Dwelling extraction in a refugee camp
A simple Object based Image Analysis Toolbox for ArcGIS

Pascal Krafft
Sebastian Scheckel

Due to famines, wars or natural disasters millions of people have to leaf their home countries. Many times the only shelter that they can find is a refugee camp. Often these camps must be erected in a short period of time. Planning and organizing plays an important role and therefore our **motivation** is to develop an Object Based Image Analysis (OBIA) toolbox for ArcGIS.
The general **objective** of this work is to build an easy-to-use OBIA-Toolbox in order to extract and analyse dwellings in refugee camps. Furthermore the toolbox should implement different segmentation algorithms, be able to filter objects and calculate basic statistics about the segments.
The general **workflow** of our tool is separated in two fields. On the one hand we created three segmentation tools and on the other hand six object tools in order to analyse and map refugee camps.
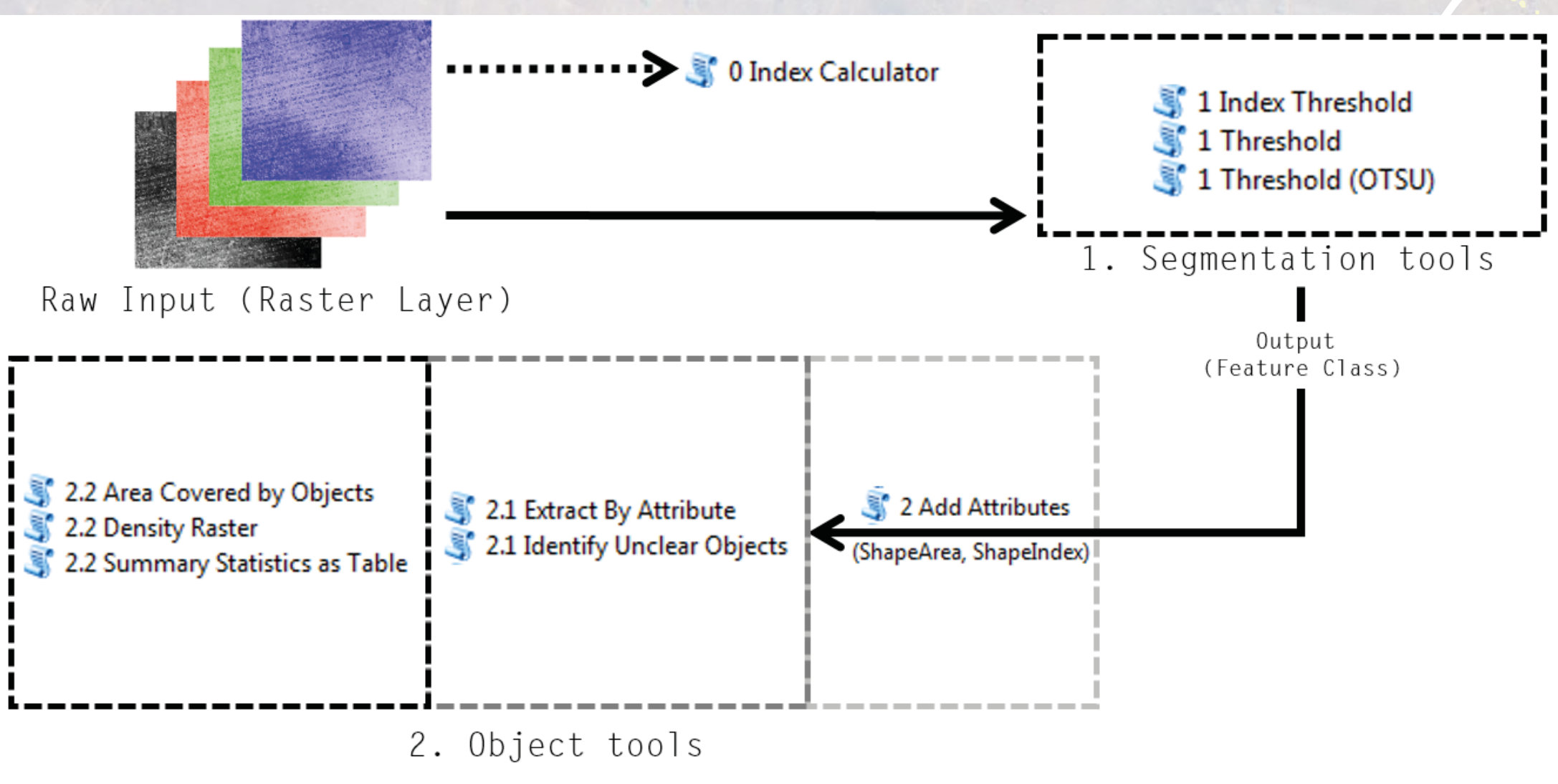

