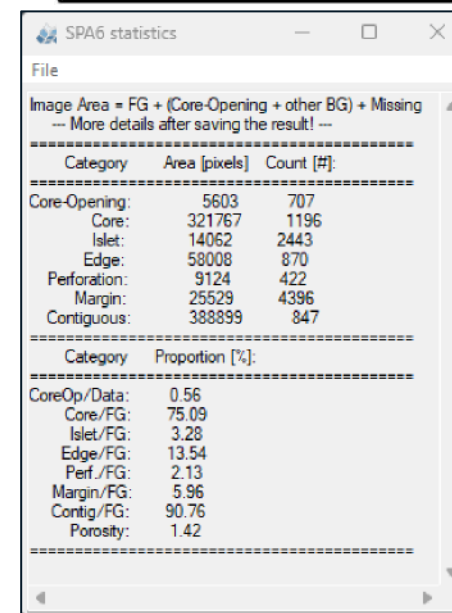
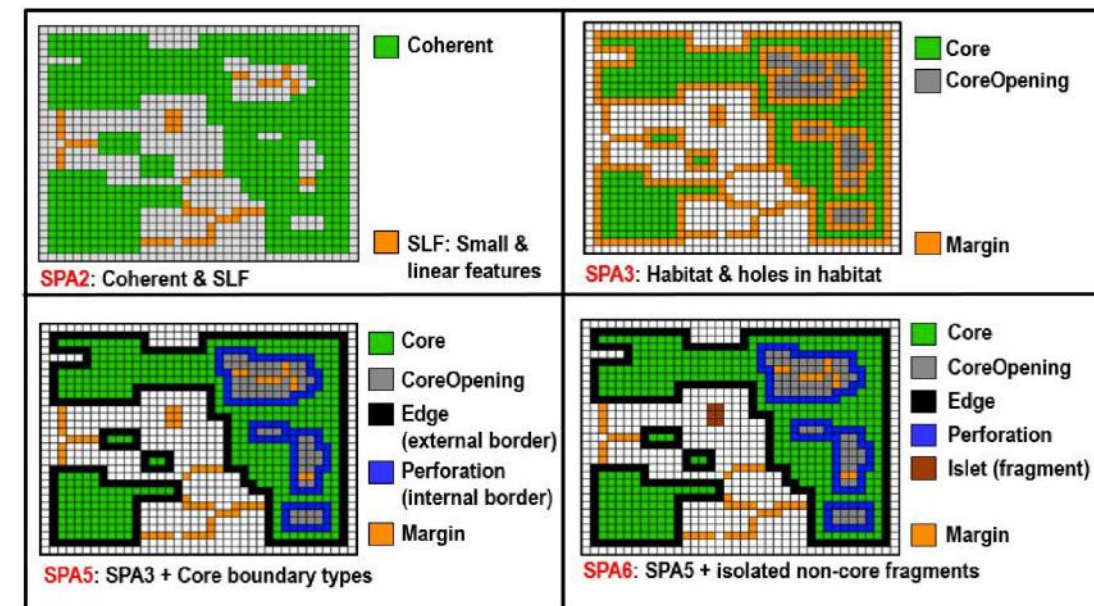
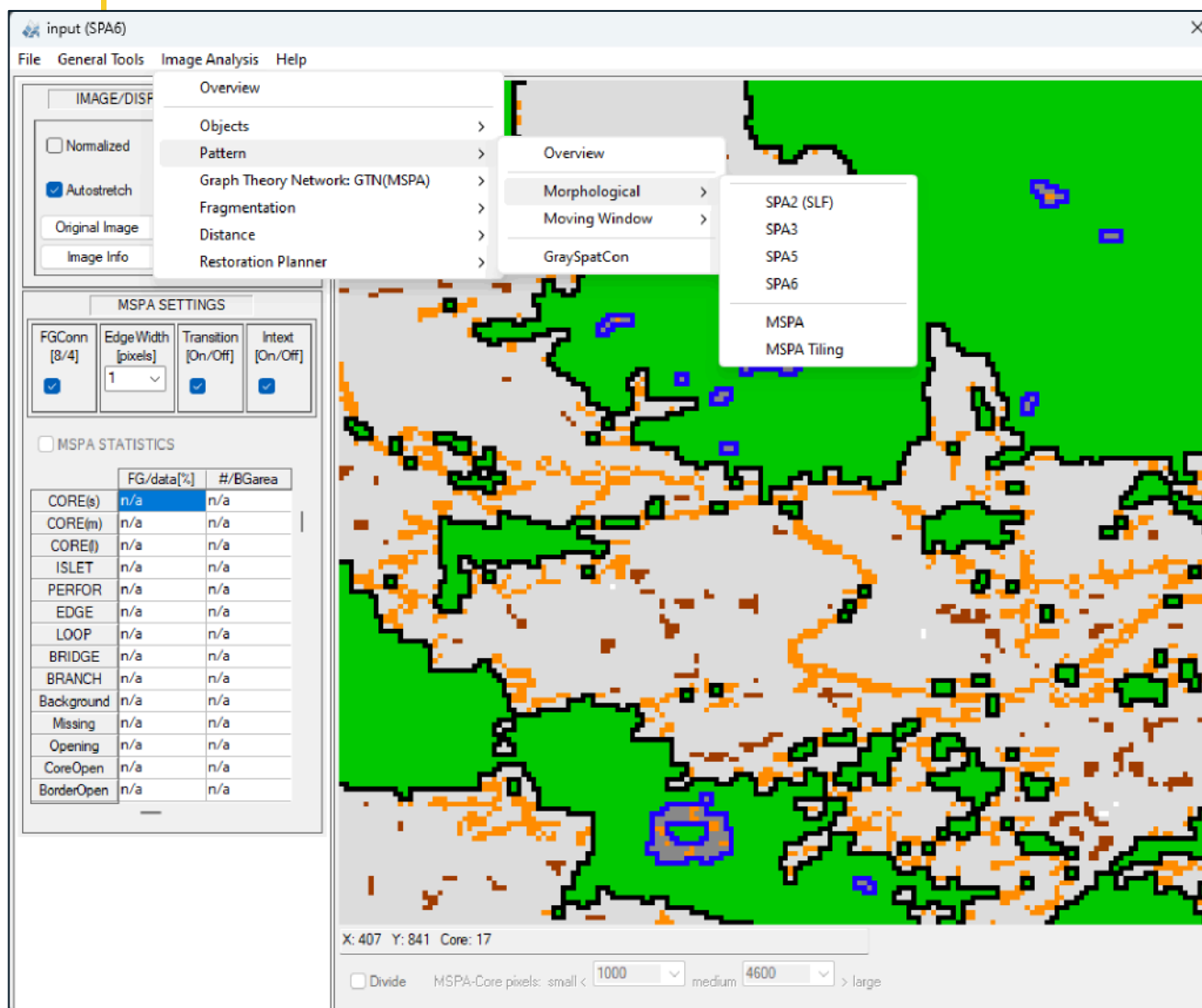
Natural objects

User can define **minimum object size of interest** & set threshold to **group** contortion





SPA2/3/5/6: Simplified Pattern Analysis in 2-6 classes including CoreOpening

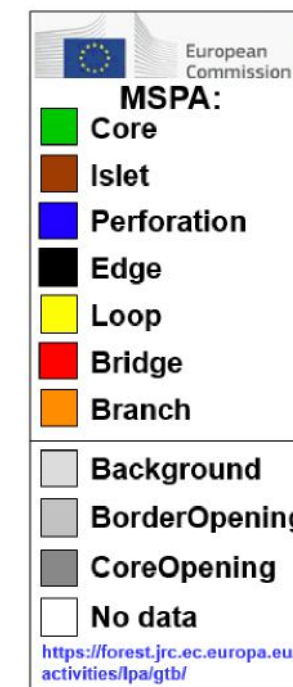




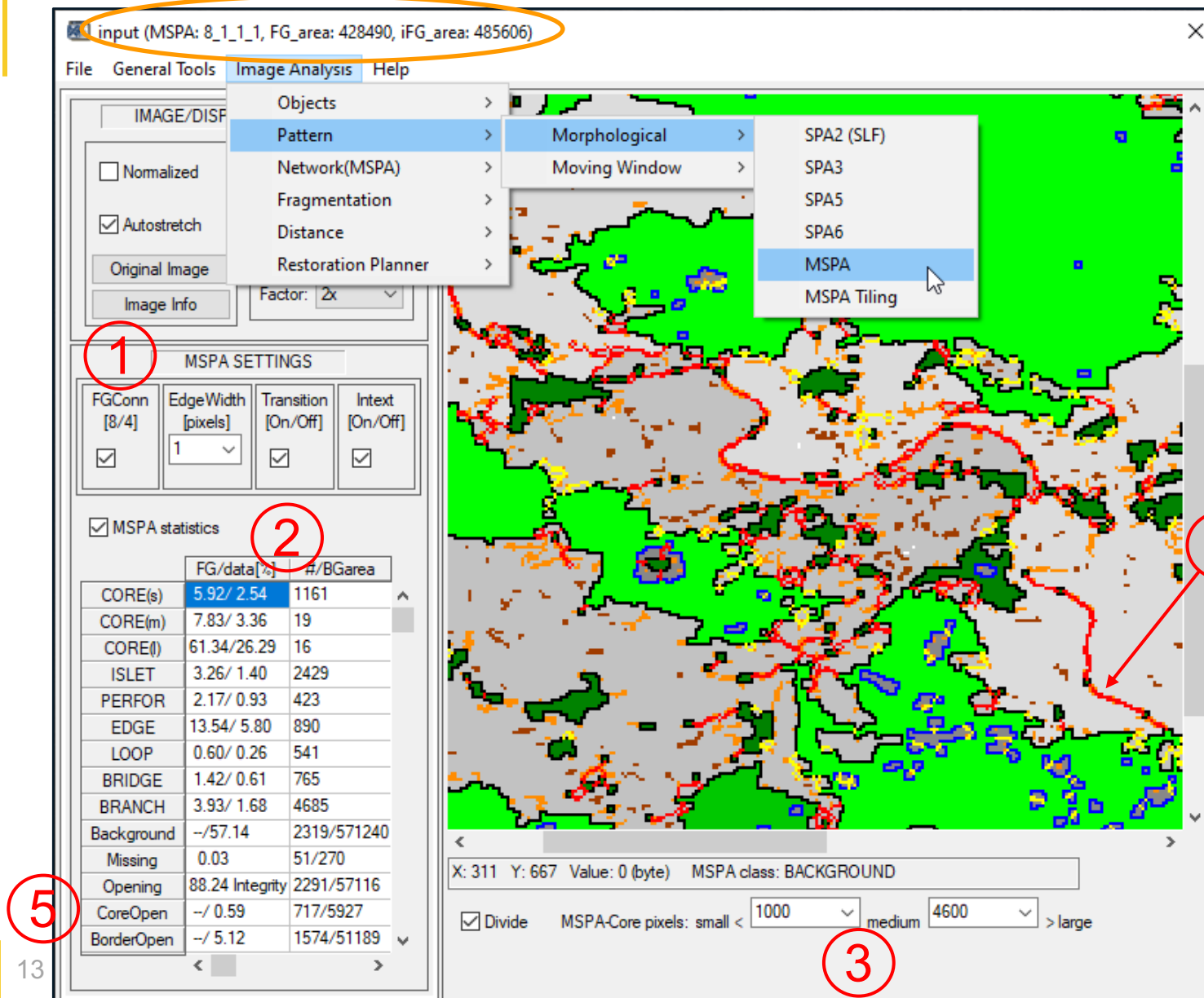
MSPA: Spatial Pattern Analysis in up to 25 classes

