ZonalMetrics toolbox v1
User manual

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The Toolbox can be accessed via ArcToolbox menu within both ArcCatalog and ArcMap: right-click the ArcToolbox main catalog and use the option Add Toolbox…, then check the ZonalMetrics.pyt file and click Open.

The ZonalMetrics toolbox is written for ArcGIS Desktop 10.1 and newer. It has two main components, related to two main steps of the analysis:

1) Zonal layer calculation – containing statistical units for landscape metrics calculation.
    - Hexagons
    - Pie layer
2) Metrics to be calculated within the zones based on layers representing e.g. landscape structure, LULC classifications, etc.
    - Area metrics
    - Area Metrics - Largest Patch Index
    - Connectance Metrics
    - Contrast Metrics
    - Diversity Metrics
    - Edge Metrics

1) Zonal layer calculation

Create hexagons

Creates a new hexagon layer based on a user defined hexagon height.
Hexagons may also be centered on the specific point (defined by the centroid of the given layer) to represent the relations between the distance from the center and the observed values.

Syntax

Parameter	Explanation	Data Type
in_area	A layer defining the extent of the hexagon layer (usually, the layer for which the metrics will be calculated).	Feature Layer
use_extent	Hexagon layer will have the same extent as set in map window (if not selected the extent of the Input layer will be used).	Boolean
clip_to_input	To be selected if the hexagon layer extent should clipped by the input layer (hexagons not overlapping with the input layer will be deleted).	Boolean
hex_height	Shorter diagonal of the hexagon.	Double
center_hexagons (Optional)	Set if the hexagon layer should be centered to the layer given below.	Boolean
center_fc (Optional)	The layer to which centroid the hexagon layer will be centered.	Feature Layer
output_layer	The name for the output hexagon layer.	Shapefile

Create pie layer

Creates layer dividing the input area (defined by the to be analyzed layer) into a defined number of sections (similar to pie charts, but with equal arc length).
The sections are geographically oriented; that means that the first sector is always directed to the North, and e. g. when four sections would set in the properties, the whole area will be divided into the 90-degree sections directed to the four sides of the world.

Syntax

Parameter	Explanation	Data Type
in_area	A layer defining the extent of the pie layer (usually, the layer for which the metrics will be calculated).	Feature Layer
sections_number	The number of pie sections to be calculated. Pie section will be geographically oriented; the first is directed to the North. Recommended are numbers divisible by 4.	Long
output_layer	The name for the output pie layer.	Shapefile

2) Zonal Metrics

Area metrics

Calculates area metrics:

- *Class Area **(CA)*** - area of the patches of the corresponding class within the statistical zone (calculated for each selected class).
- *Number of patches per class **(NPC) -** number of patches for each corresponding class within the statistical zone.*
- *Zone area **(ZA)** - area of the statistical zone in which landscape metrics are calculated (e.g. the area of single hexagon/single pie or of any other zone).*
- *Percentage of zone **(PZONE)**- percentage of the area of the corresponding class per statistical zone*

Outputs:

- *ca<className>- area of patches for each selected class*
- *npc<className>- number of patches for each selected class*
- *zone_area- area of the used statistical zone*
- *pz<className>- percent of the area of whole statistical zone taken by patches of selected classes*

Syntax

Parameter	**Explanation**	**Data Type**
in_area	A layer with categorical values for which landscape metrics will be calculated.	Feature Layer
stat_layer	A layer with statistical zones within which the metrics are calculated (e.g. hexagons, pies, administrative units, watersheds).	Feature Layer
class_field	Name of the field containing classes for which metrics calculations will be performed.	Field
class_list (Optional)	Selection of specific classes for which metrics calculations will be performed. If nothing is selected metrics will be calculated for all classes.	Multiple Value
area_analysis_method	Area analysis method: • Cut patches – the default method of calculation where all the patches overlapping the statistical zone are clipped by its borders. • Select overlapping patches- statistics are calculated for the whole patch if intersecting a given statistical zone, the same patch can be taken into account in several zones (double counting of intersecting patches). • Select by centroids – statistics are calculated for the whole patch intersecting a zone if its centroid is located within the zone (no double counting of intersecting patches).	String

Area Metrics - Largest Patch Index

Looks for the patch covering the largest area within the statistical zone, calculates the area of this patch (LPI) and identifies the class of thatpatch.

