Object-based LULC classification of urban and peri-urban areas

Luka Valozic, junior researcher

University of Zagreb
Faculty of Science
Department of Geography

Contents

1) Introduction

Why bother?

”There will undoubtedly always be **political and administrative uses** to which dichotomies such as urban/rural and metropolitan/non-metropolitan will be put… ” (Weeks, 2005)

Developing models such as ”The Model for the **Differentiation of Urban, Rural and Semi-Urban Settlements** in the Republic of Croatia” (Croatian Bureau of Statistics, 2011)

1) Introduction

Issue of urban or rural

”Spatial **concentration of people** whose lives are organized around **nonagricultural** activities – urban means nonagricultural, rural means not urban.”(Weeks, 2010)

Working Group for Determination of Criterion for Settlement Standardization proposed a model with four variables (CBS, 2011)

1) Administrative status of settlement
2) Settlement size
3) Socioeconomic structure of population and employment function of settlement
4) <u>Morphological-physiognomical characteristics of settlement</u>

1) Introduction

Is there a problem?

- data for such a model gathered only through census or surveys
- lack of other sources of data for the differentiation of settlements
- lack of a different perspective

1) Introduction

Is there a solution?

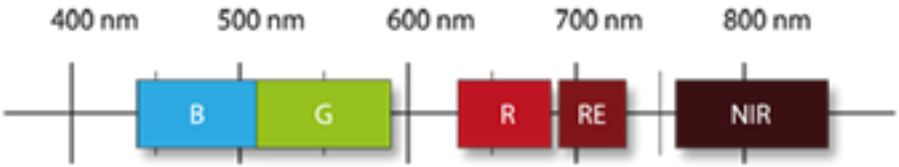
”Remote sensing classification of surface reflectance characteristics allows the creation of simple, robust and directly comparable measures of the dichotomy between natural and artificial land cover.

Remote sensing can provide a useful and direct indication of the physical form and morphology of urban land cover in cities.” (Besussi et al., 2010)

LULC classification of remotely sensed data can be used as complementary or alternative approach to the more traditional ways of differentiating places as urban or rural.

2) Data

- Rapid Eye's sample 5-band multispectral satellite image tile 25x25 km (5000 rows and columns)
- Orthorectified and radiometrically corrected
- Spatial resolution: 5 meters
- Radiometric resolution: 16 bit
- Date: 29th June 2011



