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Cellular Automata (CA) Approach for Medium Sized Cities

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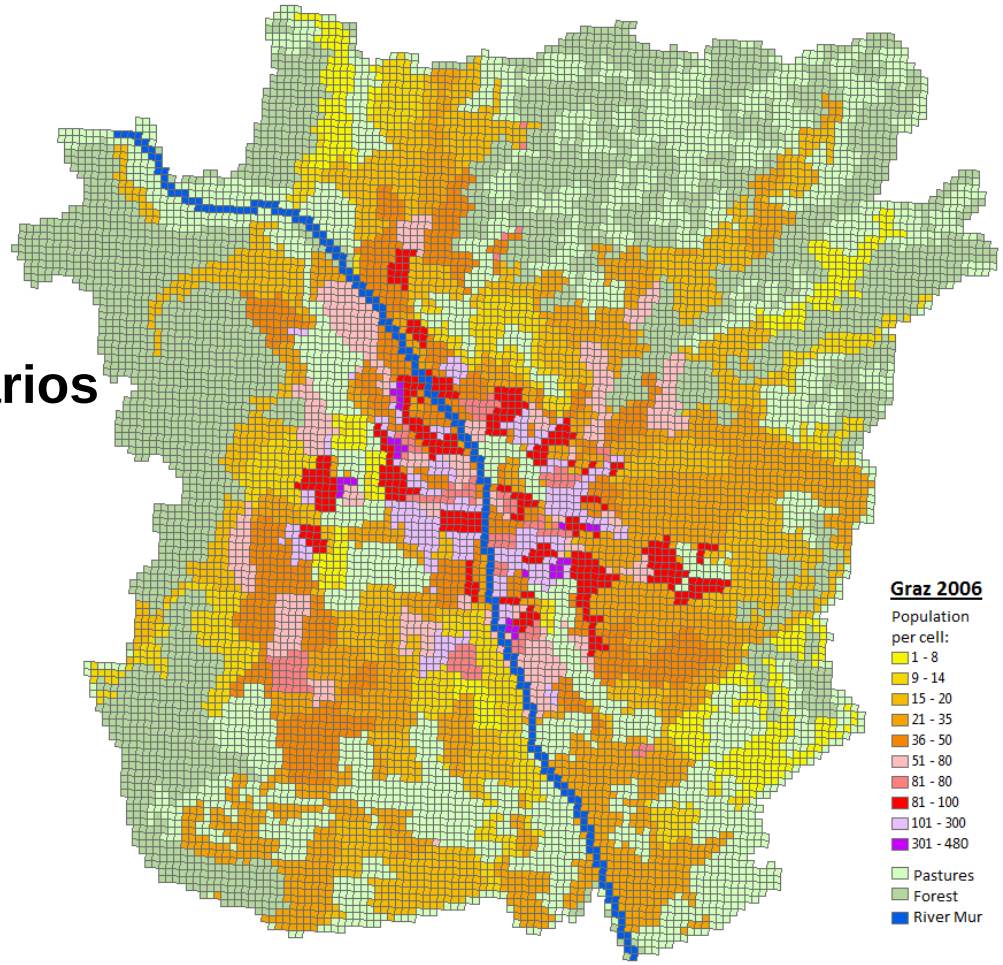
What do we do?

- **We use land use data and population data**
  - per cell (100m x 100m)
- **We develop CA model**
  - to illustrate result of location choice based on certain assumptions (population and land use)
- **We analyse 5 different scenarios**
  - to represent socio-economic trends
  - to integrate decisions of city planning commission
- **Capacity checks**
  - e.g. public transport
  - Sewage capacities
  - Integration of zoning rules
  - Optimal school location