Figure 1: General workflow of the Object Based Image Analysis toolbox for ArcGIS.
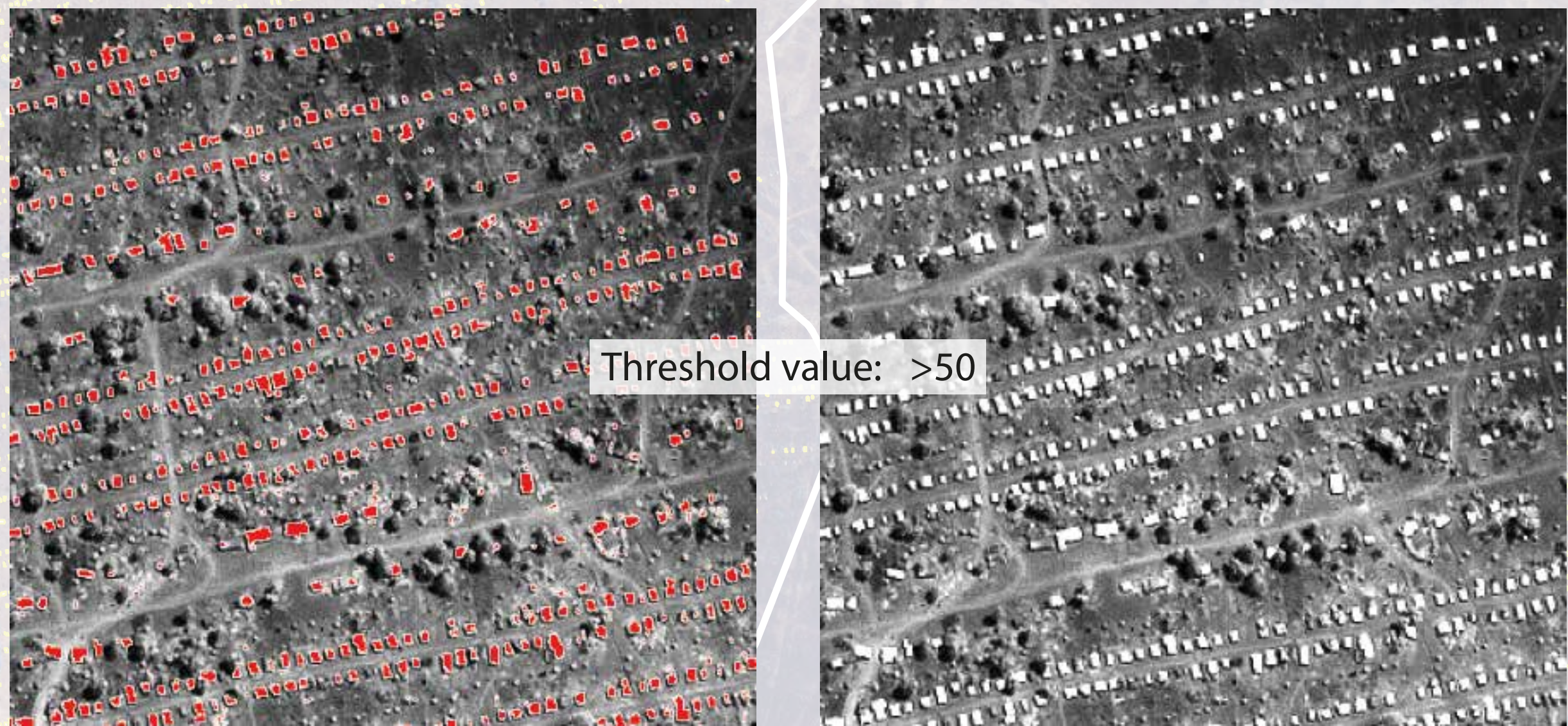

