



## Urban Quarters –

Relevance of local urban neighborhoods for social, economic and environmental change

A GIS-based delineation and typology for local urban neighborhoods

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# Agenda

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- Research project and relevant terms
- Applied delineation and typology approach
- Examples of intermediate and final results
- Conclusion and possible applications

# Urban Quarters – a short overview



Publicly funded  
research project

2 (+2) years,  
started in  
January 2014

Interdisciplinary  
team working on  
6 sub-projects

**Energy efficiency of  
residential buildings**

**Stakeholders and  
local cooperation**

**Urban water  
management**

## URBAN QUARTERS

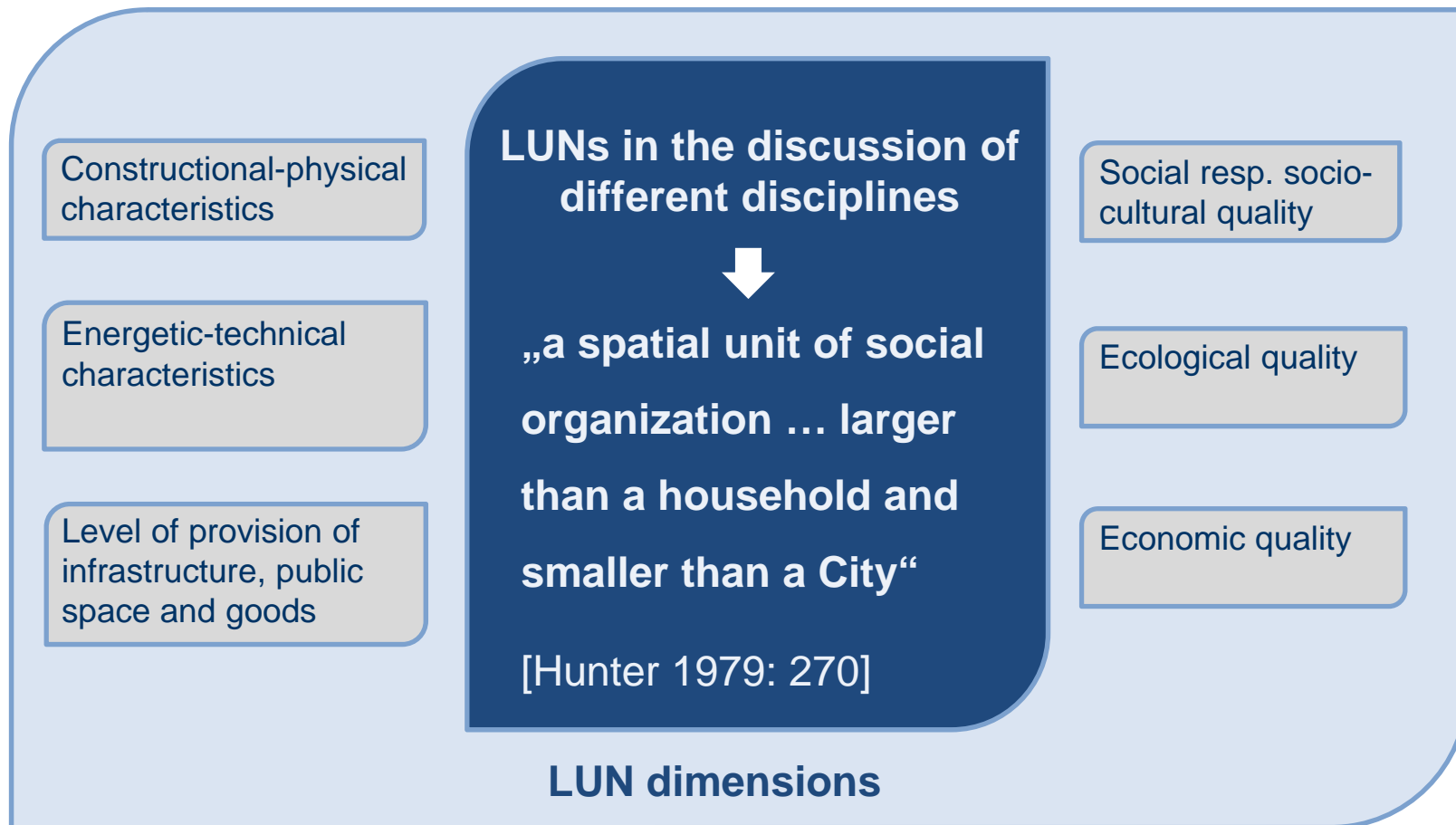
*Relevance of local urban  
neighborhoods for social,  
economic and  
environmental change*