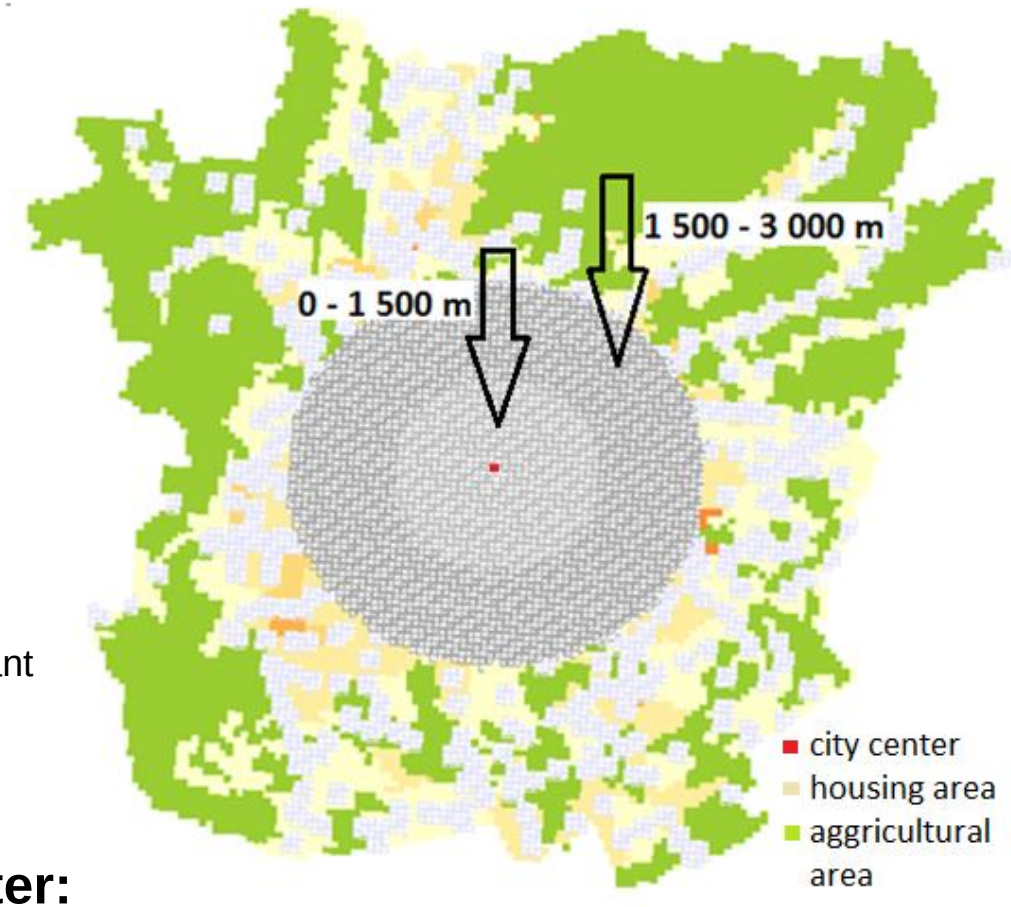
CA model

Structure of the model:

- Cells
- States
- Neighbourhoods
- Transition rules

Model assumptions:

- Closeness to city center is attractive
- Public transport connections are important
- Monocentric city model



3 regions round the city center:

- 1 500 m: maximal walking of 20 minutes to city center
- 3 000 m: easy cycling distance and good transport connection
- > 3 000 m: peripheral regions – except if good public transport connection to city center

Why cellular automata?