RapidEye
Delivering the World

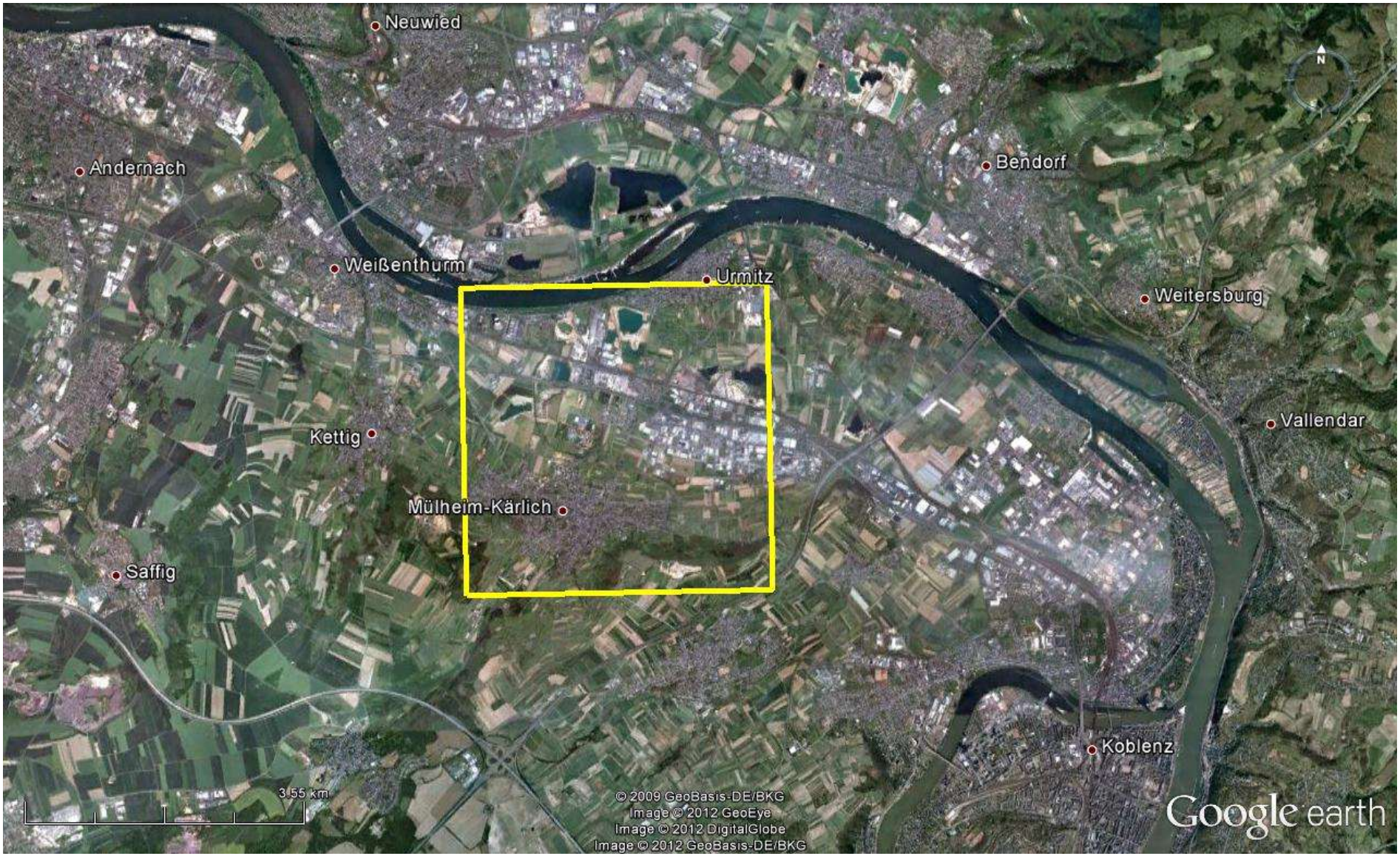
Courtesy of Rapid Eye AG

3) Study area

- Subset scene near Koblenz was chosen
- Size: 15.25 km² or 781x781 pixels

Source: ArcGIS Explorer Online

3) Study area

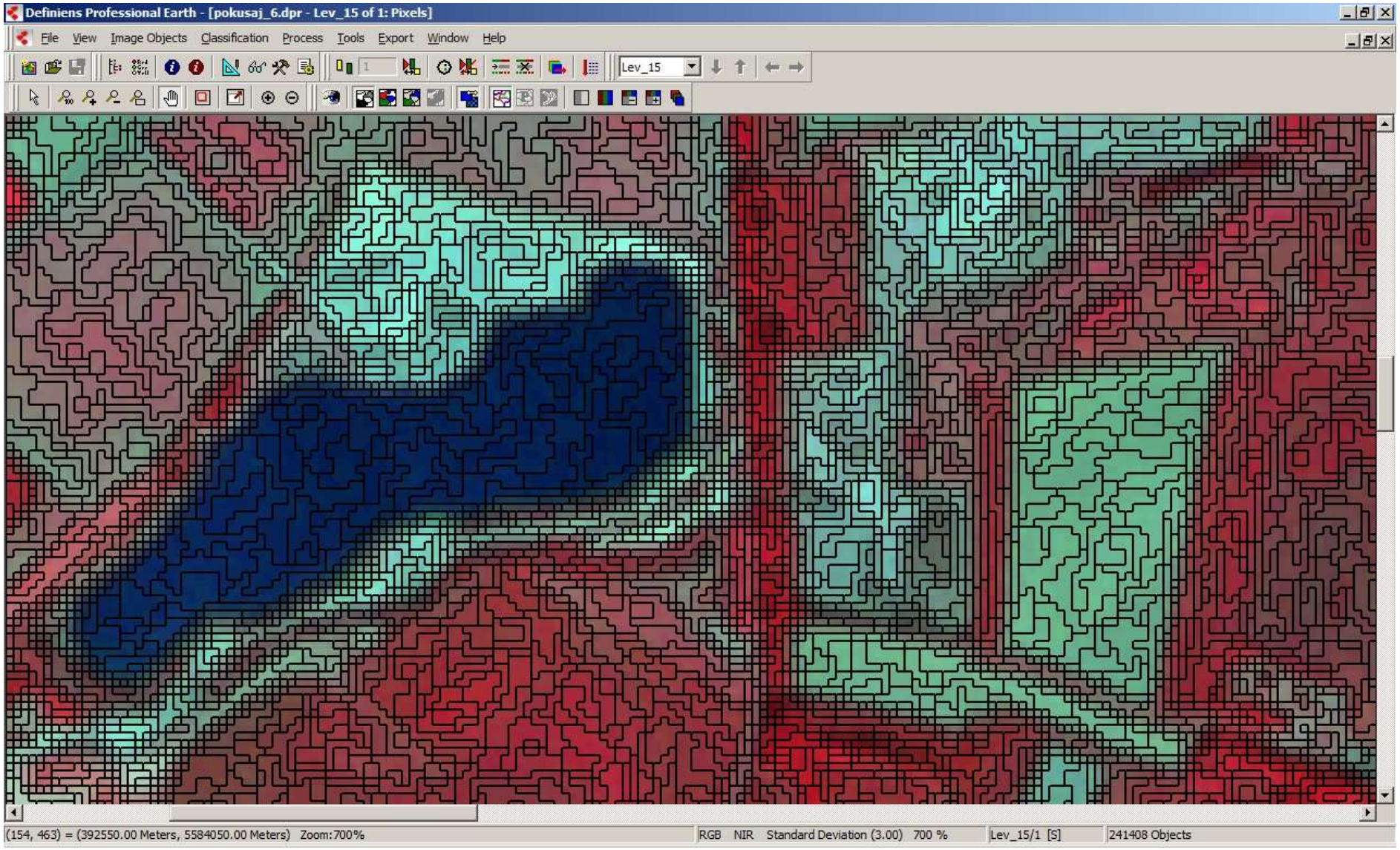


Source: Google Earth

4) Methodology

- image segmentation: converting image into multiple objects
- object defined as a grouping of pixels of similar spectral and spatial properties
- objects are primitives that form a scene
- can be used for image classification rather than pixels (Navulur, 2007)

4) Methodology



Source: Definiens AG, Definiens Professional 5

4) Methodology

- image segmentation based on parameters:
  - Scale: 15
  - Color: 0.9 (Shape: 0.1)
  - Compactness: 0.5 (Smoothness: 0.5)
- supervised classification performed by selecting numerous sample objects for five classes:
  - impervious surfaces (built up)
  - vegetation
  - water
  - soil
  - shadow