**Social  
infrastructures**

**Cost-benefit  
analysis**

**LUN delineation  
and typology**

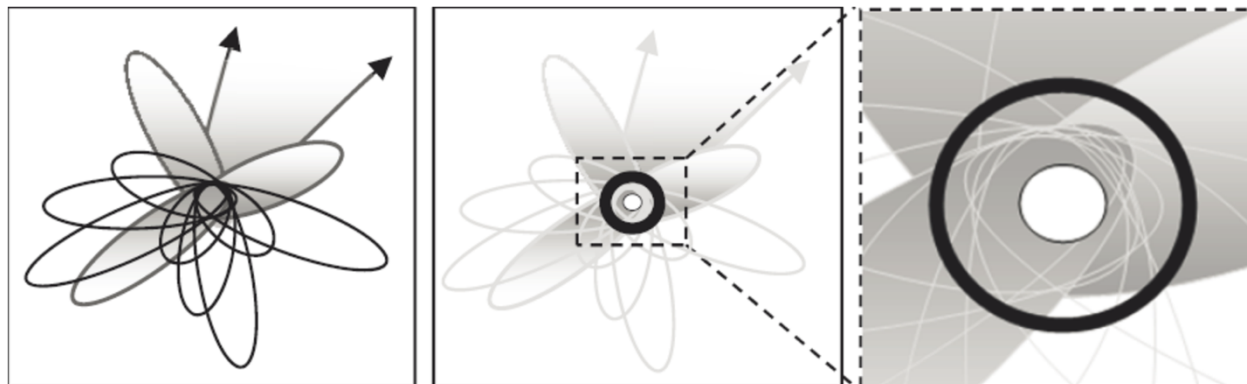
# A definition of the term local urban neighborhood (LUN)



# Key questions in a nutshell

- How can LUNs a) be demarcated according to definition and b) how can LUN types be defined?
- GIS-based automation?
- Requirements for data and methodology?
- Limits and challenges?
- Practical benefits?