Features:

1. Flexible processing via four MSPA-parameters
2. Detailed statistics
3. Core grouping
4. Corridor detection (Bridge)
5. Measure area of holes



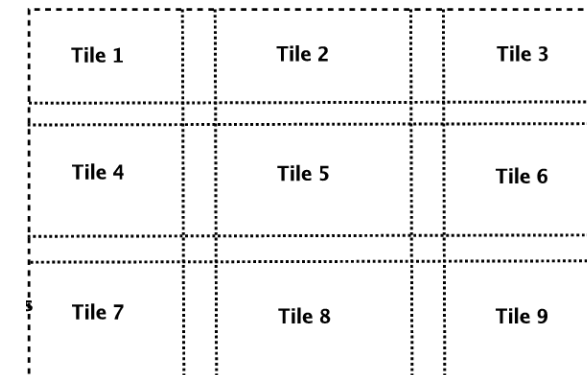
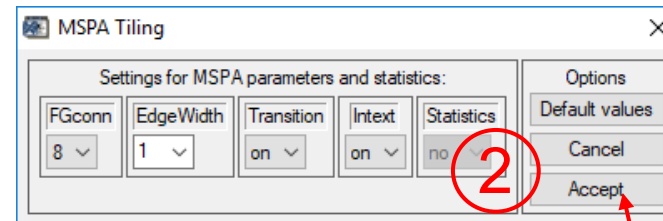
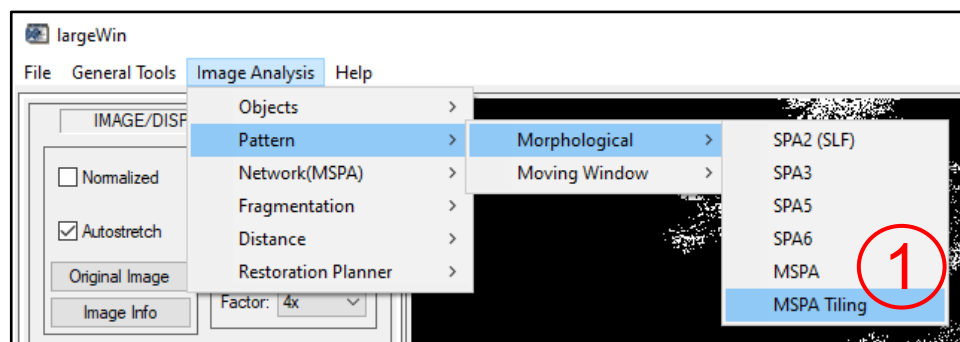
[Pattern product sheet](#)
[Pattern website](#)





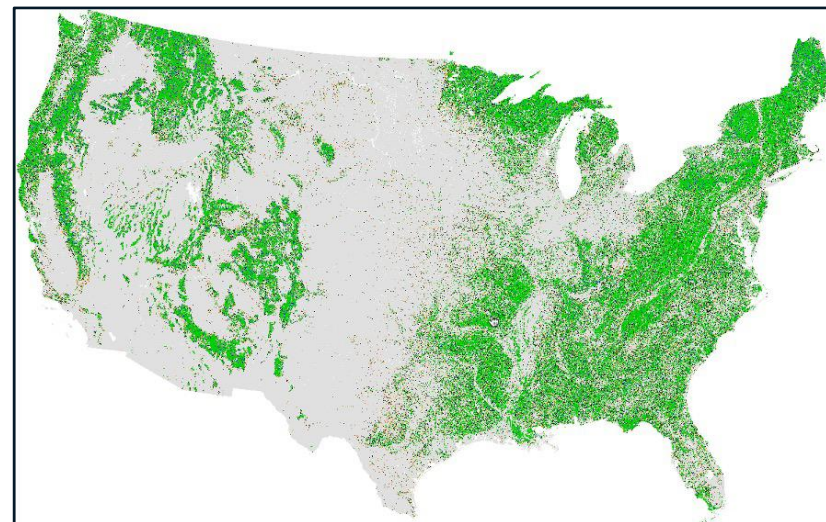
MSPA Tiling: MSPA for **large** maps. **Warning:** very slow & potentially incorrect!

Correct solution: use GWB MSPA when processing large maps!



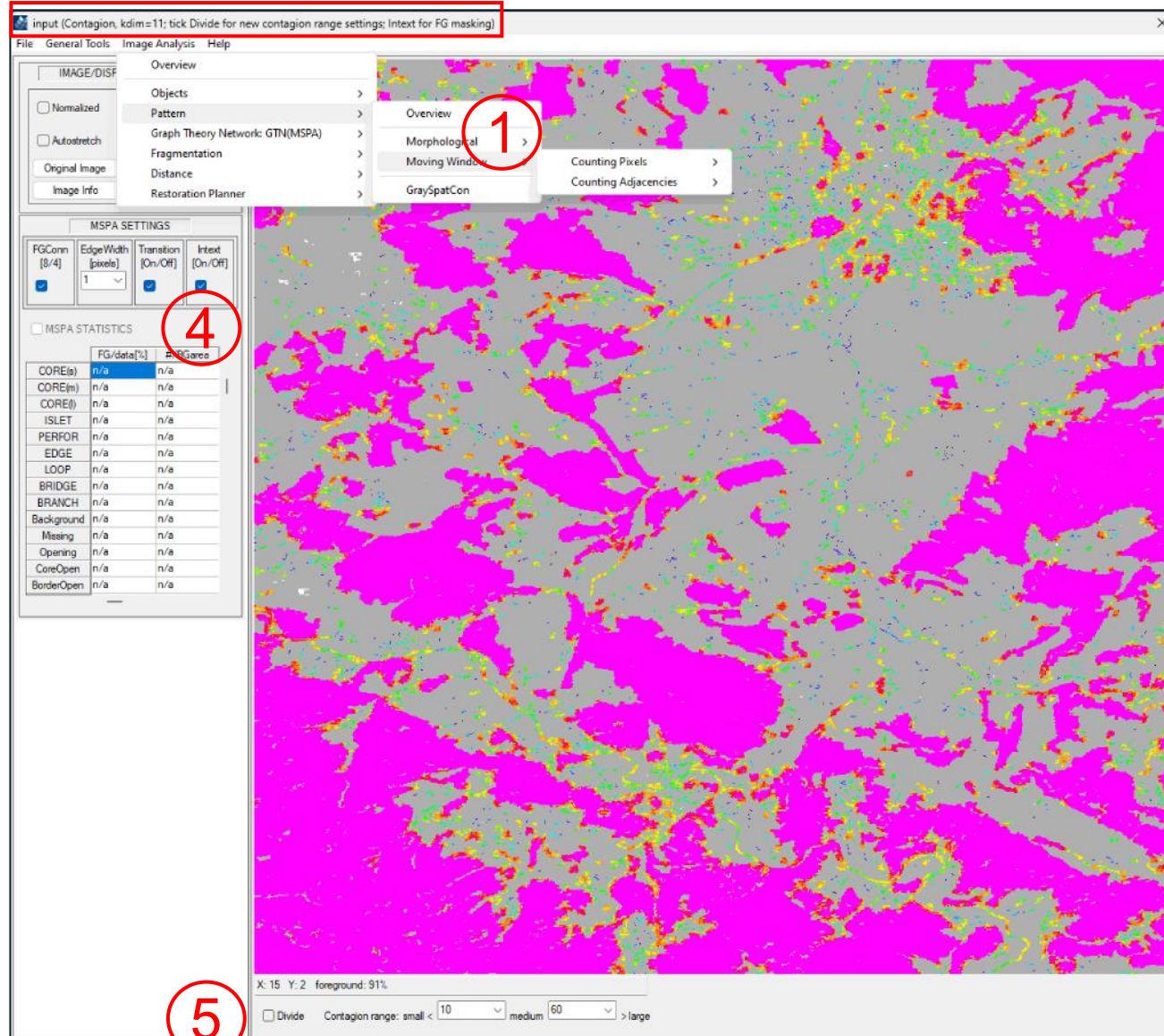
1. Select geotiff input image
2. Set MSPA-parameters
3. Accept: let GTB do the job...

- a) Cut buffered sub-tiles
- b) MSPA loop over buffered sub-tiles
- c) remove buffers and reassemble
- d) save the final result as geotiff



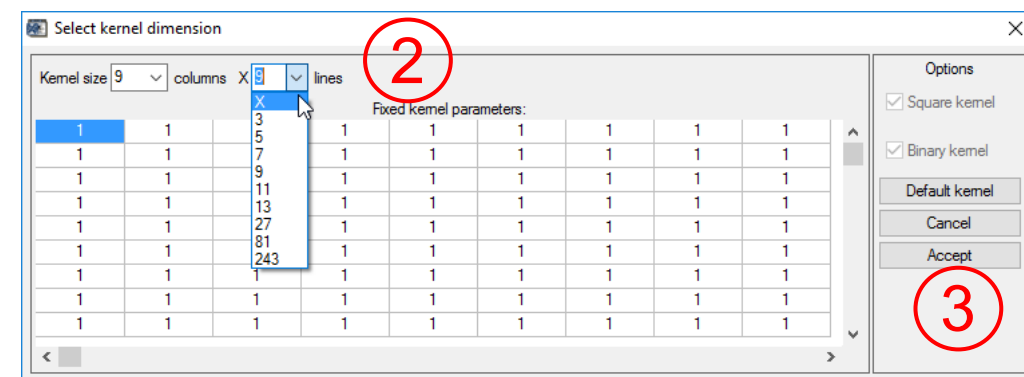


Moving Window: Various kernel filters, e.g., counting adjacencies (contagion)



Features:

1. Select analysis type
2. Set kernel-parameters
3. Accept: start analysis

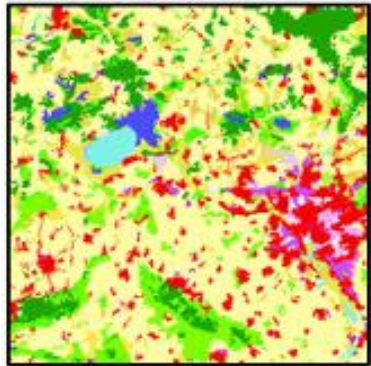


4. Mask FG-switch
5. Color-group range settings

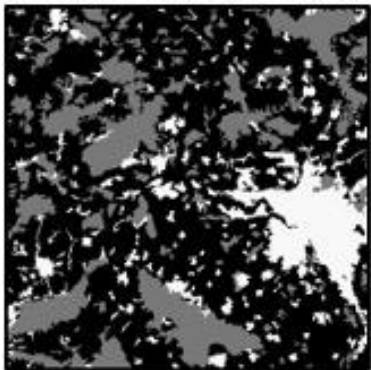


Landscape Mosaic: Measure land cover composition and human impact

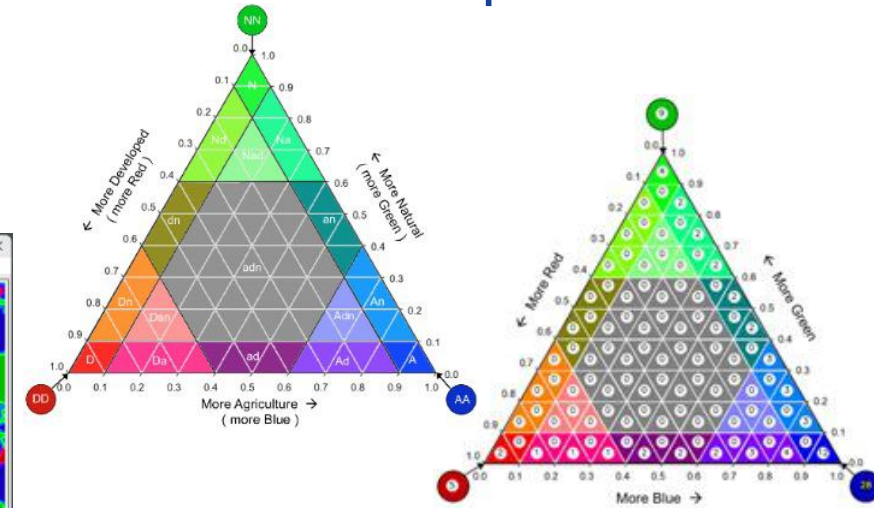
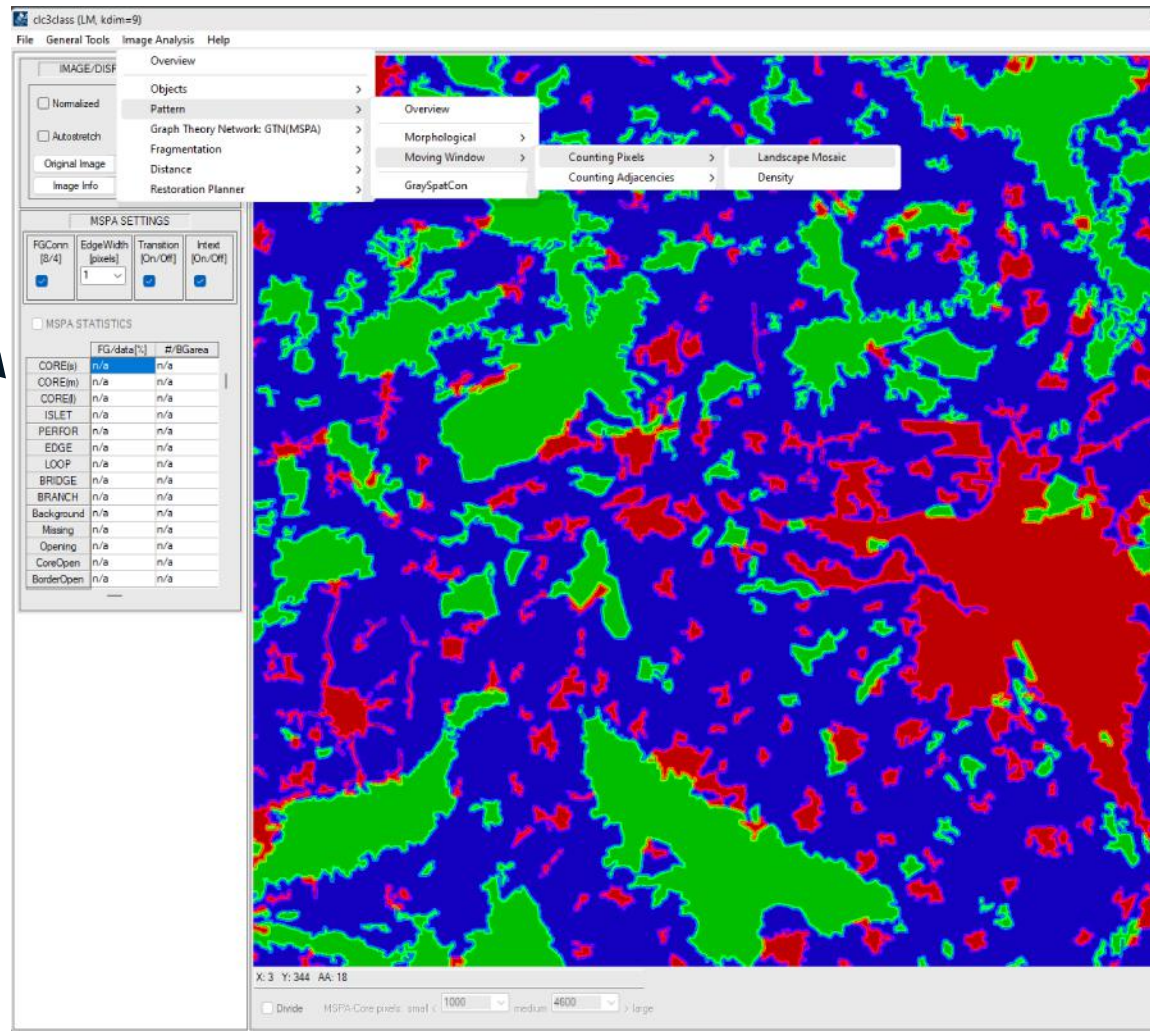
Land cover map



Agr./Nat./Developed



Heterogeneity in Agriculture/Natural/Developed
(at user-selected observation scale)



Measure composition

- Geometric concept
- Monitor & quantify influence of the three components
- Heatmap summary

[LM product sheet](#)
[LM paper](#)



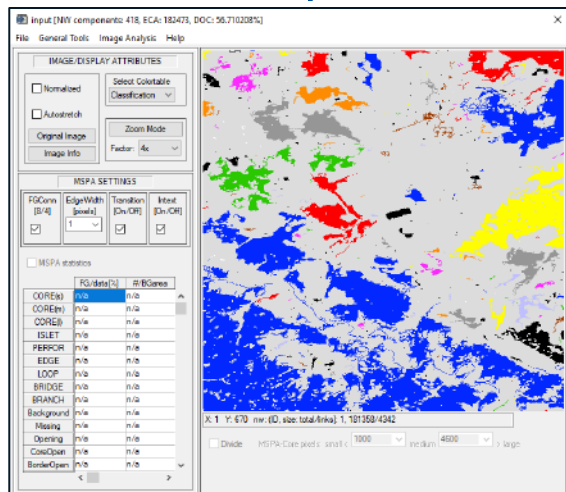
European
Commission



Network: NW-components; importance of connectors and habitat patches...

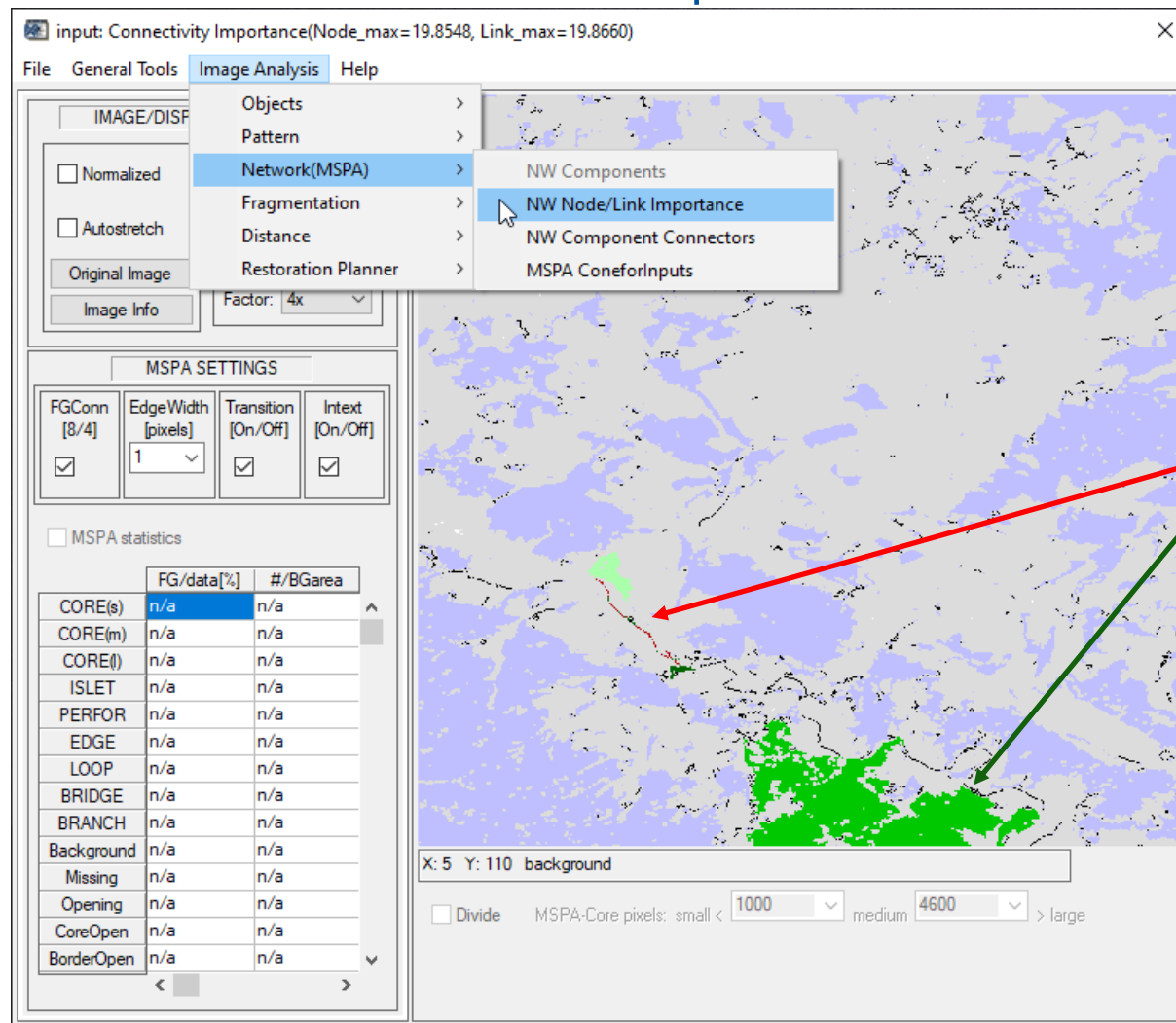
Node/Link-importance

NW-components



Additional options:

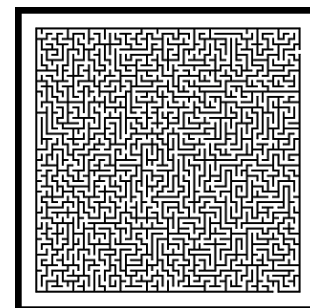
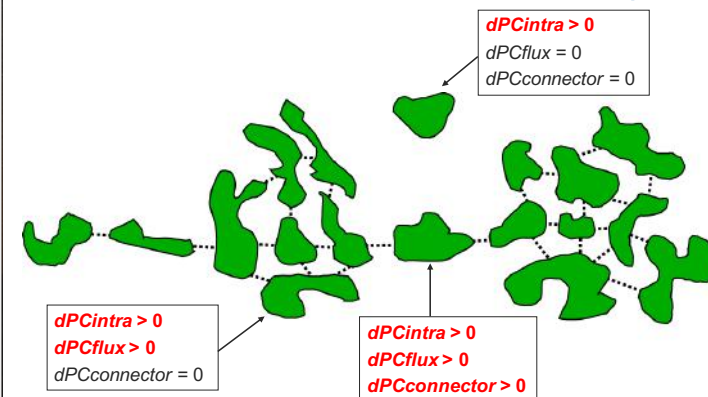
- Component connectors
- Setup input data for graph-theory analysis e.g., in [Conefor](#)



- Use MSPA to detect habitat patches/corridors

- Conversion to Nodes & Links

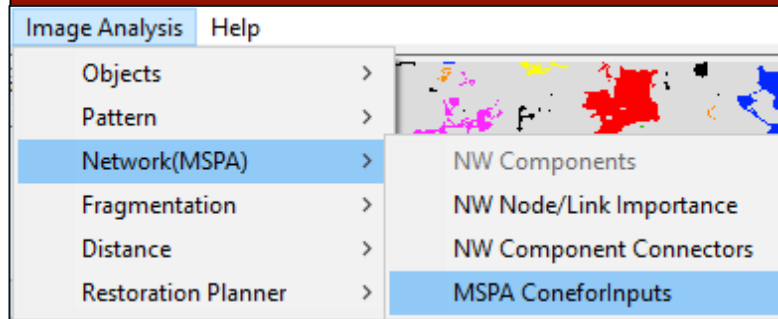
- Use graph theory to rank and locate the most important **corridors** and **habitats** in the current network (highest priority for protection/conservation)





Graph theory: Requires two tables: *Nodes* & *Links*. You have 2 options in GTB:

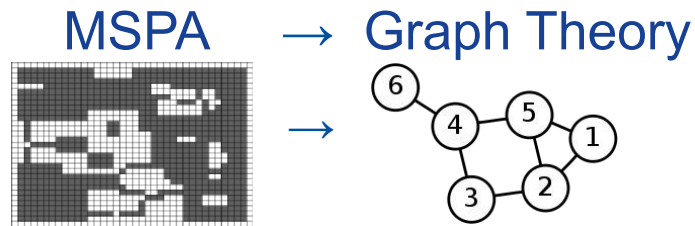
1.) MSPA ConeforInputs



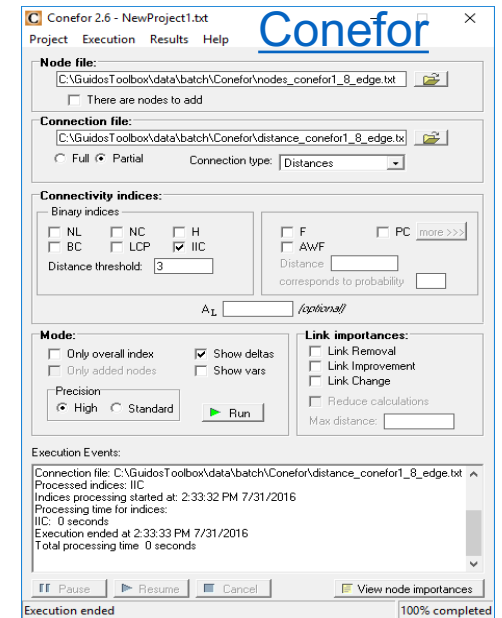
Connectivity: defined by **MSPA**

Nodes = MSPA-class Core

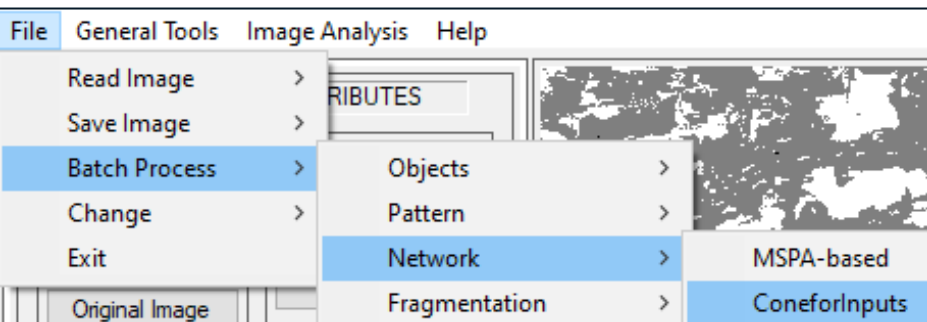
Links = MSPA-class Bridge



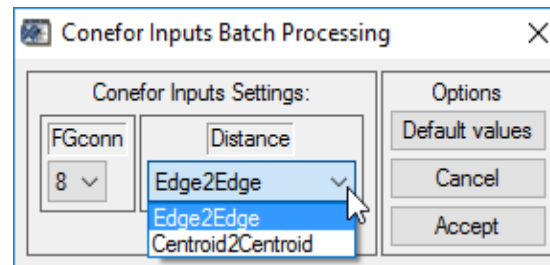
Input image: MSPA image



2.) ConeforInputs



Connectivity: defined by **Euclidean distance threshold**



Additional options:

- Select FG-connectivity
- Select distance type
- Accept: write out input tables for graph-theory analysis in [Conefor](#)

Input image: raster image with network objects assigned to 2 byte



Fragmentation: Choose from indices to map products to multiscale analysis...

1) Select type of input, method, reporting, scale, etc.

Please set: PixelResolution [m] x square WindowSize = Observation Scale

Input: **GRAYSCALE** Settings for Fixed Observation Scale (FOS):

Gray Threshold: 30 Method: FAD Reporting: 5class FG-conn: 8 PixelRes [m]: 25 WinSize: 7 Observation scale [hectares, acres]: 3.06250 7.56759

gdalinfo: Pixel Size = (2430.0000000000000000,-2430.0000000000000000)

Please set: PixelResolution [m] x square WindowSize = Observation Scale

Input: **BINARY** Settings for Fixed Observation Scale (FOS):

Method: FAD Reporting: 6class FG-conn: 8 PixelRes [m]: 25 WinSize: 27 Observation scale [hectares, acres]: 45.5625 112.587

000000000000,-25.0000000000000000)

2) Resulting map and statistics showing the degree of fragmentation in 2-6 classes for the selected observation scale.

FOS statistics

File

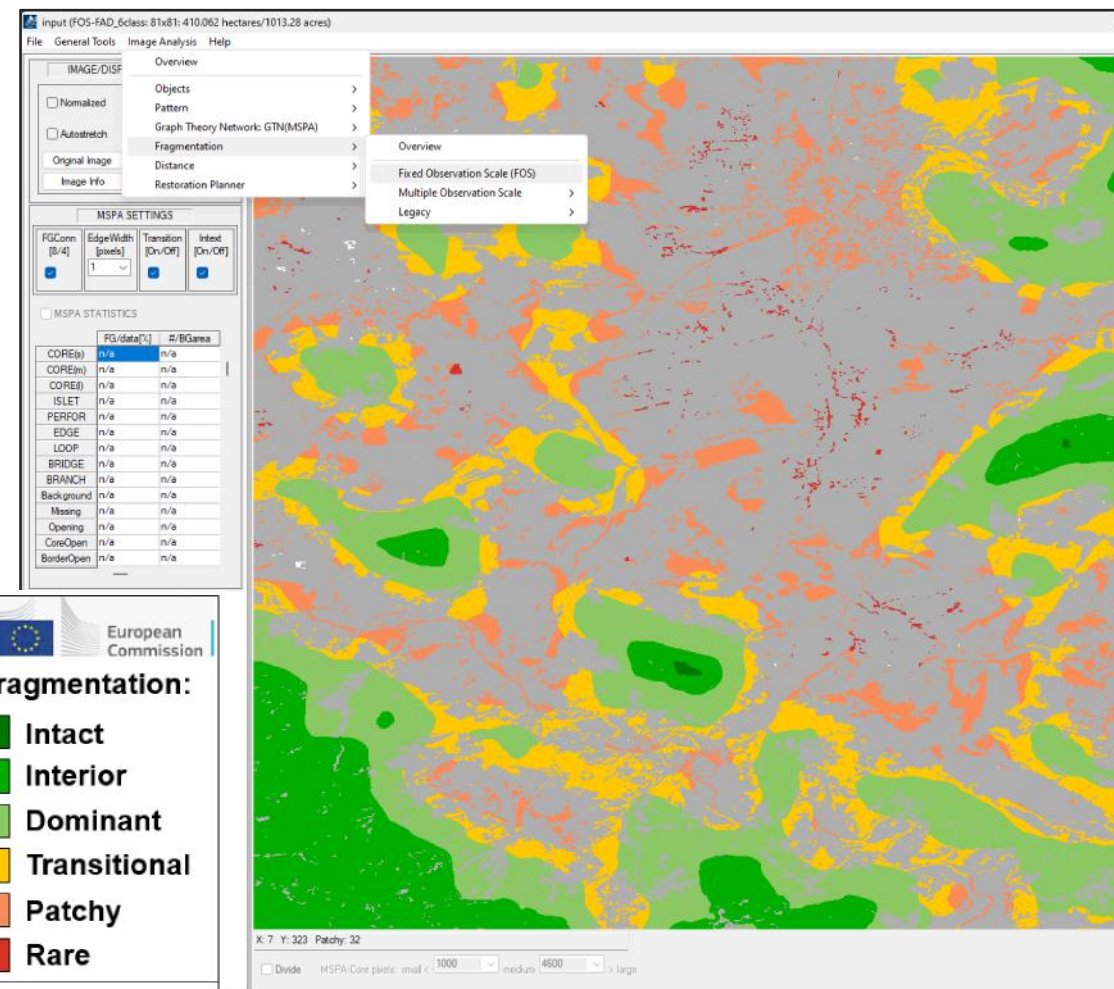
Fragmentation analysis using Fixed Observation Scale (FOS)
Method options: FAD - FG Area Density; FED - FG Edge Density; FAC - FG Area Clustering;
Summary analysis for image:
C:\GuidosSource\data\input.tif