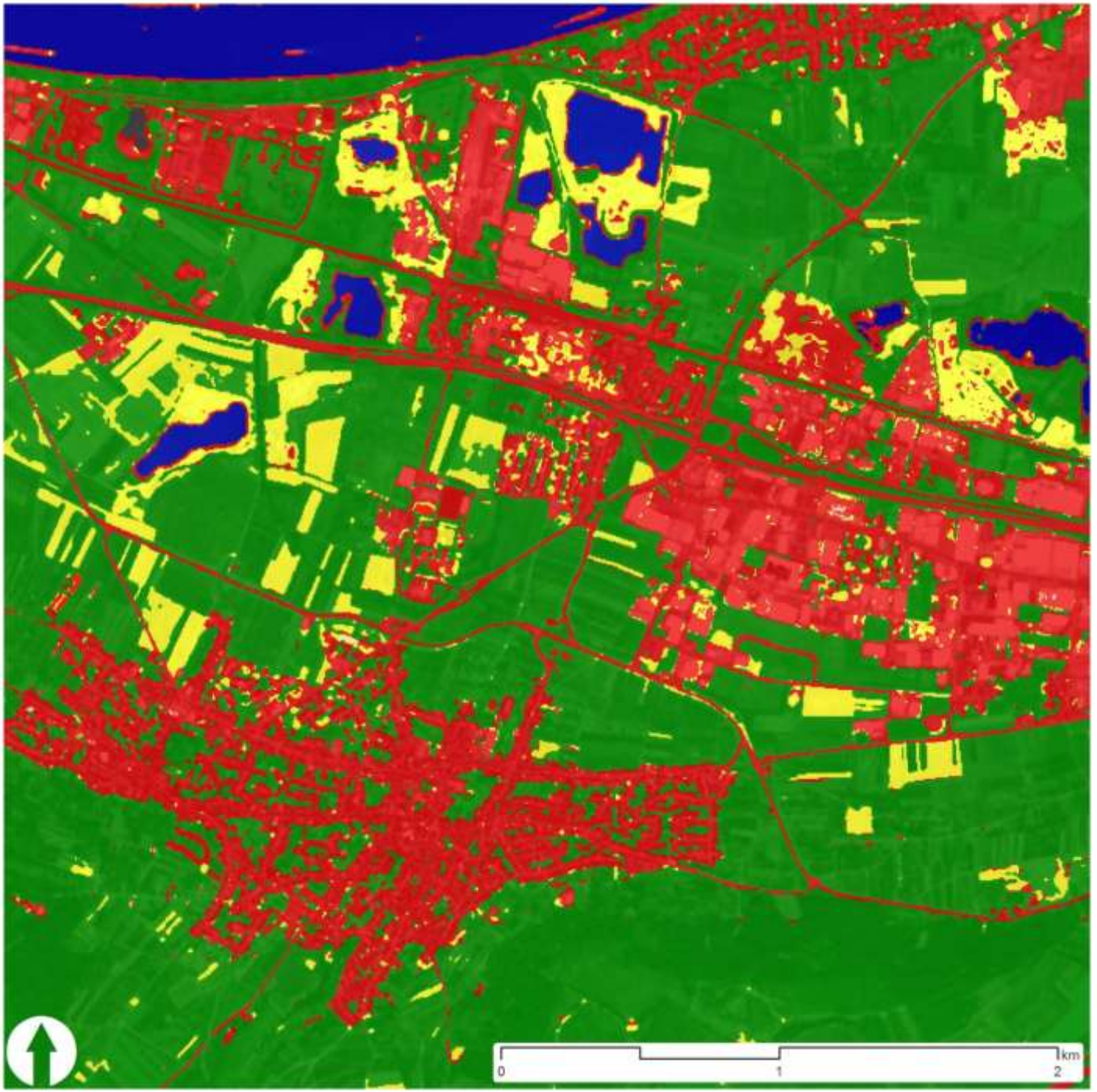
4) Methodology

- standard nearest neighbor classifier applied on all the land cover classes
- objects' mean values of all five original bands with the addition of brightness band and maximum difference band used in classification (Myint, Stow 2011)
- majority filter
- error matrix