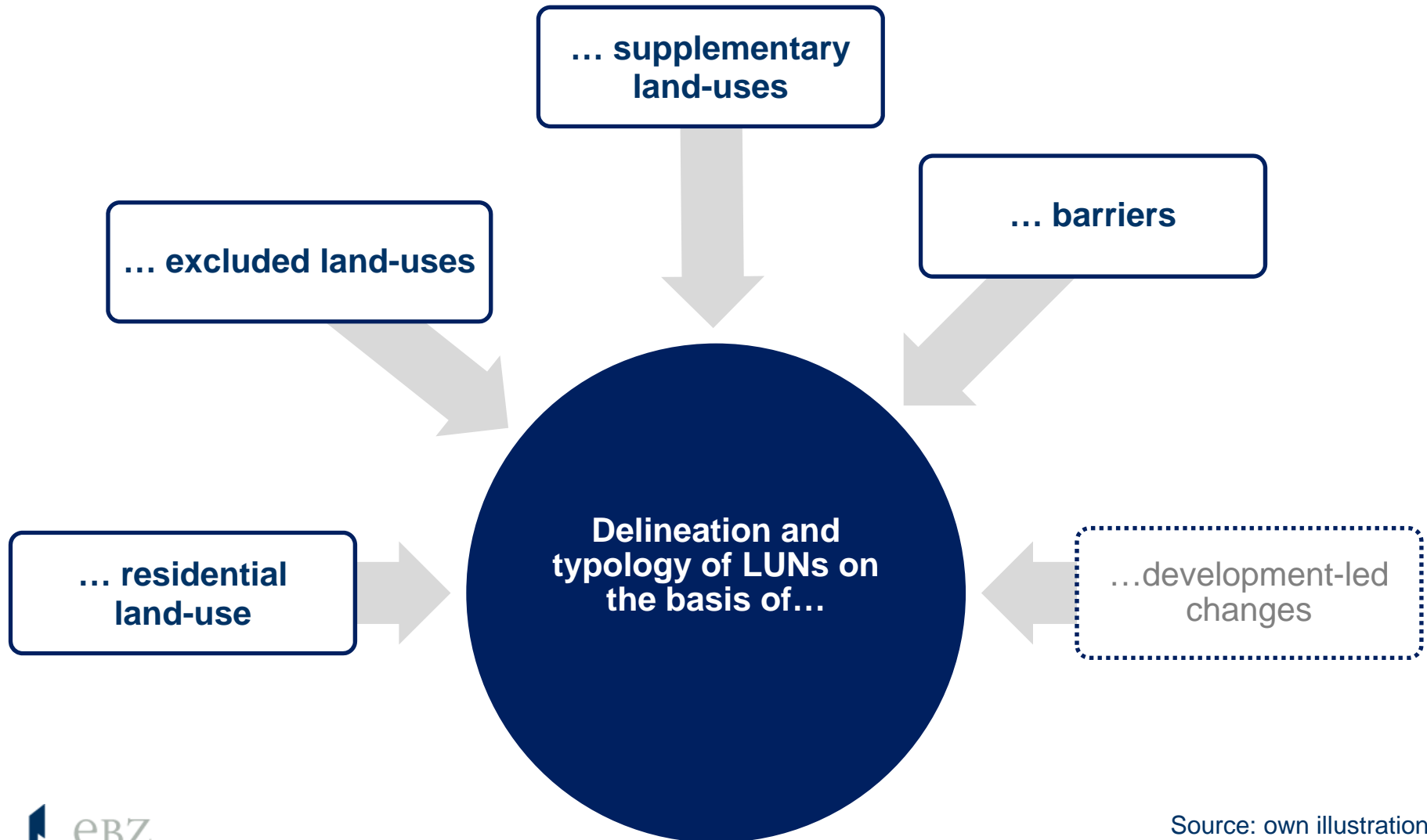
LUNs: a fuzzy concept



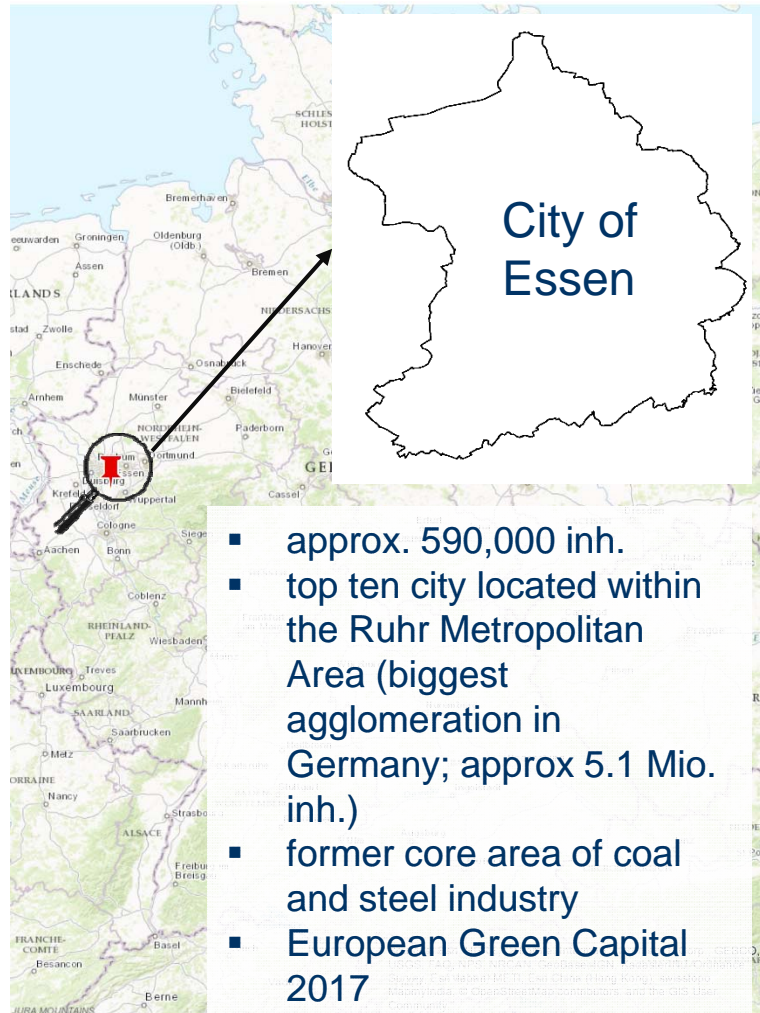
**Additionally  
include changes  
over time!**

Source: Schnur 2014: 44

# Relevant delineation factors



# Area of investigation and available spatial data



- approx. 590,000 inh.
- top ten city located within the Ruhr Metropolitan Area (biggest agglomeration in Germany; approx 5.1 Mio. inh.)
- former core area of coal and steel industry
- European Green Capital 2017

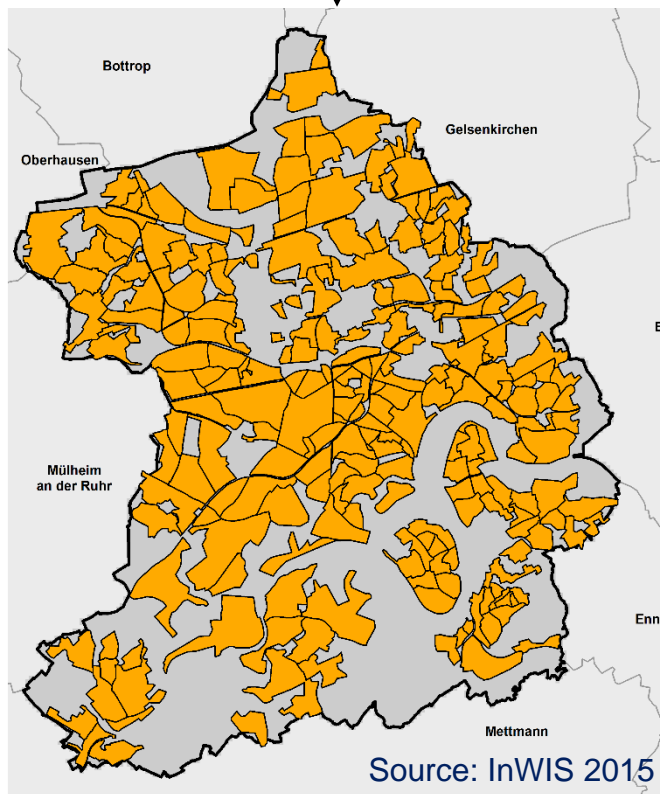
- Vector data of the official German geo-information system
  - buildings
  - parcels
  - land-use classes
  - roads
  - railways
  - water bodies
- Additional vector data
  - settlement typology
- Socio-economic data (point data)
  - population numbers incl. age
  - purchasing power
  - rental prices