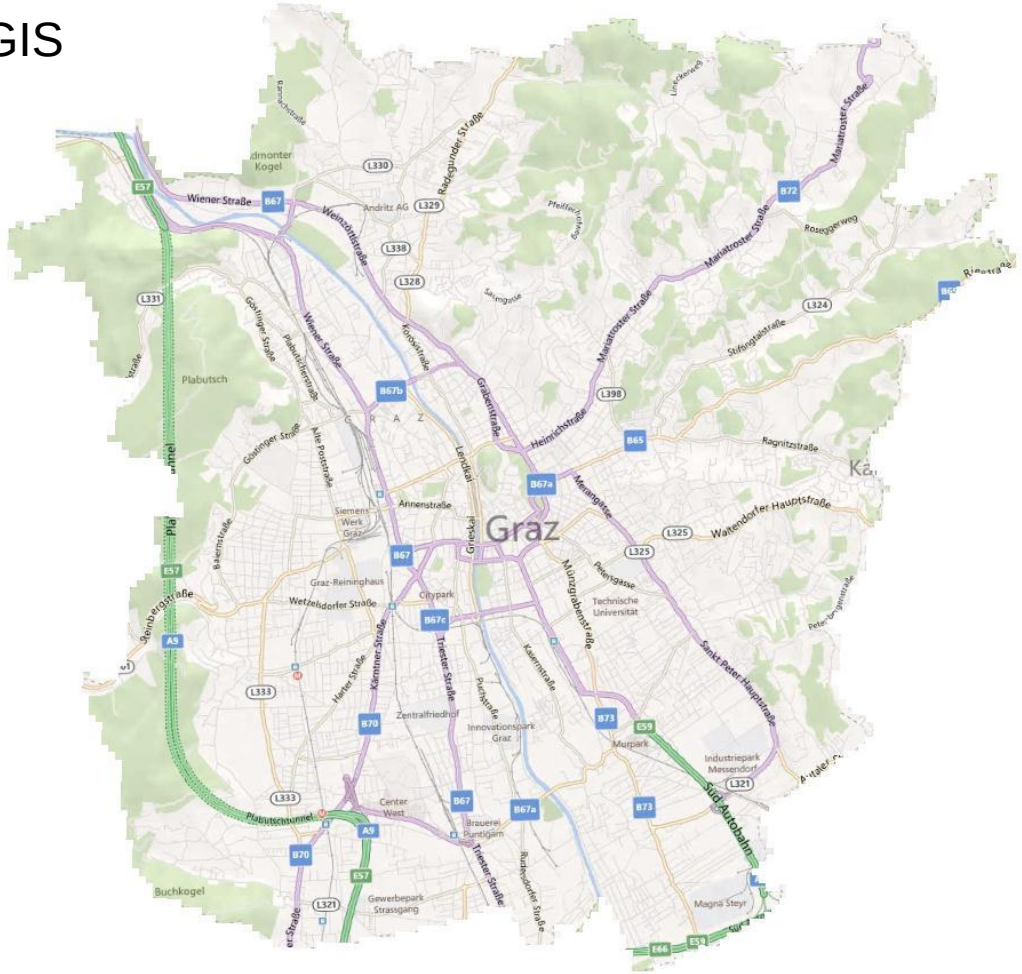
- Natural model for GIS data
- Data easy to aggregate
- Very flexible
- Intuitive, fast and economical representation
- Can compare different scenarios
- Can incorporate city planner or political “visions”
- Freedom to override past trends
- Evaluate existing planning restrictions and zoning rules
- Many applications possible