Threshold value: >50

Figure 2: Example calculation of the **Threshold** segmentation tool. The red polygons represent the segments.

The first step is it to segment the dwellings from the raw input satellite imagery. Therefore we created three tools with different segmentation algorithms. All are based on the histogram based threshold segmentation.
The first tool is called **Index Threshold** and calculates from two raster bands an index based on the NDVI formula. On the basis of the index layer a threshold segmentation is performed.
The second tool is called **Threshold**. On basis of a single banded raster satellite image the threshold segmentation is performed.
The second tool is called **Threshold (OTSU)**. With this tool the threshold value will be calculated via Otsu's method which assumes a bi-modal histogram.

In order to apply further object tools it is necessary to run the **Add Attributes** tool which calculates the size of the objects and their ShapeIndex.
The tool **Extract by Attribute** allows to select features by attributes and extract them in a new feature class. Therefore it is good to filter data and eliminate wrong segmented polygons.
The tool **Identify unclear Objects** highlight features which fall out of the alignment.
The tool Area Covered by Objects creates polygons of the built up areas (cf. figure 3).
The tool Density Raster calculates a magnitude per unit area (cf. figure 4 & 5).
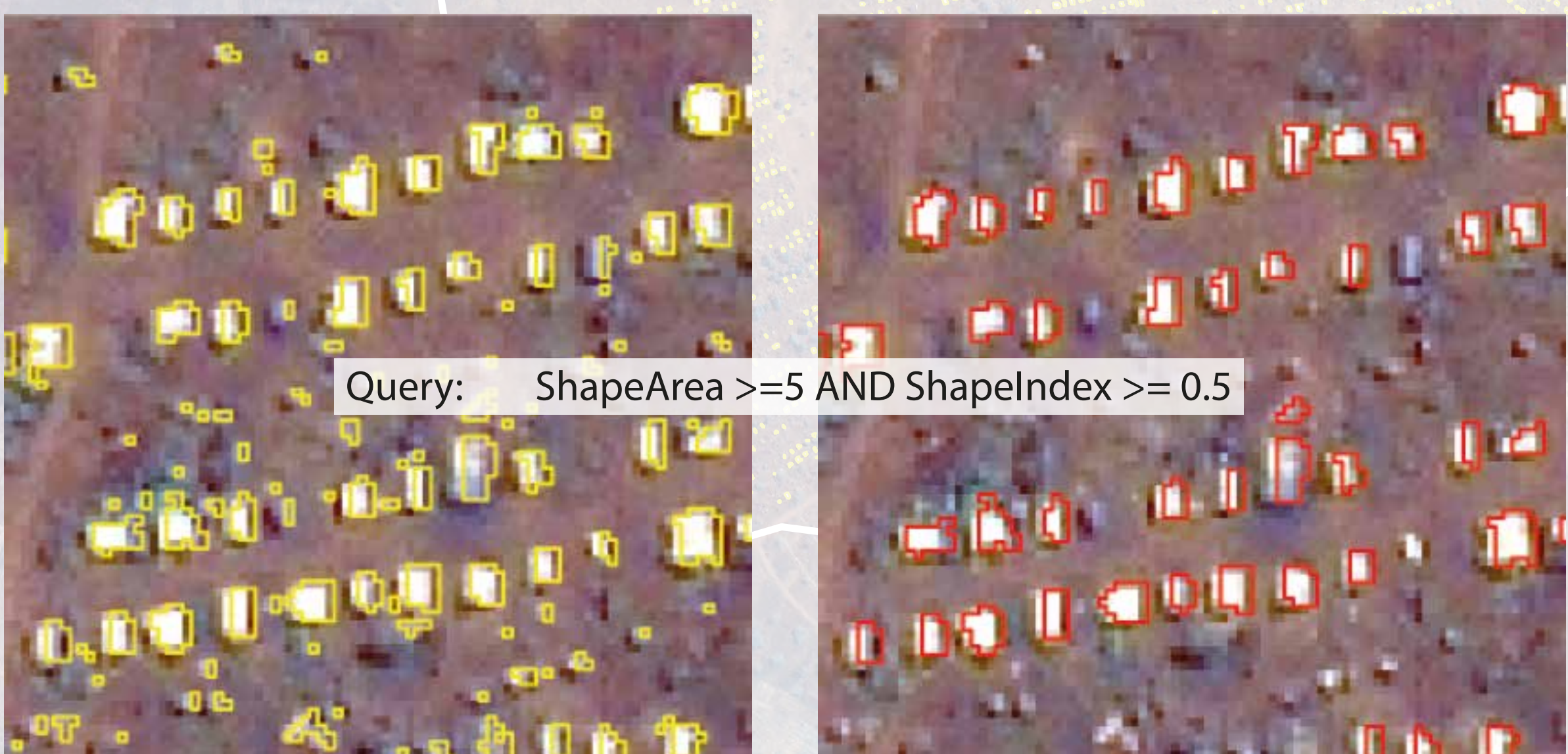The Statistics as Table tool calculates summary statistics.