# Delineation approaches



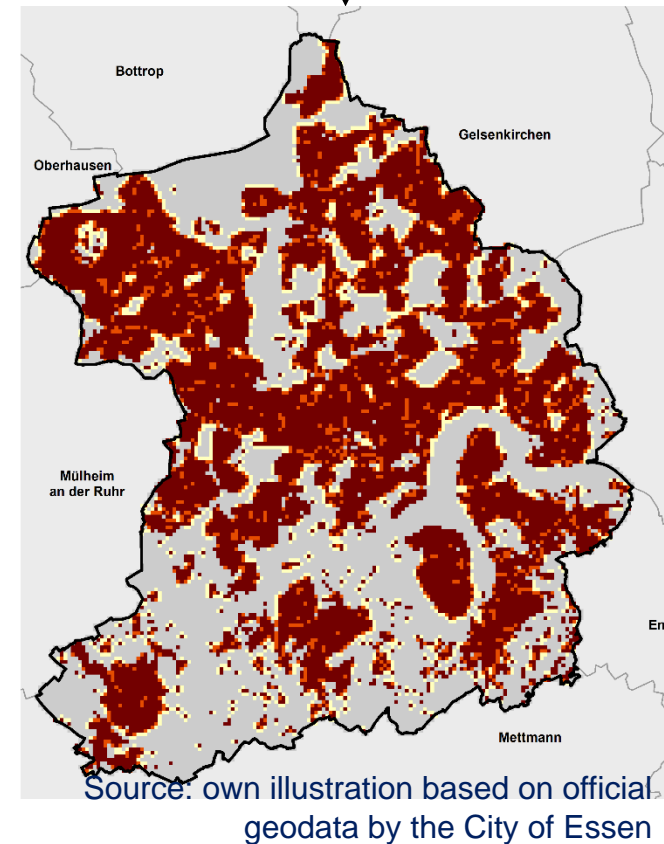
## Vector approach

- Aerial image interpretation
- Spatial base data



vs.

## Raster approach





# Pros and cons



## Vector approach

- + clearly defined spatial unit
- + common reference area
- + high spatial accuracy on the basis of a given urban environment

- multiple dimensions of LUNs hard to map
- rigid boundary:
- only reflection of a certain point in time
  - issue-specific focus of a study or a project

## Raster approach

- + spatial unit with equal reference areas
- + independent from fixed administrative boundaries
- + high thematic and temporal flexibility
- + multiple demarcation options
- + fast data processing

- abstraction of the given urban circumstances
- useful demarcations highly dependend on data and indicators

→ Finally applied a 100x100m raster approach



**Energy efficiency of residential buildings**

**Stakeholders and local cooperation**

**Urban water management**



**Social infrastructures**

**Cost-benefit analysis**

**LUN delineation and typology**

# Textual approach



		High potential for investment		Low potential for investment	
		Availability of waterbodies	No availability of waterbodies	Availability of waterbodies	No availability of waterbodies
High potential for energy-saving measures	High variety of land-uses	Dark Green	Dark Green	Dark Green	Light Green
	Low variety of land-uses	Dark Green	Light Green	Light Green	Light Green
Low potential for energy-saving measures	High variety of land-uses	Dark Green	Light Green	Light Green	Light Green
	Low variety of land-uses	Light Green	Light Green	Light Green	Grey