Characterisation of Scenarios

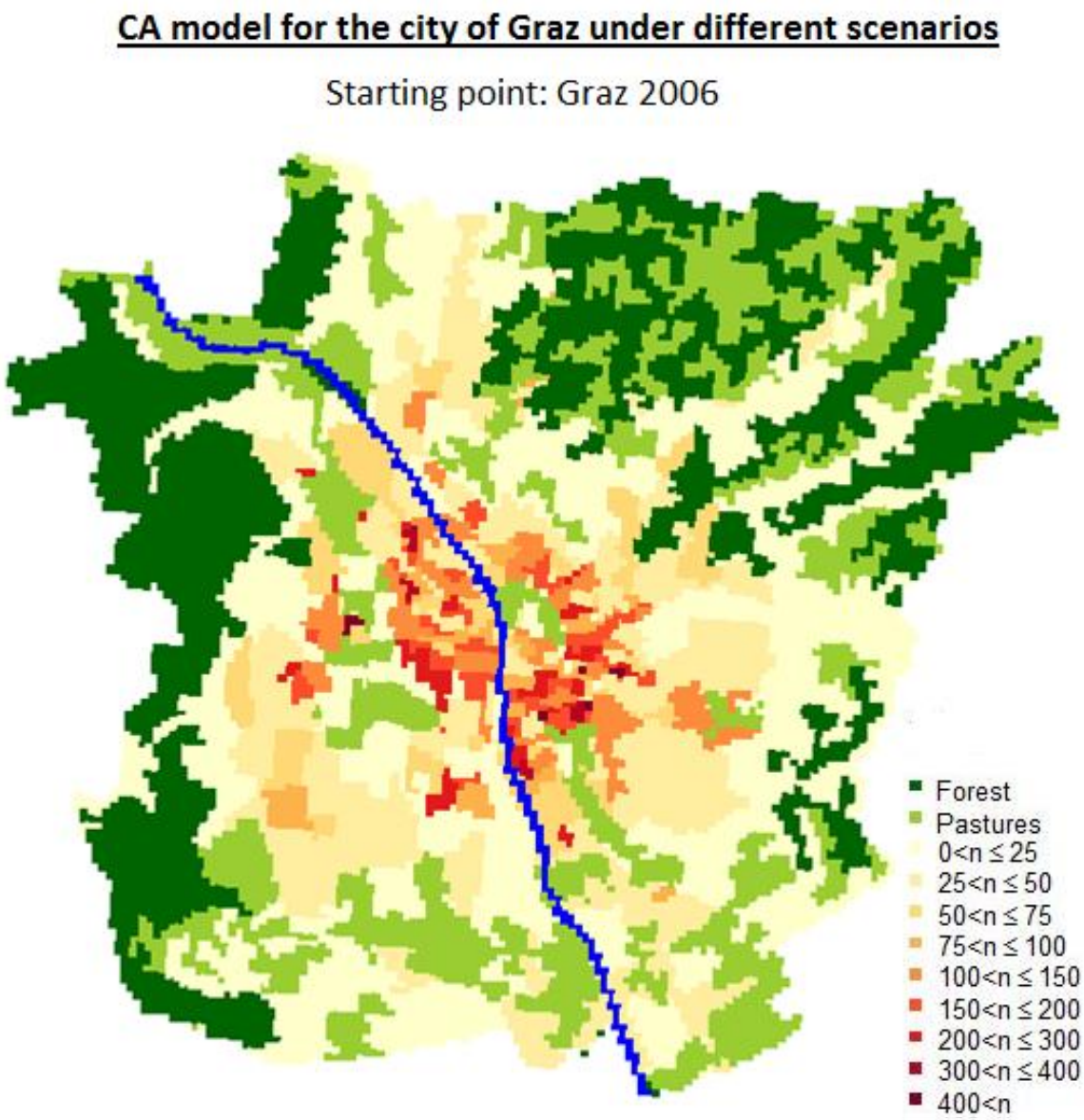
Scenario 1	fast population growth
Scenario 2	slow population growth
Scenario 3	socioeconomic preference for one part of the city
Scenario 4	population growth centred on the city's special development areas
Scenario 5	urban sprawl