Outputs:

- *lpi* - percentage of statistical zone total area taken by largest patch
- *lpi_class*- name of the largest patch class

Syntax

Parameter	Explanation	Data Type
in_area	A layer with categorical values for which landscape metrics will be calculated.	Feature Layer
stat_layer	A layer with statistical zones within which the metrics are calculated (e.g. hexagons, pies, administrative units, watersheds).	Feature Layer
class_field	Name of the field containing classes for which metrics calculations will be performed.	Field
class_list (Optional)	Selection of specific classes for which metrics calculations will be performed. If nothing is selected metrics will be calculated for all classes.	Multiple Value
merge_same_class_patches	If checked LPI will be calculated for all patches of the selected classes (aggregated).	Boolean
area_analysis_method	Area analysis method: • Cut patches – the default method of calculation where all the patches overlapping the statistical zone are clipped by its borders. • Select overlapping patches - statistics are calculated for the whole patch if intersecting a given statistical zone, the same patch can be taken into account in several zones (double counting of intersecting patches). • Select by centroids – statistics are calculated for the whole patch intersecting a zone if its centroid is located within the zone (no double counting of intersecting patches).	String

Connectance Metrics

Explores connectedness within the statistical zone in a defined distance.

Calculates:

- **Connectance Index(CI)** - number of distinct connected patches
- Area of parts of patches within the range of connection and its percentage per statistical zone area
- Area of connection zone between two patches, and its percentage per statistical zone area.

An optional connection layer is generated showing the areas of connection between the patches within a defined distance.

Outputs:

- *ci_np*- number of distinct (by FID) connected patches
- *ci_pa*- patch area within range of connection
- *ci_pp*- percentage of patch area within range of connection to statistical zone area
- *ci_ca*- area of connection zone between patches
- *ci_cp*- percentage of connection zone between patches to statistical zone area

Syntax

Parameter	**Explanation**	**Data Type**
in_area	A layer with categorical values for which landscape metrics will be calculated.	Feature Layer
stat_layer	A layer with statistical zones within which the metrics are calculated (e.g. hexagons, pies, administrative units, watersheds).	Feature Layer
conn_distance	Radius for searching for potential connections between the patches.	Double
class_field	Name of the field containing classes for which metrics calculations will be performed.	Field
class_list	Selection of specific classes for which metrics calculations will be performed. Patches of selected classes will be analyzed jointly (input layer will not be changed).	Multiple Value
out_connections (Optional)	Output connection layer with areas of connection between the patches within a defined distance.	Shapefile

Contrast Metrics

Calculates:

- **Edge Length(EL)** of a selected focus class sharing a boundary with corresponding contrast classes(calculated per class).
- **Contrast Class Edge (CCE)**- percentage of edge length of the focus class shared with contrast classes.

Outputs:

- *el_a_class*- edge length of focus class
- *el<className>*- edge length of focus class boundary shared with contrast class/es
- *cce<className>*- contrast index calculated as a percentage of the edge length of focus class shared with contrast classes

Syntax

Parameter	**Explanation**	**Data Type**
in_area	A layer with categorical values for which landscape metrics will be calculated.	Feature Layer
stat_layer	A layer with statistical zones within which the metrics are calculated (e.g. hexagons, pies, administrative units, watersheds).	Feature Layer
class_field	Name of the field containing classes for which metrics calculations will be performed.	Field
analyzed_class	Analyzed class for which the land cover contrast is calculated.	String
class_list	Selection of specific contrast classes for which contrast index will be calculated.	Multiple Value

Diversity Metrics

Calculates Shannon diversity index (SHDI) per zone, based on the selected classes.

Outputs:

- *shdi*- SHDI value for selected classes per zone
- *zone_area*- total area of statistical zone

Syntax

Parameter	Explanation	Data Type
in_area	A layer with categorical values for which landscape metrics will be calculated.	Feature Layer
stat_layer	A layer with statistical zones within which the metrics are calculated (e.g. hexagons, pies, administrative units, watersheds).	Feature Layer
class_field	Name of the field containing classes for which metrics calculations will be performed.	Field
class_list (Optional)	Selection of specific classes for which metrics calculations will be performed. If nothing is selected metrics will be calculated for all classes.	Multiple Value

Edge Metrics

Calculates:

- **Class Edge length (TCE)** for edges of all patches of selected class(es) (aggregated)within the statistical zone.
- **Edge Density (ED)-**length of the edges within the statistical zone per area defined by the user (1 000 ha is the default setting).

Outputs:

- *tc_edge* - length of edges of all patches in selected classes within the statistical zone
- *ed*- edge density

Syntax

Parameter	Explanation	Data Type
in_area	A layer with categorical values for which landscape metrics will be calculated.	Feature Layer
stat_layer	A layer with statistical zones within which the metrics are calculated (e.g. hexagons, pies, administrative units, watersheds).	Feature Layer
class_field	Name of the field containing classes for which metrics calculations will be performed.	Field
class_list (Optional)	Selection of specific classes for which metrics calculations will be performed. If nothing is selected metrics will be calculated for all classes.	Multiple Value
density_area	Area (in hectares) for calculation of the Edge Density Index.	Long