Methodology based on OECD 2008

# Valuation standard: Selection of indicators

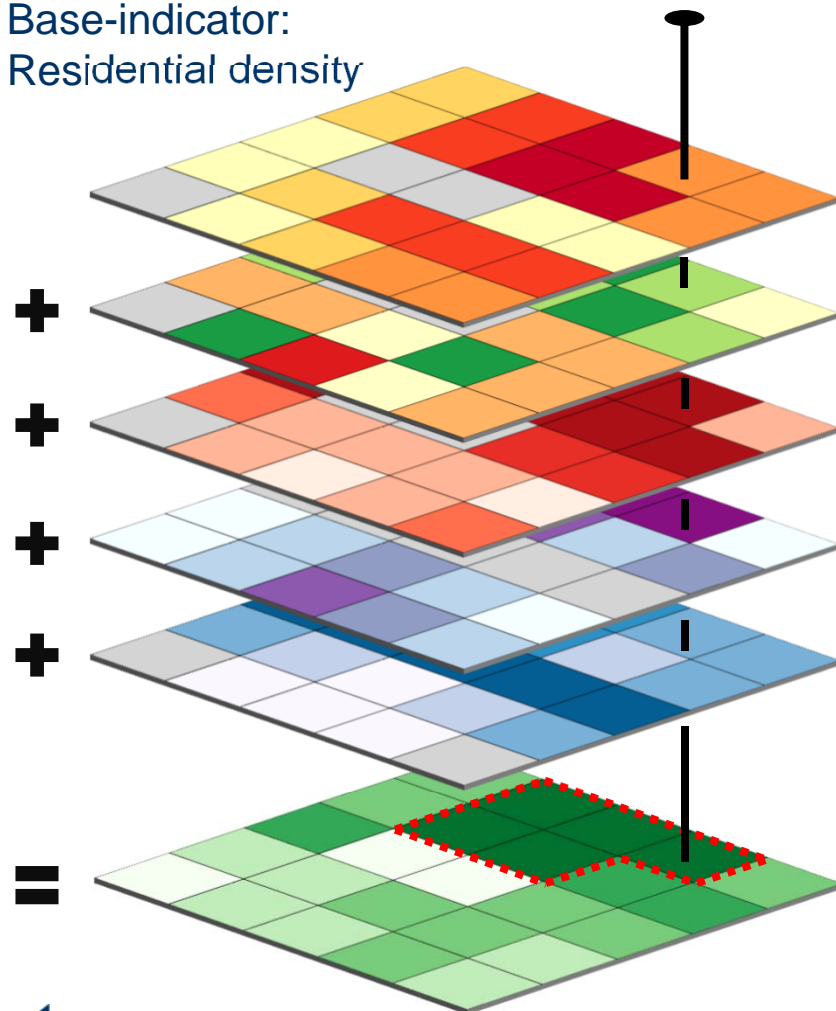


Sources: <http://thefinancialbrand.com/wp-content/uploads/2009/05/hsbc-old-car.jpg>;  
[http://24.media.tumblr.com/tumblr\\_m68ectFfpD1qe7mxjo1\\_500.jpg](http://24.media.tumblr.com/tumblr_m68ectFfpD1qe7mxjo1_500.jpg)

# Spatial approach



Base-indicator:  
Residential density



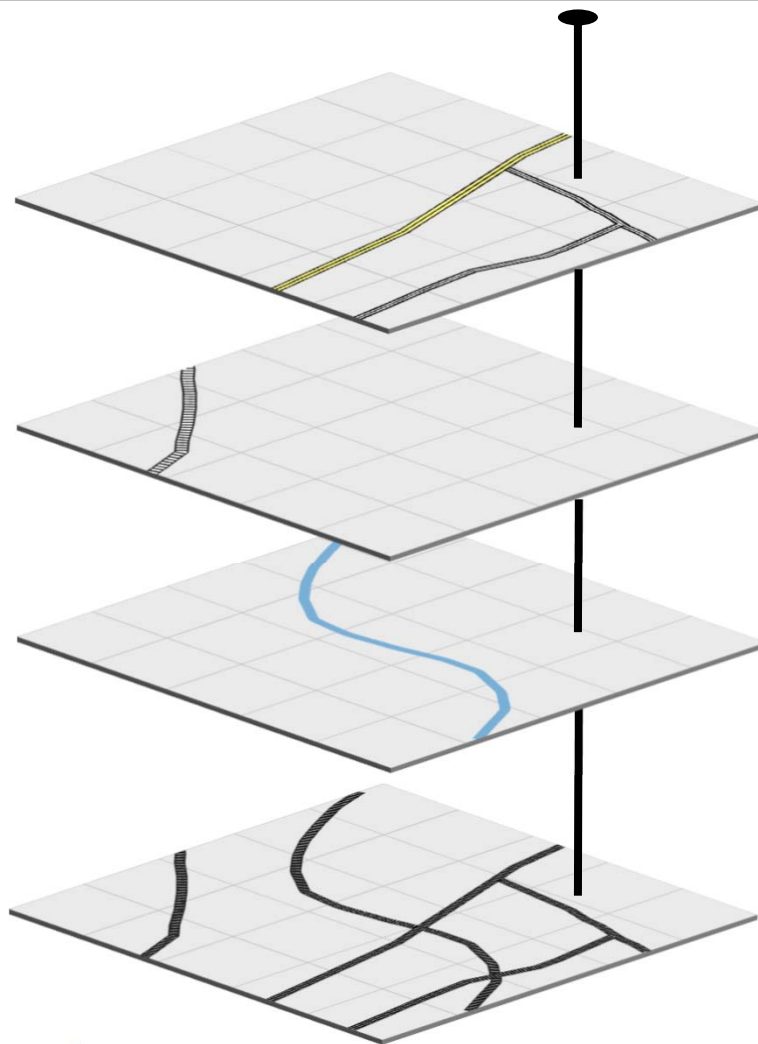
Source: own illustration

		High potential for investment		Low potential for investment	
		Availability of waterbodies	No availability of waterbodies	Availability of waterbodies	No availability of waterbodies
High potential for energy-saving measures	High variety of land-uses				
	Low variety of land-uses				
Low potential for energy-saving measures	High variety of land-uses				
	Low variety of land-uses				

- (1) Data value attribution: spatial join of point input data to polygon cells
- (2) Feature to raster
- (3) Raster calculator: min-max normalization (0-1) and raster combination
- (4) Raster to polygon: **relevant LUN areas!**