Data input

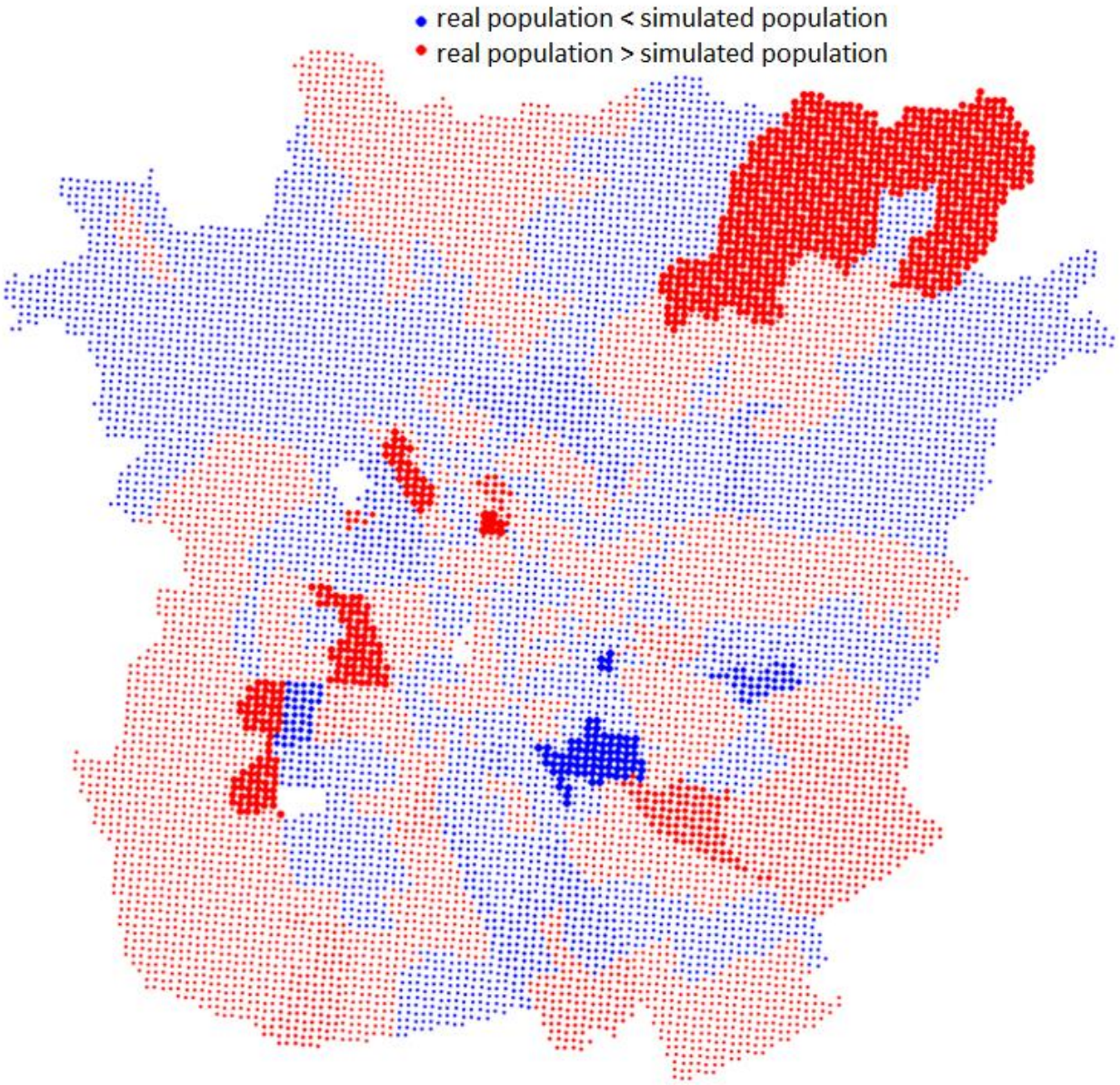
- Population per cell
- Corine Land Cover Data (2006) - GIS
  - 53% covered by CLC classes 1 or 2
- Public transport stops – GIS
- All major roads out of the city center – GIS
- Distance to the city center
- Distance to public transport stops
- River Mur – GIS