FOS parameter settings:
Input type: Binary
Foreground connectivity: 8-connectivity
FOS-type selected: FAD_6class
Method: FAD
Reporting style: FAD at pixel level
Number of reporting classes: 6
Pixel resolution [m]: 25
Window size [pixels]: 81
Observation scale [(window size * pixel resolution)^2]: 410.062 hectares <-> 1013.28 acres

Image foreground statistics:
Foreground area [pixels]: 428490
Number of foreground patches: 2850
Average foreground patch size: 150.34737

Proportion [%] of foreground area in foreground cover class:
Rare (FAD-pixel value within: [0 - 9]): 0.9477
Pachy (FAD-pixel value within: [10 - 39]): 18.6697
Transitional (FAD-pixel value within: [40 - 59]): 26.1248
Dominant (FAD-pixel value within: [60 - 89]): 36.9115
Interior (FAD-pixel value within: [90 - 99]): 17.2522
Intact (FAD-pixel value: 100): 0.0941

Average pixel value across all foreground pixels using FAD-method: 61.7917
Equivalent to average foreground connectivity: 61.7917
Equivalent to average foreground fragmentation: 38.2083

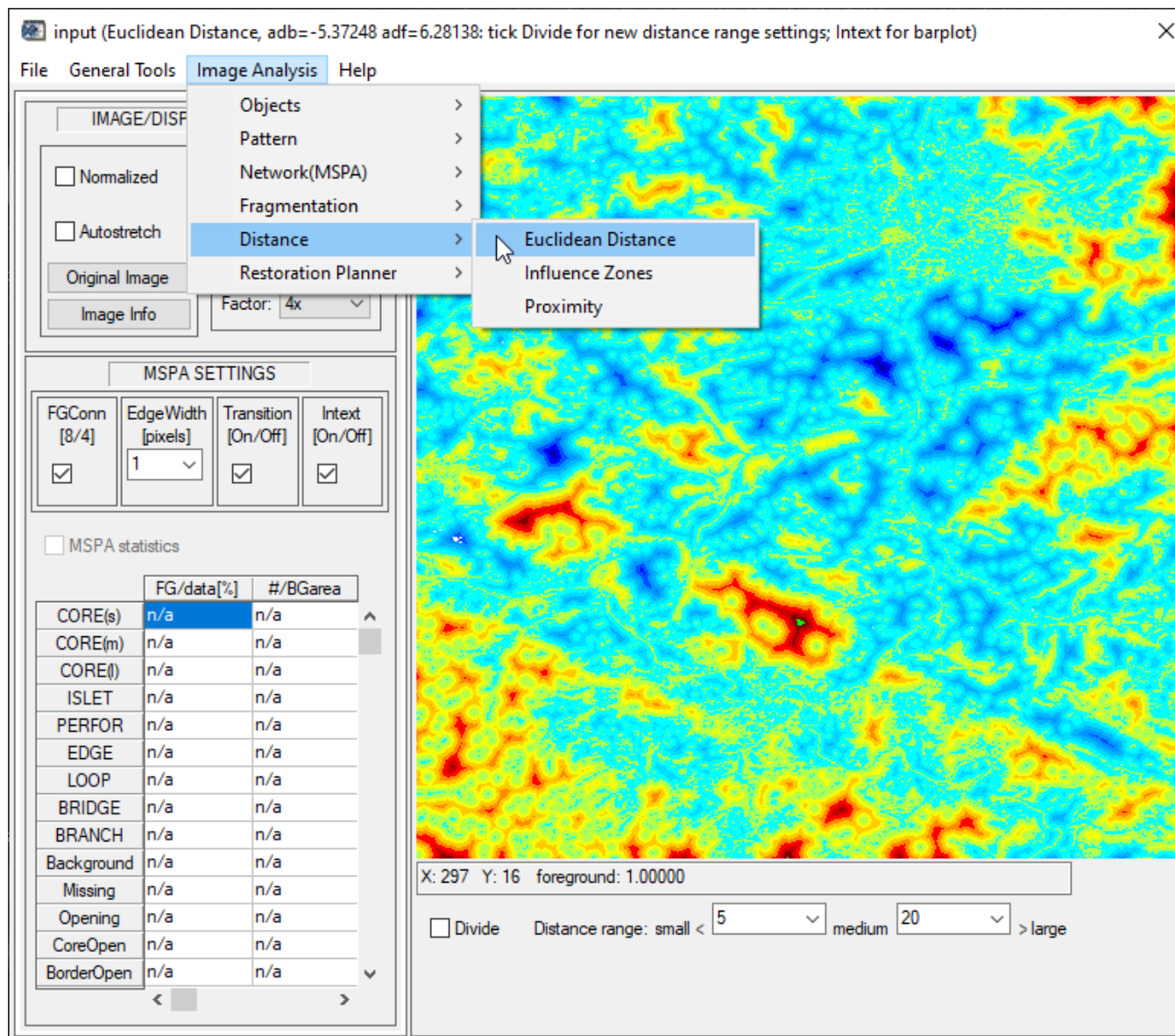
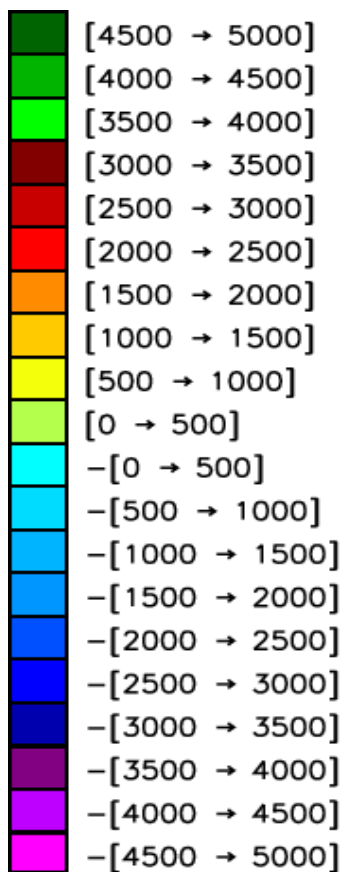


[Binary vs grayscale paper](#)
[Fragmentation product sheet](#)

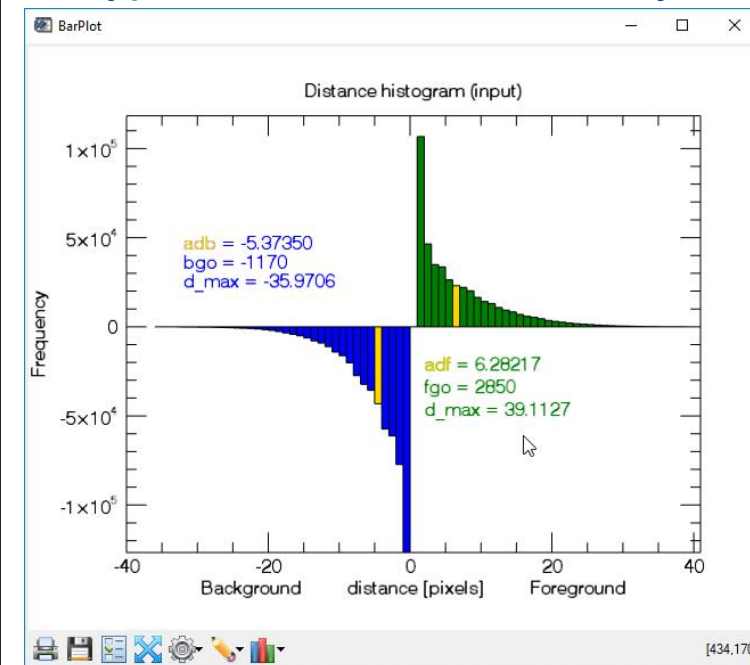


Euclidean: Pseudo elevation map showing shortest distance to FG/BG boundary

Distance [m]



- Locate compact habitat
- Distance to habitat boundary
- Hypsometric curve summary



[Distance product sheet](#)



Influence Zones: Distance between selected objects

The screenshot shows the Guido's Toolbox software interface. The 'Distance' menu is open, showing options: Euclidean Distance, Influence Zones (highlighted), and Proximity. The 'MSPA SETTINGS' panel is visible on the left, with 'FGConn' set to 8/4, 'EdgeWidth' set to 200 (circled with a red '1'), and 'Transition' and 'Intext' checked. Below this is a table with various object types and their statistics. At the bottom, the 'Buffer zone' settings are shown with 'Foreground' set to 1 (circled with a red '2') and 'Background' set to 10 (circled with a red '3').

| | FG/data[%] | #/BGarea |
|------------|------------|----------|
| CORE(s) | n/a | n/a |
| CORE(m) | n/a | n/a |
| CORE(l) | n/a | n/a |
| ISLET | n/a | n/a |
| PERFOR | n/a | n/a |
| EDGE | n/a | n/a |
| LOOP | n/a | n/a |
| BRIDGE | n/a | n/a |
| BRANCH | n/a | n/a |
| Background | n/a | n/a |
| Missing | n/a | n/a |
| Opening | n/a | n/a |
| CoreOpen | n/a | n/a |
| BorderOpen | n/a | n/a |

Features:

1. Select minimum object area of interest
2. Set FG-buffer to define Core objects
3. Set BG buffer for Outreach Zone

— Watershed: equal distance between neighboring objects)

■ Neglected:
- object < min. object area, or
- buffer into foreground (2)

■ Outreach Zone into background (3)


— Outreach Zone boundary

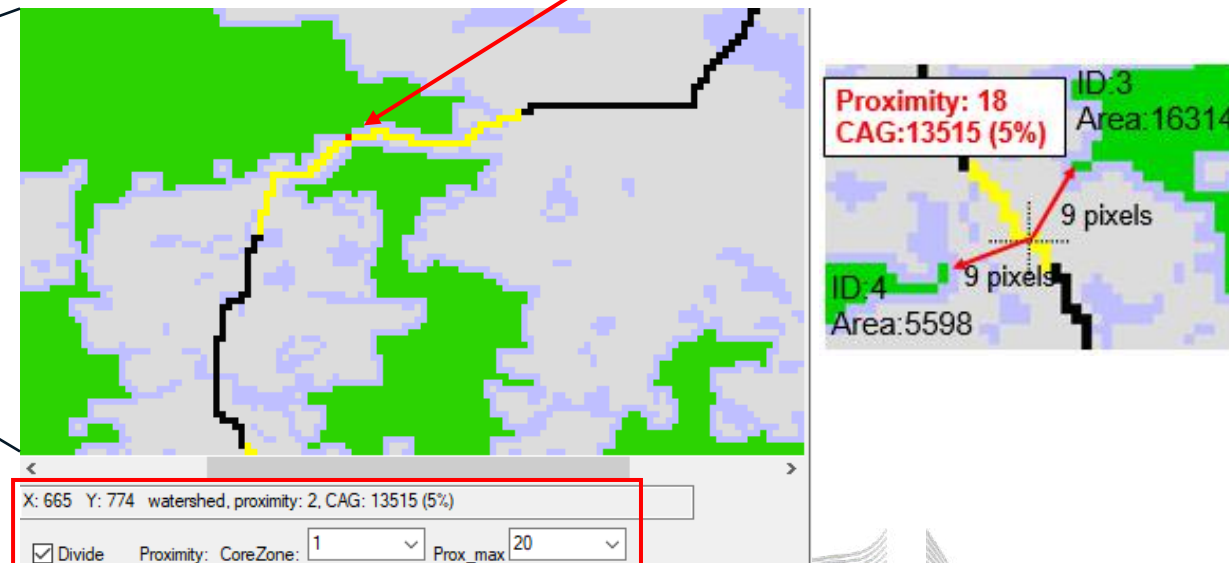


Proximity: Locations where pairwise distance < X (restoration planning)