# Barriers



Main roads with barrier effect on people

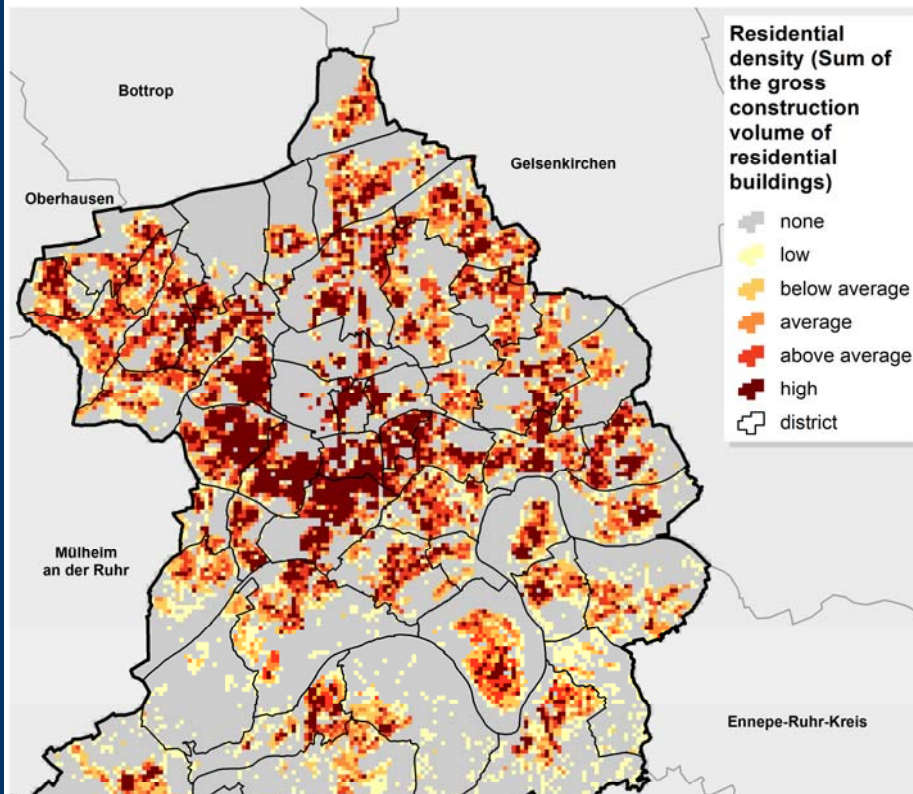
Railways

Rivers

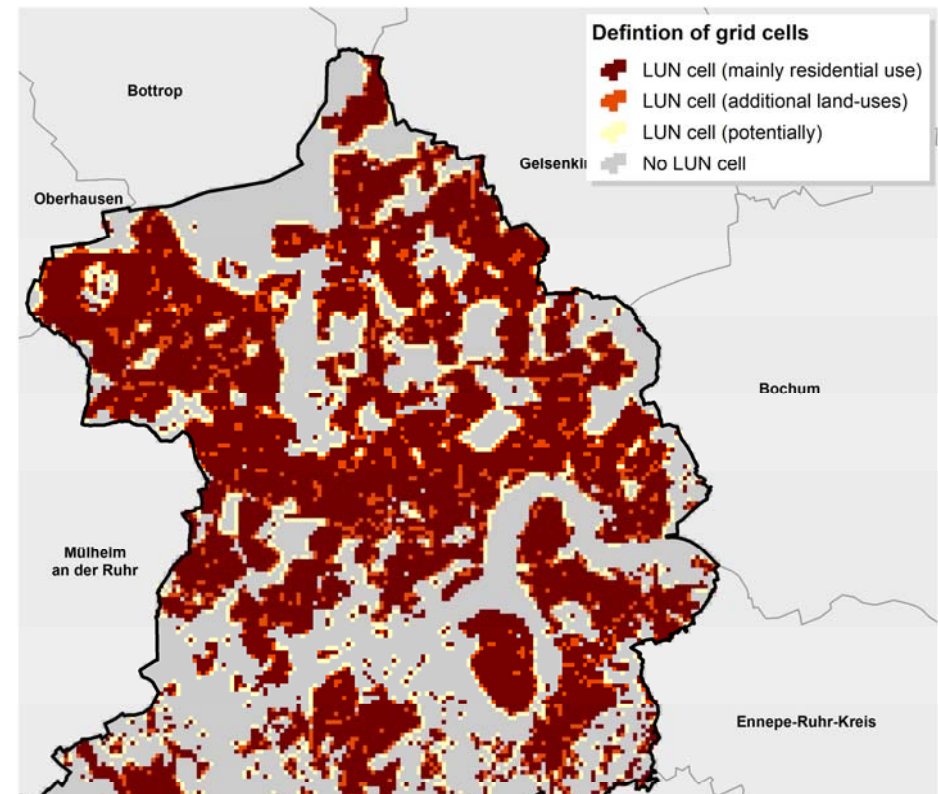
Merged barriers

- Identified using python in combination with R
- Segmentation of centerlines into equal parts
  - Perpendicular lines
  - Statistical analysis for plausible street widths
  - Average street widths based on street IDs
  - Combination with congestion

# Base indicator and LUN areas



Using the R-bridge for data reclassification to find typical residential density classes within the City of Essen