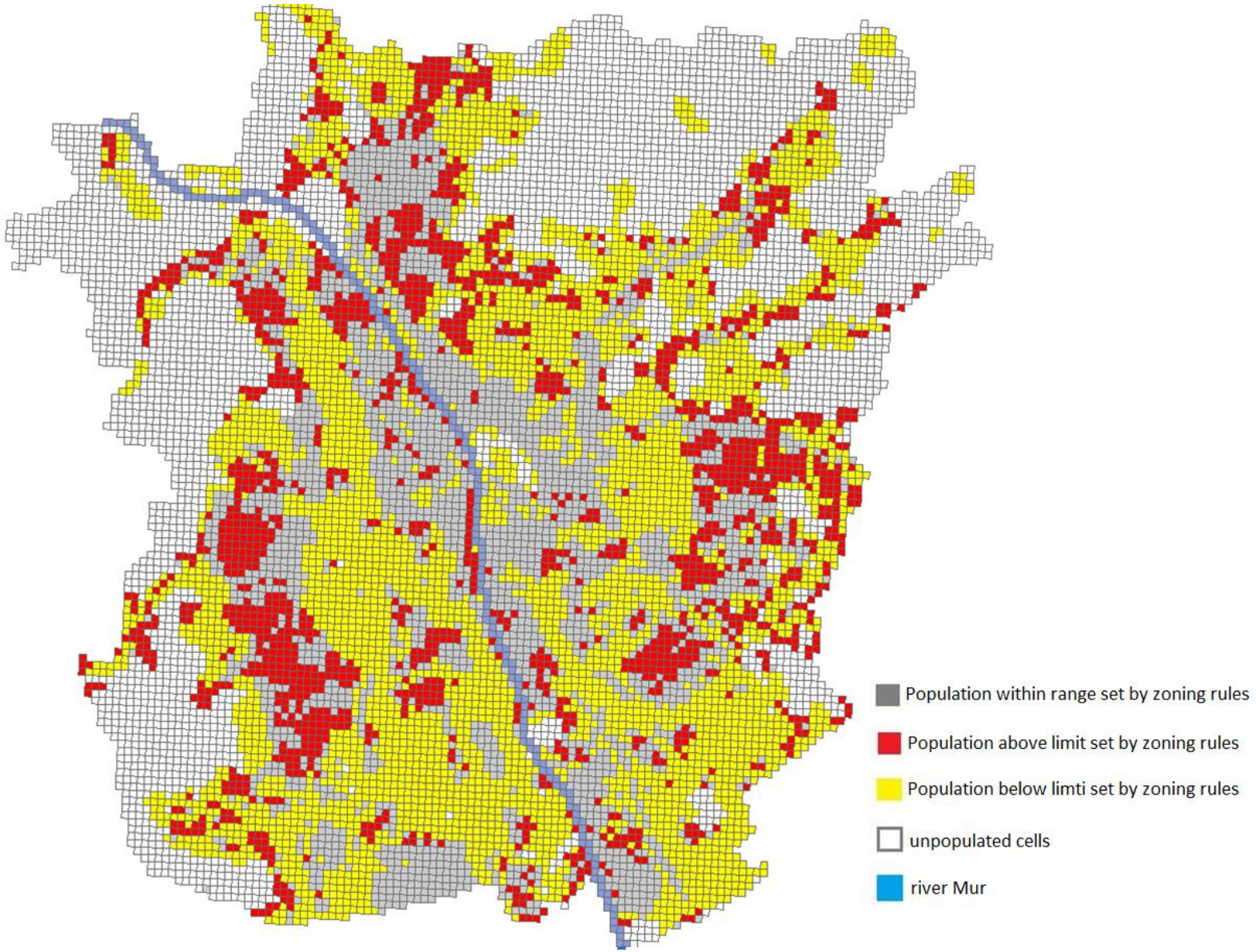
Simulation


CA model for the city of Graz under different scenarios
Starting point: Graz 2006
Forest
Pastures
0<n ≤ 25
25<n ≤ 50
50<n ≤ 75
75<n ≤ 100
100<n ≤ 150
150<n ≤ 200
200<n ≤ 300
300<n ≤ 400
400<n