Features:

1. Select minimum object area of interest
2. Set FG-buffer to define Core objects
3. Set proximity threshold
4. Mouseover component ID/area
5. Mouseover watershed: proximity between neighb. components and Connected Area Gain (CAG)

 Distance < $Prox_{max}$  Min. proximity





Setup Tools: Guided help to define resistance or marker maps

Resistance [%]: proxy for restoration effort

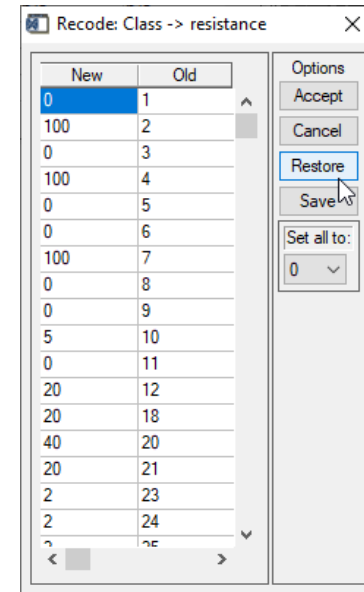
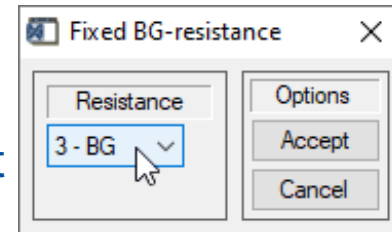
Fixed BG-Resistance: assign a constant resistance value to all background pixels:

Land Cover → Resistance: assign or reclassify land cover class-specific resistance values:

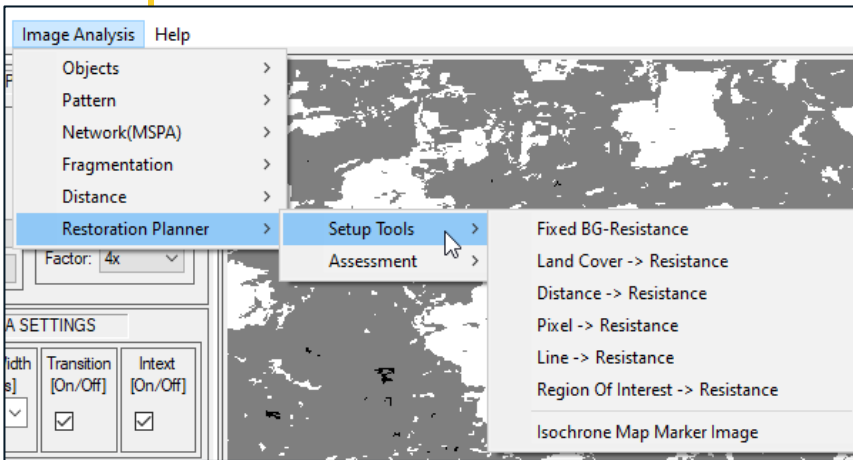
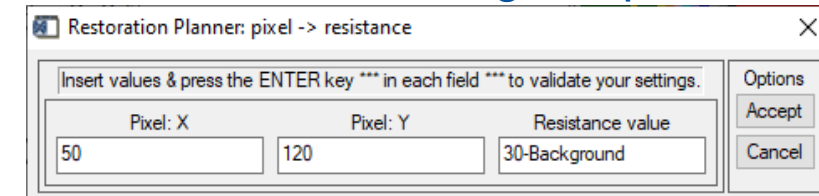
Distance → Resistance: ~ distance from FG-objects (birds/flying insects):

Line → Resistance:

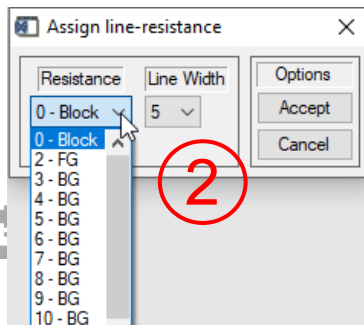
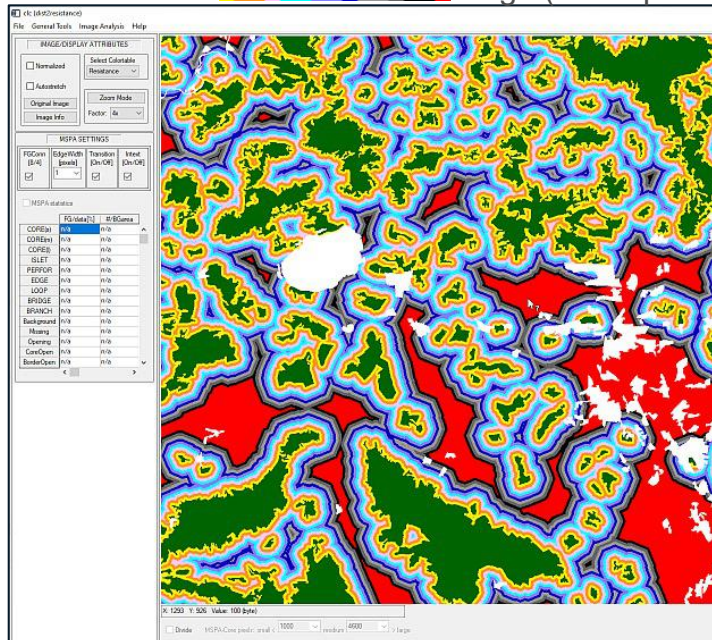
- 1) draw a freehand or straight line
- 2) assign width/resistance value



Pixel → Resistance: assign custom resistance value to a given pixel:



Distance: low High (≥ 100 pixels)



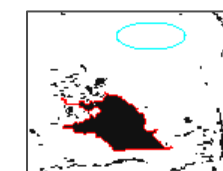
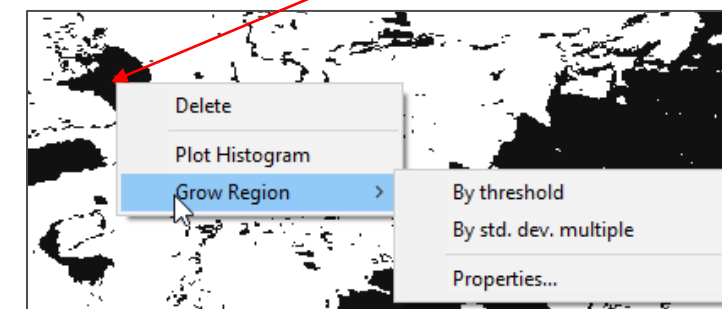
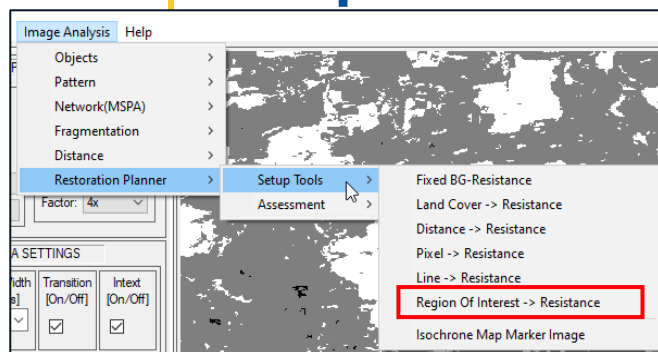


Setup Tools: Guided help to define resistance or marker maps

Region Of Interest (ROI) → Resistance:
assign resistance values to custom regions:

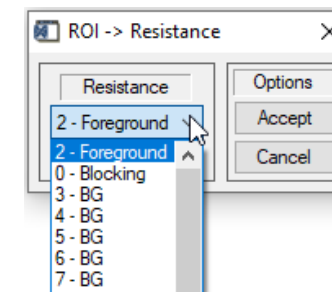
ROI Selection Tool features:

- Add new ROI: rectangular, oval, freehand, or polygon
- Shift or warp the shape of a ROI
- Region Growing to select irregular feature: setup a small **Marker**, then right-click on it for region growing



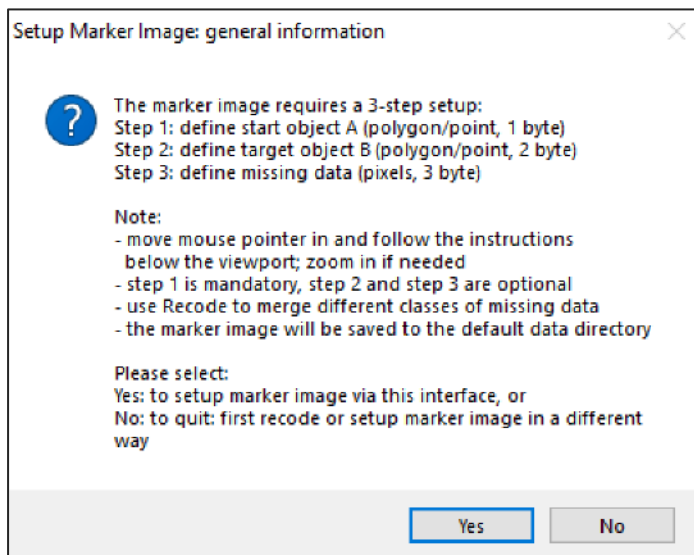
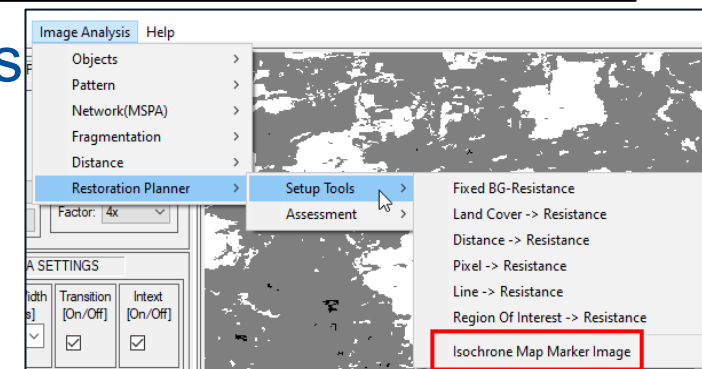
Irregular feature is selected