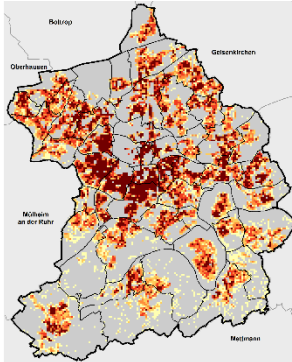


Python script including a rule-based algorithm to add supplementary land-uses and potential LUN cells

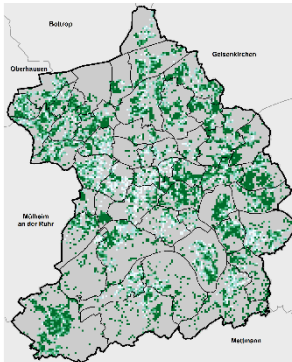
# Exemplary indicator: Potential for energy-saving measures



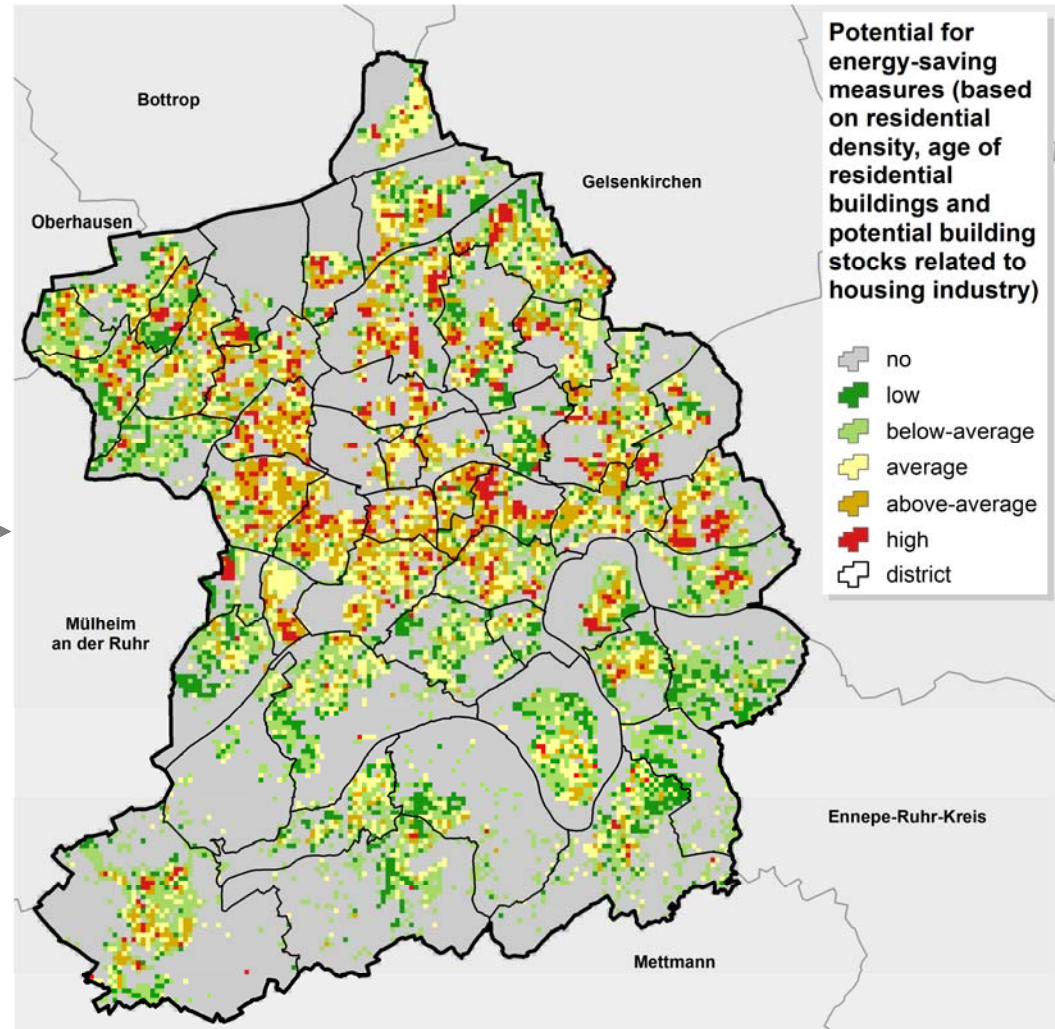
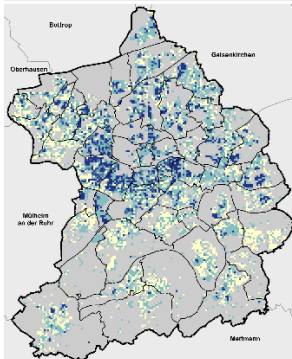
Residential Density



Share of residential buildings with potential for energy-saving measures



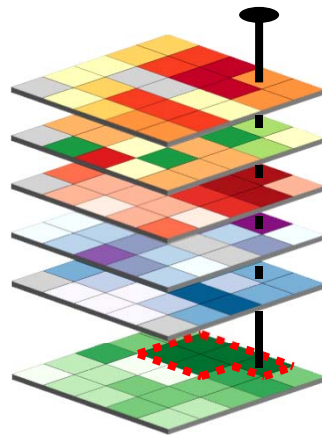
Potential proportion of building stocks related to housing industry