Query: ShapeArea >=5 AND ShapeIndex >= 0.5

Figure 3: Example calculation of the **Extract by Attribute** tool. Left input, right output.

Sep. 2000

	2000	2005
Camp Area:	12.7 km²	6.3 km²
Dwellings:	21.107	4.614
Population*:	115-144k	23-27k
Vegetation (camp area 2000):	38%	73%

*5-6 persons per tent
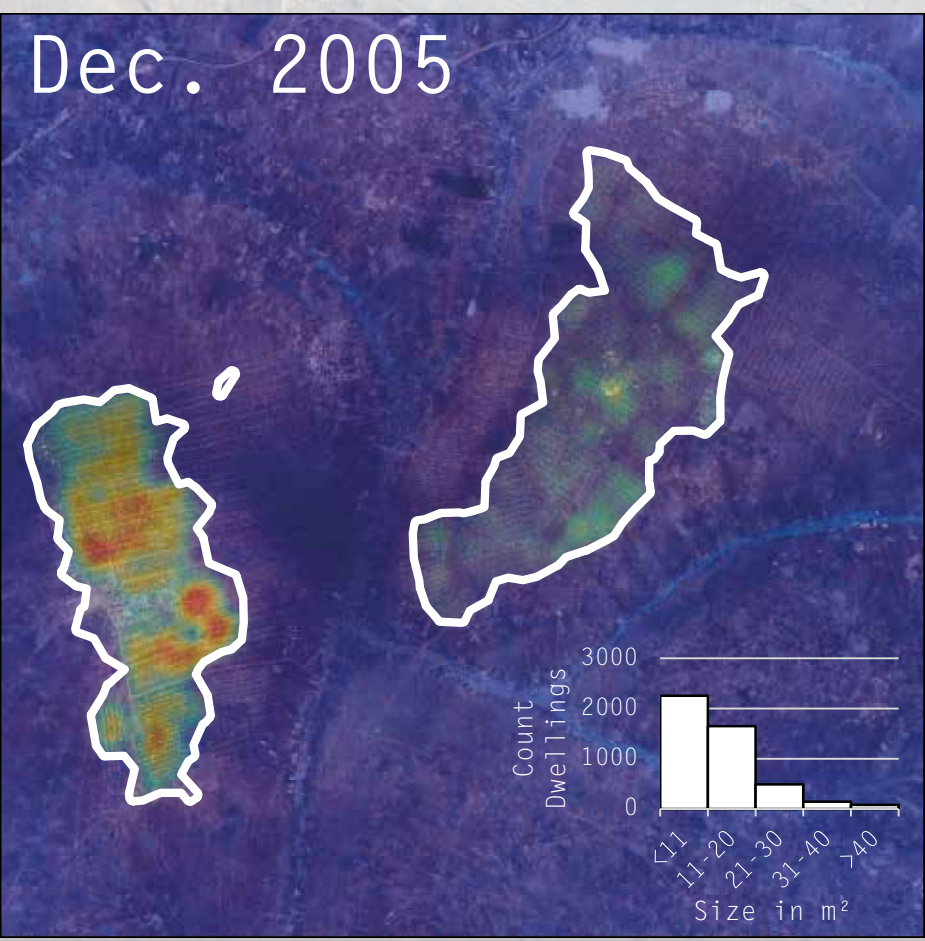
Dec. 2005
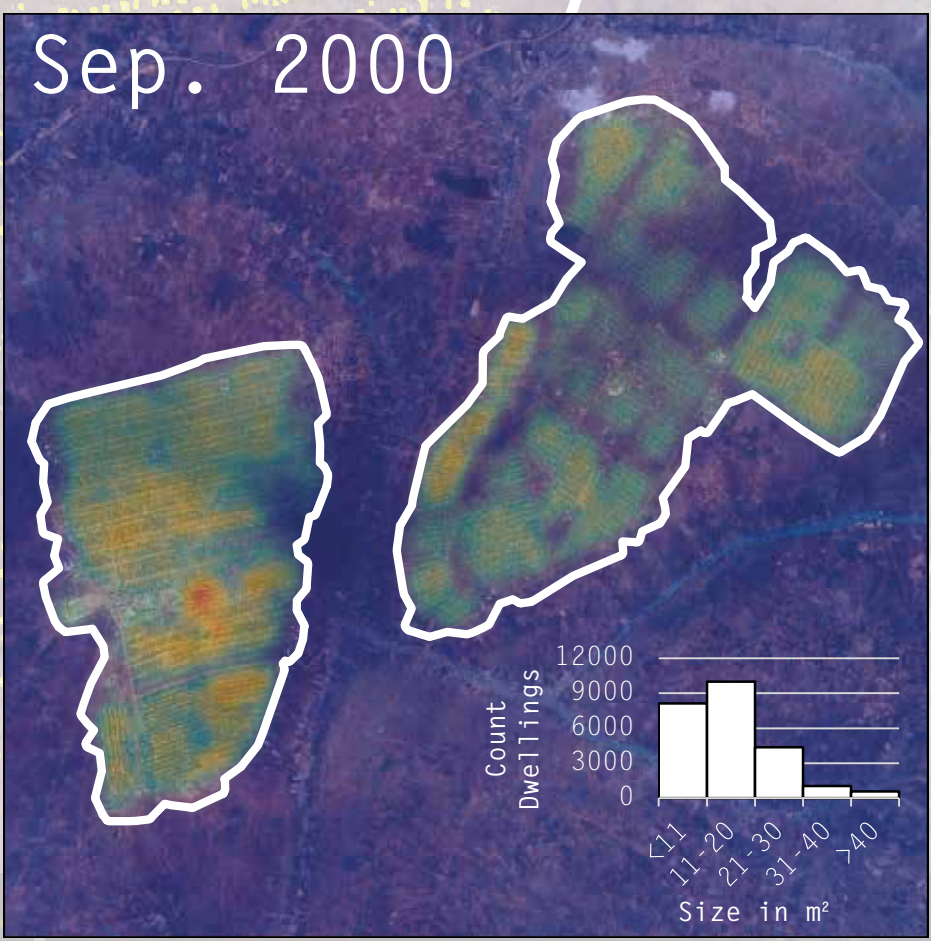
Figure 4: Density map with camp border in the year 2000.

Figure 5: Density map with camp border in the year 2005.

High / Low Dwelling Density — Camp Border
0 1 2km