- Close window & assign resistance for all ROIs:





Setup Tools: Set start/target object for travel time analysis

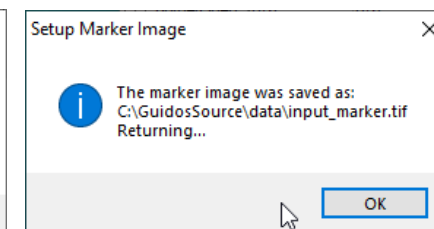
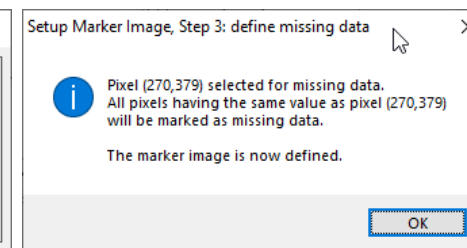
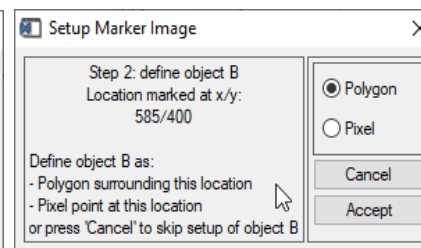
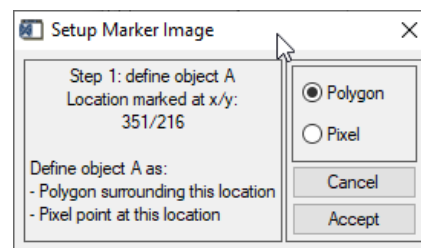


1) Click Start object & press Enter key:

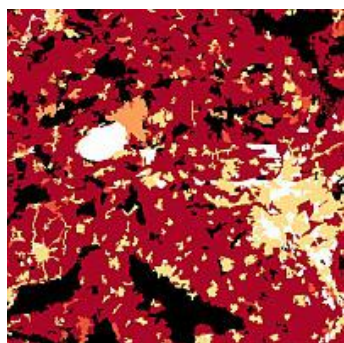
2) Click Target object & press Enter key (optional):

3) Click specific pixel & press Enter key to define missing data (optional):

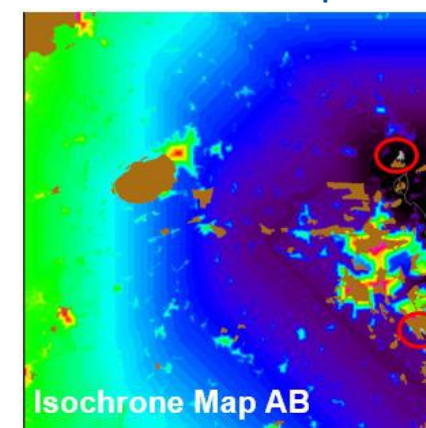
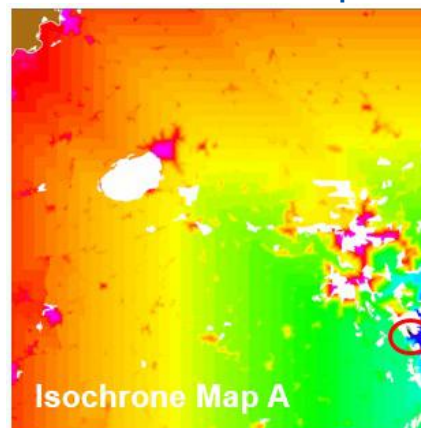
Marker Image is saved for travel time analysis:



Resistance Map + Marker Map



Isochrone Map A or Isochrone Map AB





Assessment: Network status summary and evaluate restoration efficiency

Status Summary: including reachable area (ECA) and overall **Coherence** [%].

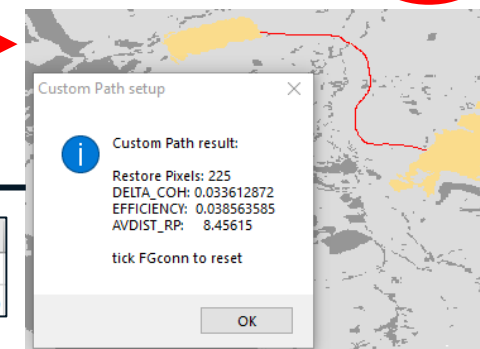
| | A | B | C | D | E | F | G | H | I |
|---|---------------|--------|-----------|--------|----------|-----------|---------|-----------|-----------|
| 1 | FNAME | AREA | RAC[%] | NR_OBJ | LARG_OBJ | APS | CNOA | ECA | COH[%] |
| 2 | fm00.tif | 304837 | 47.505411 | 3952 | 247536 | 77.134868 | 1188516 | 247829.13 | 81.298902 |
| 3 | molise_80.tif | 131321 | 29.568011 | 266 | 42565 | 493.68797 | 41423 | 48469.757 | 36.909372 |
| 4 | montana.tif | 533462 | 26.025076 | 32 | 355485 | 16670.688 | 882233 | 358898.55 | 67.277247 |

Change Summary: gain in Δ ECA and Δ Coherence.

| | A | B | C | D | E | F | G | H | I | J |
|---|----------|-----------|-------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1 | REST_PIX | AVDIST_RP | EXP_3 | EFFIC | ECA_ORIG | ECA_NEW | DELTA_ECA | COH_ORIG | COH_NEW | DELTA_COH |
| 2 | 359 | 8.293 | 1077 | 23.46145 | 221292.76 | 246560.74 | 25267.982 | 51.644789 | 57.493603 | 5.8488133 |

Custom Path: *I want this path.*

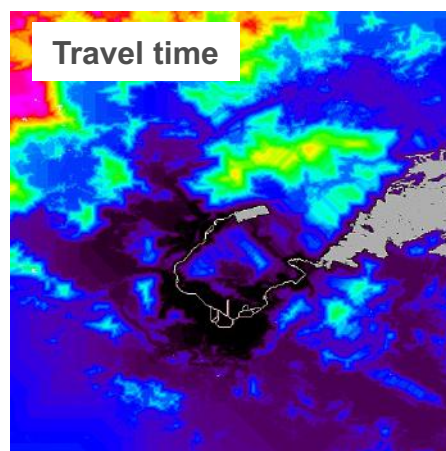
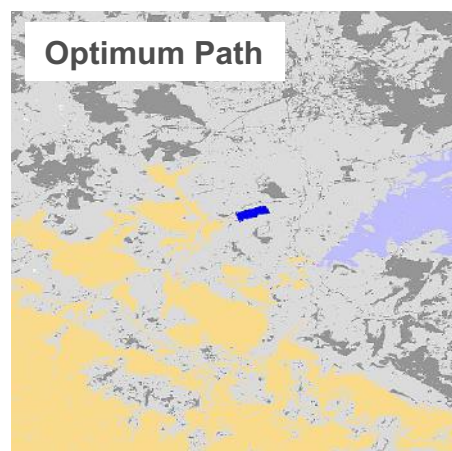
- Draw *Freehand* or *Straight Line* path (1 pixel width)
- Instantly get restoration path statistics



Optimum Path: *I want the optimum path between two objects of my choice.*

- Interactively select **Start** & **Target** object
- Get LCP + cost surface between 2 objects

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|--------|--------|----------|-----------|--------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1 | SIZE_A | SIZE_B | REST_PIX | AVDIST_RP | EXP_30 | EFFIC | ECA_ORIG | ECA_NEW | DELTA_ECA | COH_ORIG | COH_NEW | DELTA_COH |
| 2 | 1451 | 33508 | 65 | 1.80456 | 1950 | 24.151311 | 221292.76 | 268387.81 | 47095.056 | 51.644789 | 62.626224 | 10.981435 |



low high
Least Cost Path

Optimum Big 5: best pairwise path between the 5 largest objects

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|----|---------|--------|--------|----------|-----------|--------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1 | RESTORE | SIZE_A | SIZE_B | REST_PIX | AVDIST_RP | EXP_30 | EFFIC | ECA_ORIG | ECA_NEW | DELTA_ECA | COH_ORIG | COH_NEW | DELTA_COH |
| 2 | 1 <-> 2 | 214811 | 33508 | 18 | 2.14992 | 540 | 90.476013 | 221292.76 | 270149.8 | 48857.047 | 51.644789 | 63.044285 | 11.3995 |
| 3 | 1 <-> 3 | 214811 | 26366 | 43 | 1.24715 | 1290 | 34.731307 | 221292.76 | 266096.14 | 44803.386 | 51.644789 | 62.094668 | 10.4499 |
| 4 | 1 <-> 4 | 214811 | 14983 | 8 | 1.20711 | 240 | 131.12431 | 221292.76 | 252764.99 | 31472.233 | 51.644789 | 58.988605 | 7.34382 |
| 5 | 1 <-> 5 | 214811 | 13850 | 2 | 1.41421 | 60 | 217.68263 | 221292.76 | 234353.72 | 13060.958 | 51.644789 | 54.69267 | 3.04788 |
| 6 | 2 <-> 3 | 33508 | 26366 | 23 | 4.66506 | 690 | 5.8013099 | 221292.76 | 225295.7 | 4002.9452 | 51.644789 | 52.576165 | 0.931376 |
| 7 | 2 <-> 4 | 33508 | 14983 | 61 | 1.79058 | 1830 | 35.133502 | 221292.76 | 285587.07 | 64294.309 | 51.644789 | 66.640159 | 14.9954 |
| 8 | 2 <-> 5 | 33508 | 13850 | 56 | 1.85377 | 1680 | 27.135228 | 221292.76 | 266879.94 | 45587.183 | 51.644789 | 62.275681 | 10.6309 |
| 9 | 3 <-> 4 | 26366 | 14983 | 41 | 1.239 | 1230 | 2.6203955 | 221292.76 | 224515.84 | 3223.0865 | 51.644789 | 52.391973 | 0.747183 |
| 10 | 3 <-> 5 | 26366 | 13850 | 40 | 1.23462 | 1200 | 2.5434958 | 221292.76 | 224344.95 | 3052.195 | 51.644789 | 52.352216 | 0.707427 |
| 11 | 4 <-> 5 | 14983 | 13850 | 5 | 1.08284 | 150 | 9.9899756 | 221292.76 | 222791.25 | 1498.4963 | 51.644789 | 51.993898 | 0.349109 |

[Restoration planner product sheet](#)