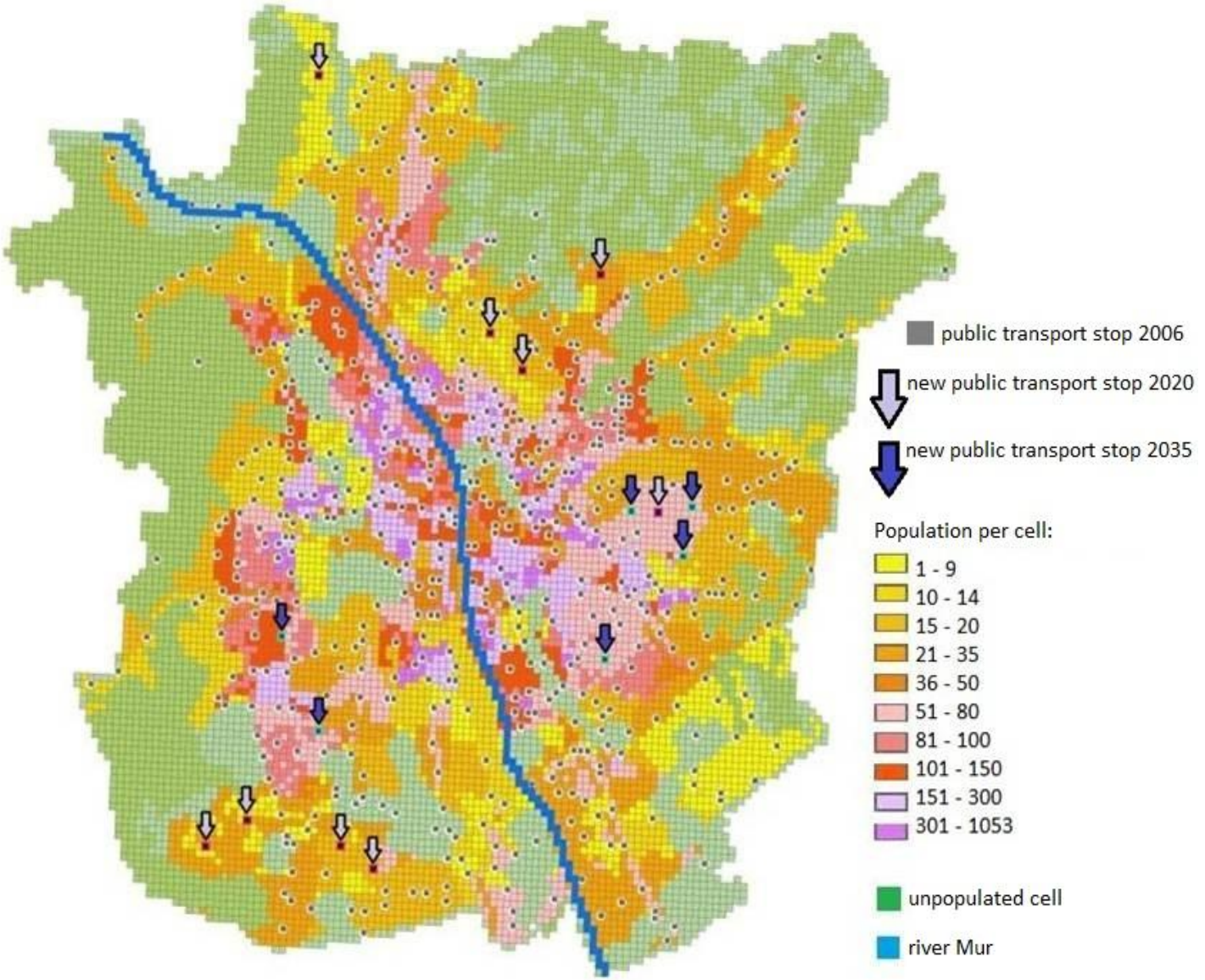
Application 1: Scenario Evaluation (Scenario 2)