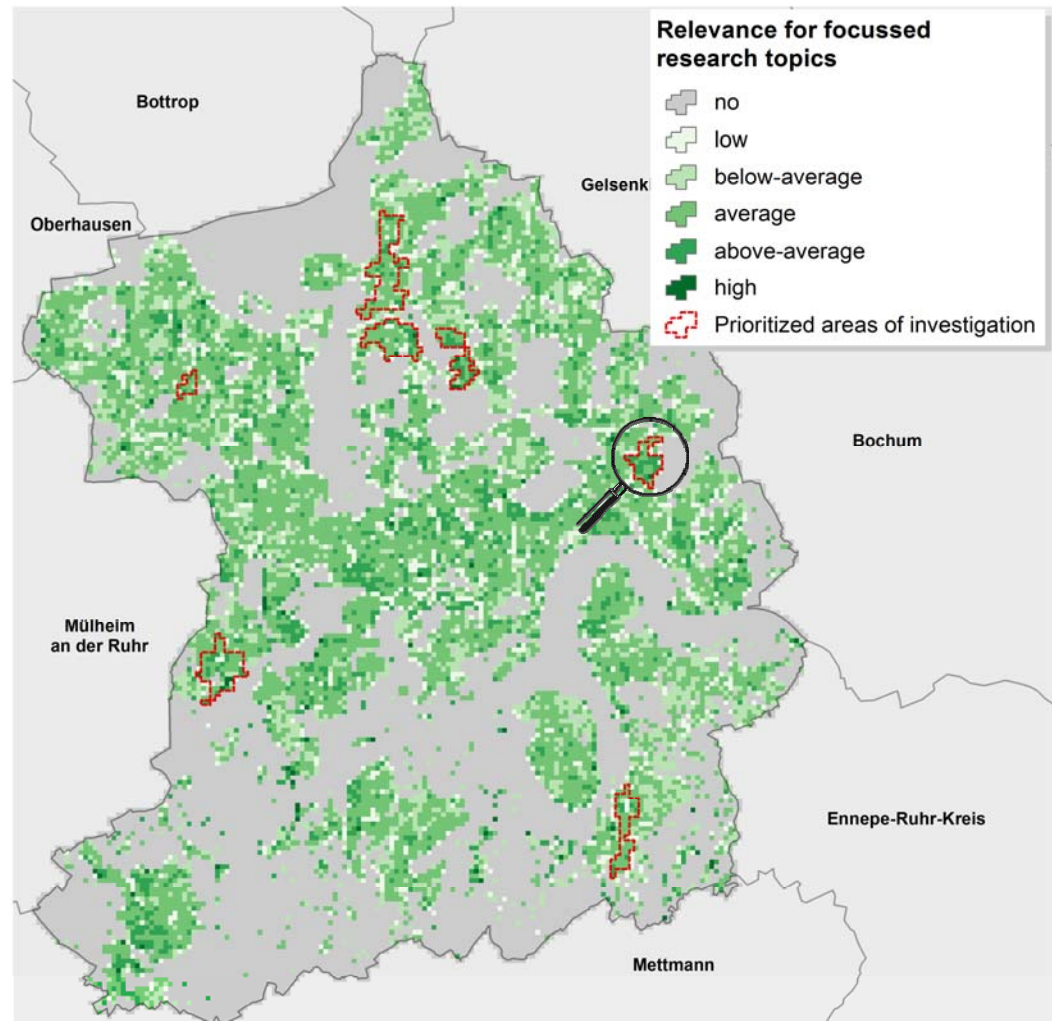
Source: own illustrations based on official geodata by the City of Essen



# Relevant LUNs for the research focus?



- Further analysis of the combined raster necessary!
- Eight prioritized areas were identified.
- Detailed analysis for those areas follow...



Source: own illustration based on official geodata by the City of Essen

# A glimpse at one prioritized area



# Conclusion and possible applications

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- Flexible tool for local spatial analysis and assessment
  - Transparent
  - Data privacy compliant
  - Automated related to the main processing steps
  - Reproducible
  - Expandable
  
- Identification of local issue-specific and cross-sector relevant areas
  
- Derivation of recommendations for fields of action and policy-makers
  
- Fine-grained and cross-sector spatial monitoring
  
- Evaluation and success monitoring for projects and measures
  
- Management of subsidy policy and funding priorities





**Thank you for your attention!**

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# Sources



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- Hunter, Albert (1979): The Urban Neighbourhood: Its Analytical and Social Contexts, in: Urban Affairs Review, Jg. 14, H. 3, S. 267-288
- InWIS (2015): See for instance [http://www.energiewende-ruhr.de/fileadmin/dokumente/Downloads/Vortraege/Vortraege\\_Zwischenkonferenz/Session\\_VI/Session\\_VI\\_Neitzel.pdf](http://www.energiewende-ruhr.de/fileadmin/dokumente/Downloads/Vortraege/Vortraege_Zwischenkonferenz/Session_VI/Session_VI_Neitzel.pdf)
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