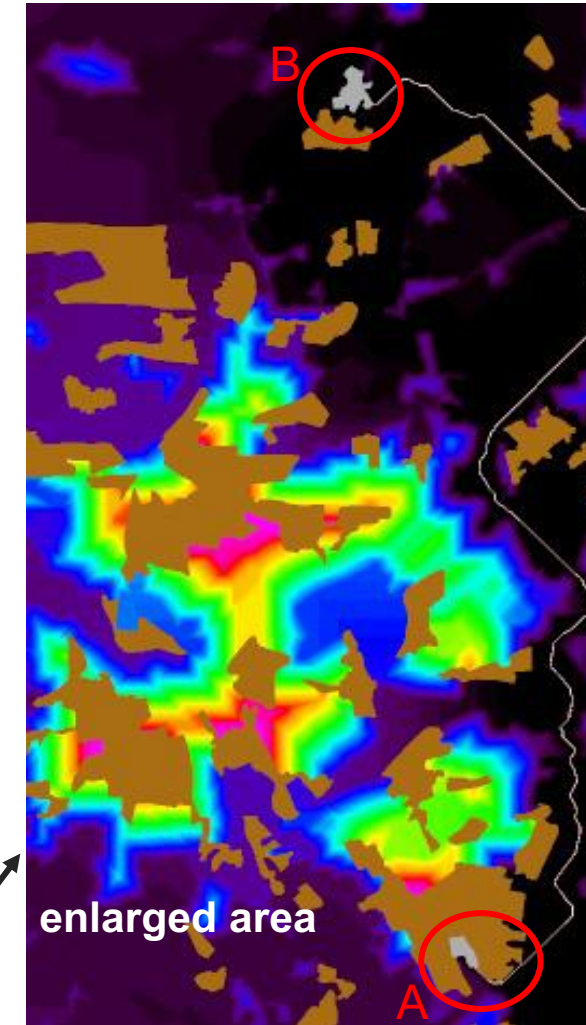


Assessment: Network status summary and evaluate restoration efficiency

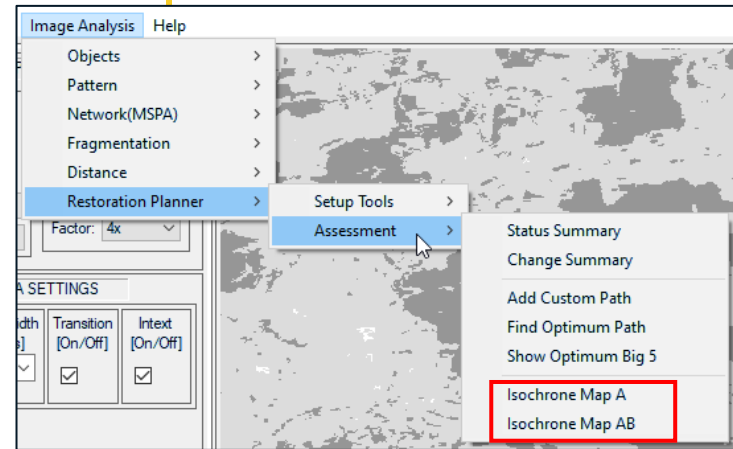
Isochrone map: show the travel time (TT) map.

- **Isochrone Map A:** TT map from object A
- **Isochrone Map AB:** TT map (A) + TT map(B) = cost surface + optimum path (A↔B)

TT Map: Evaluate local resistance fields → guidance in restoration/conservation planning.



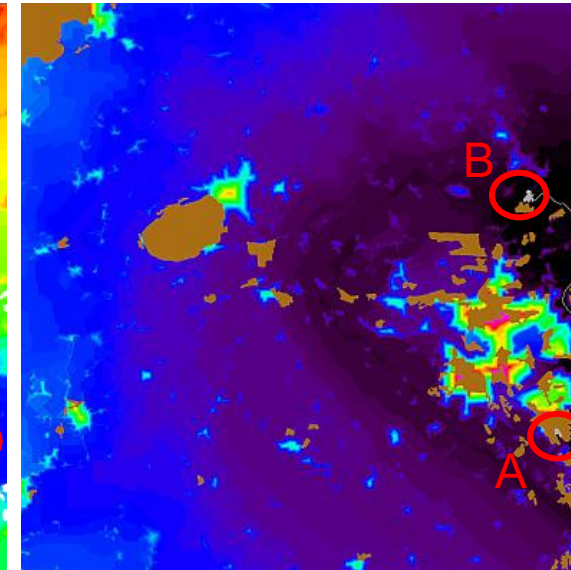
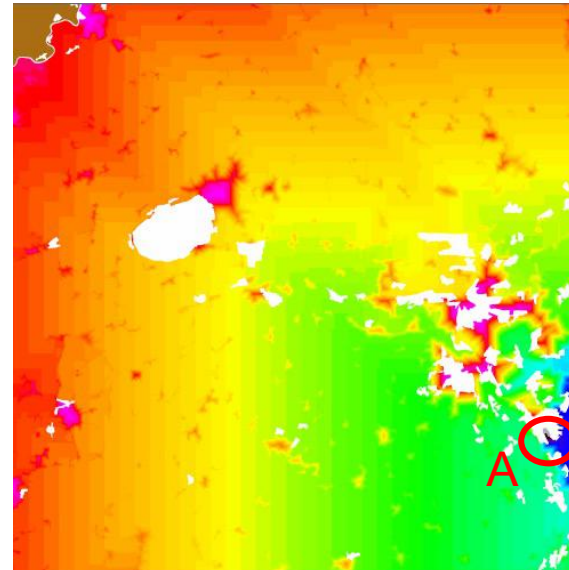
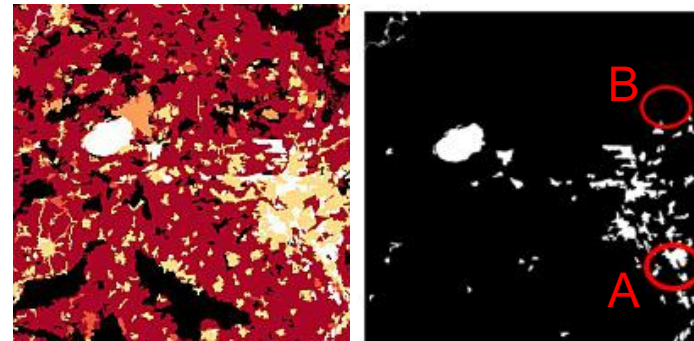
low high
Least Cost Path



Resistance Map + Marker Map →

Isochrone Map A

Isochrone Map AB

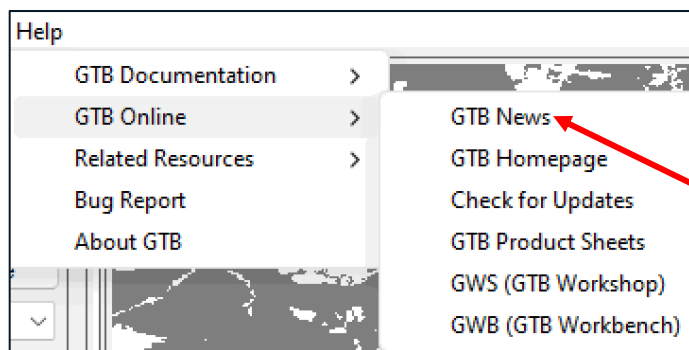
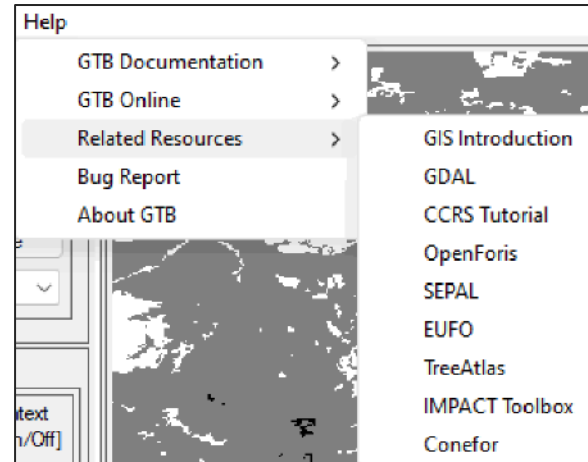
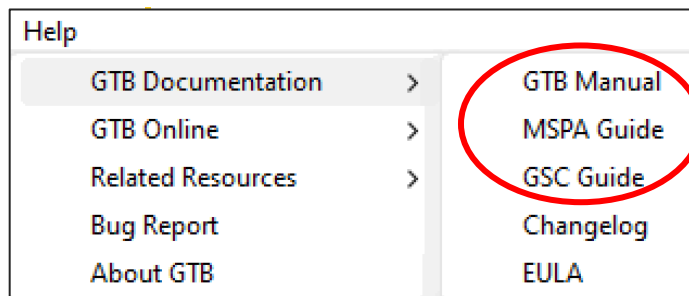


blocking, i.e. water

unreachable

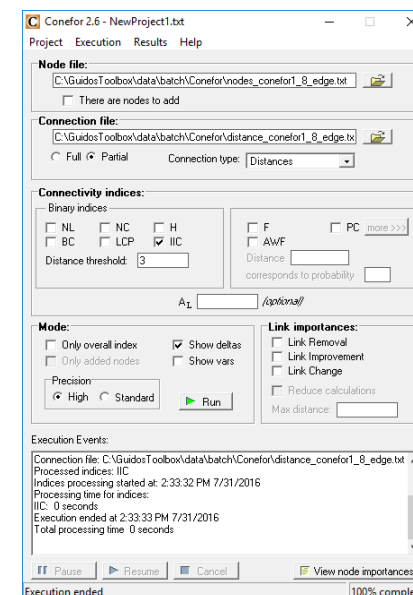
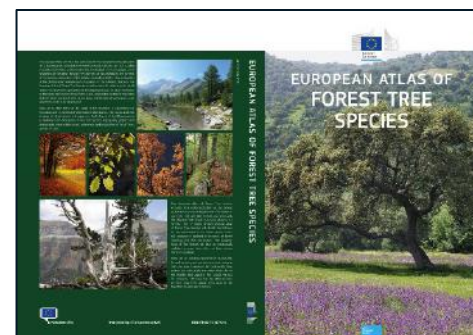
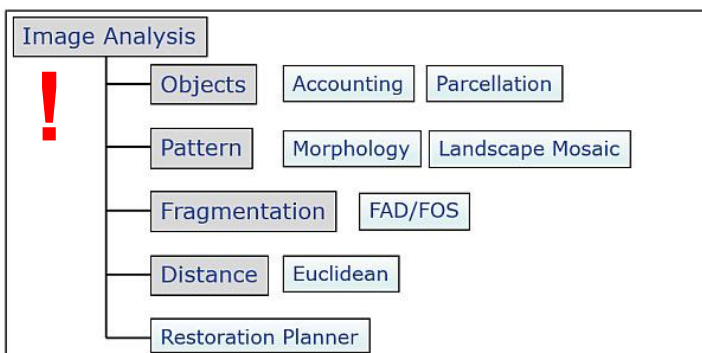


Help: GTB documentation, GTB and other related online resources, bug report template



latest news ...

The GTB Product Sheets:



Thank you



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