5) Results

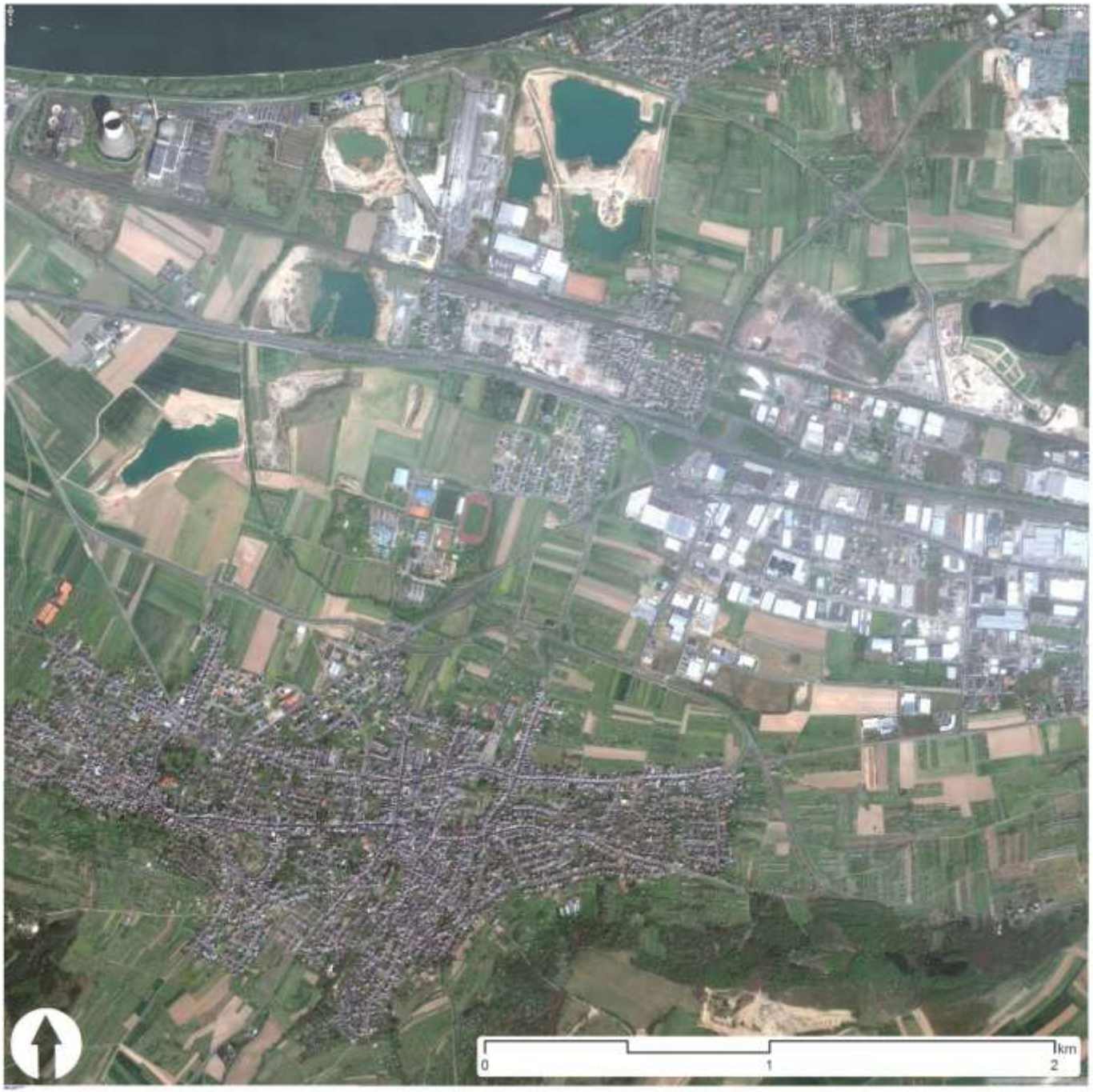
Thematic map

RED – impervious surfaces
GREEN – vegetation
BLUE – water
YELLOW – soil
GRAY - shadow