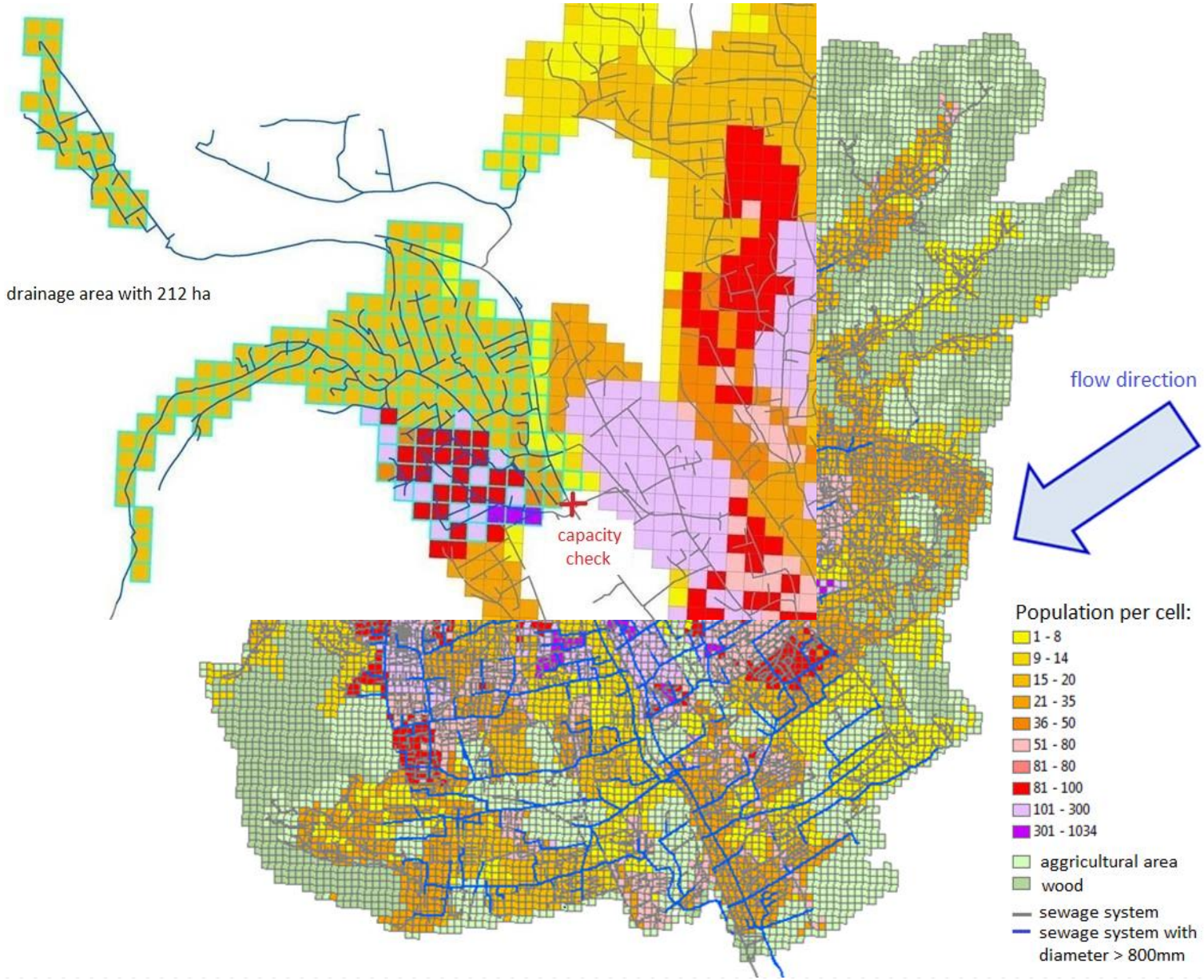
Application 2:
Ex-post building density evaluation (Scenario 5)



Application 3: Dynamic transport stops (Scenario 1)



Application 4: Sewage capacity evaluation (Scenario 1)



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