5) Results

Reference data for the Error matrix



Source: Google Earth

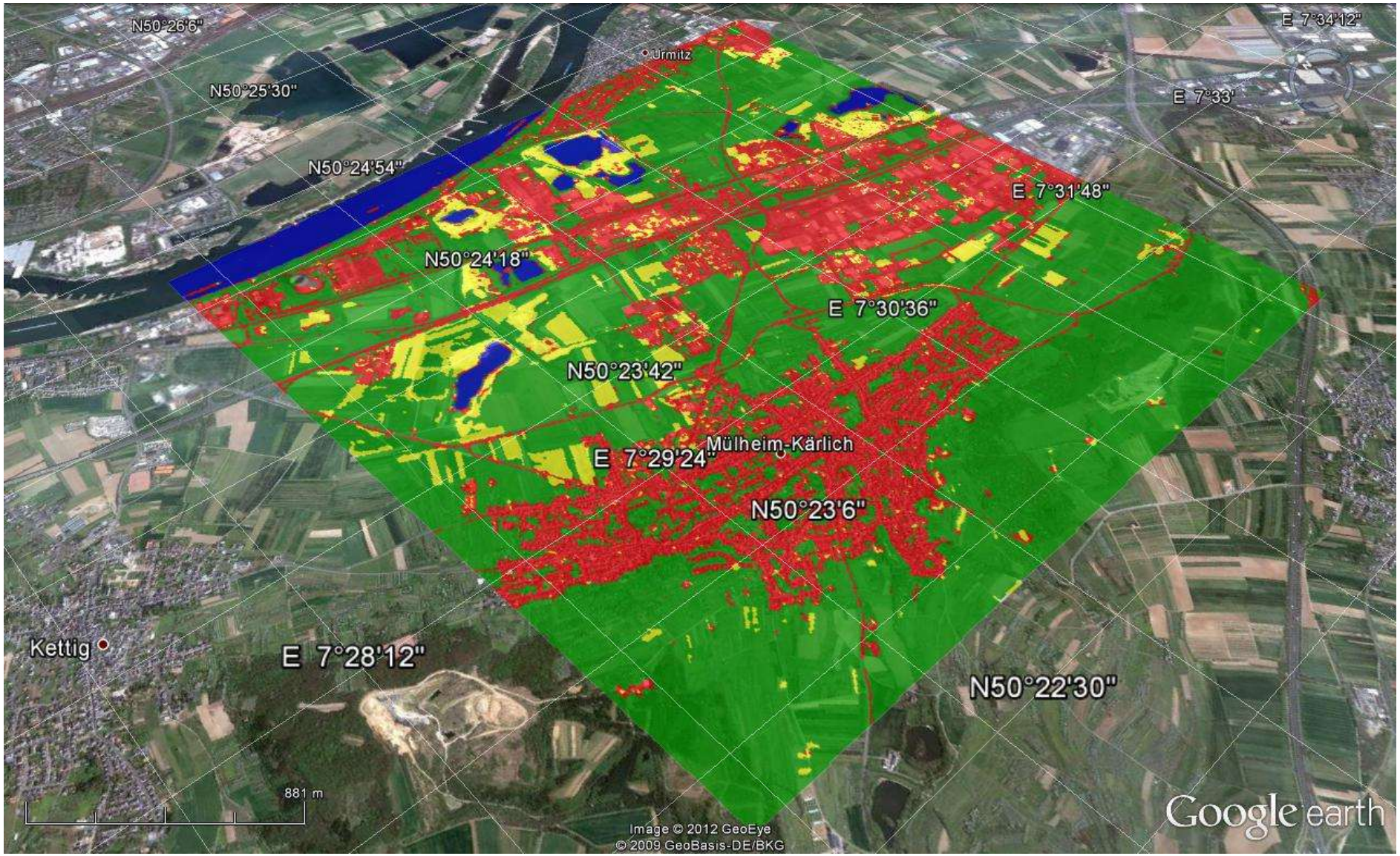
5) Results

Error matrix:
Overall Accuracy: 93.75%
Kappa Coefficient: 0.92

		Reference Data							
Classification Data		**IMP**	**SOIL**	**VEG**	**WAT**	**SHA**	**Total**	Producer's Accuracy (%)	User's Accuracy (%)
	IMP	**48**	1	0	1	0	50	96	96
	SOIL	2	**26**	2	0	0	30	89.66	86.67
	VEG	0	2	**59**	0	0	61	96.72	96.72
	WAT	0	0	0	**25**	0	25	86.21	100
	SHA	0	0	0	3	**7**	10	100	70
	Total	50	29	61	29	7	176		

5) Results

Thematic map overlayed in Google Earth application



6) Conclusion

- methodology and data used in this study seem to result with LULC classification suitable for thematic mapping of settlements' morphology and structure
- such data could be used as additional input for the differentiation of urban and rural settlements
- errors in classification impervious surfaces/soil and shadow/water are evident
- choice of more appropriate samples could lead to better results
- alternative approach is the development of rule sets for LULC classification

Thank you for your attention!