DigitalWorld 2023 Congress

The Fifteenth International Conference on Advanced Geographic Information Systems, Applications, and Services

Venice, Italy, April 24-28, 2023

Identifying and Visualizing older Single-Family House Areas for a Sustainable Spatial Planning

Dominik Visca, Max Hoppe, Kevin Kaminski, Pascal Neis

Department of Technology, Mainz University of Applied Sciences, Mainz, Germany
Contact email: max.hoppe@hs-mainz.de

Dominik Visca received his master`s degree in Geoinformatics from the Mainz University of Applied Sciences, Germany in 2021. He is currently a research associate working in the project RAFVINIERT at the University of Applied Sciences Mainz focusing on data processing and information tools for spatial planning. His research interests include digitization, open data as well as spatial data infrastructures and geo-government.

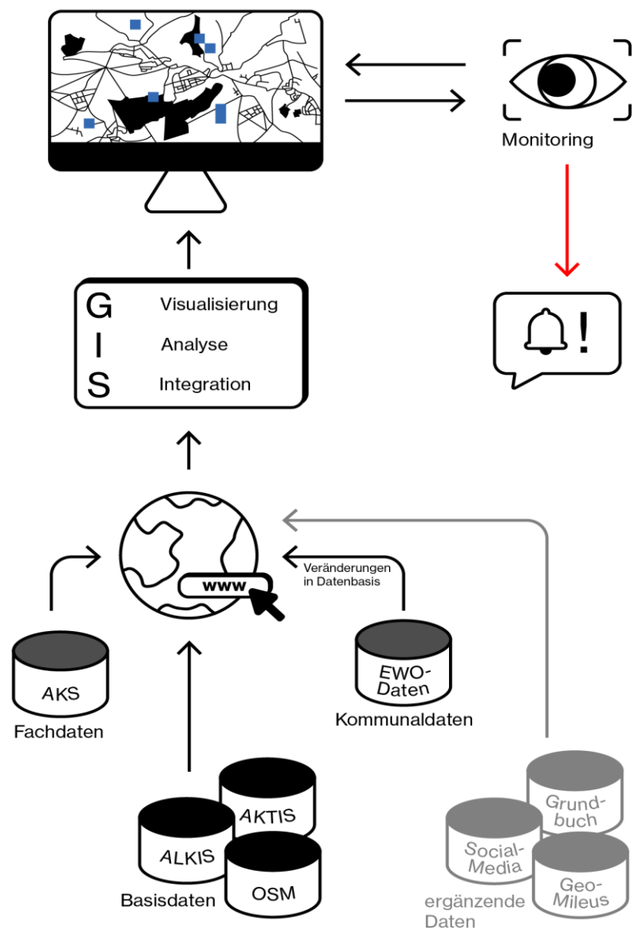
Max Hoppe received his master`s degree in Human Geography from the Johannes Gutenberg University Mainz, Germany in 2018. He is currently a research associate working in the project RAFVINIERT at the University of Applied Sciences Mainz focusing on transfer and communication with project partners. His research interests include new governance arrangements in rural areas due to processes of the digital transformation.

Kevin Kaminski received his master`s degree in Human Geography from the Johannes Gutenberg University Mainz, Germany in 2014. He is currently a research associate working in the project RAFVINIERT at the University of Applied Sciences Mainz focused on the modeling of suitable indicators for questions of demographic aging processes and generational change in single-family residential areas. His research interests include Smart Village arrangements and qualitative geoinformatics.

Prof. Dr. rer. nat. Pacal Neis was appointed as Endowed Professor for Geo-Government at Mainz University of Applied Sciences in the winter semester of 2018. For some years now, the digital workflows of administrative processes at the national or even European level have been influencing administrative actions more and more. Professor Neis' research is dedicated to these challenges and takes place on different levels. In addition to emerging issues and opportunities around Open Government, current and forward-looking topics such as Open Data in the context of Geo-Government will be addressed in particular.

RAFVINIERT

Raumintelligenz für die integrierte Versorgung von Seniorinnen und Senioren in ländlichen Quartieren



RAFVINIERT: Spatial intelligence for the integrated care of senior citizens in rural neighborhoods

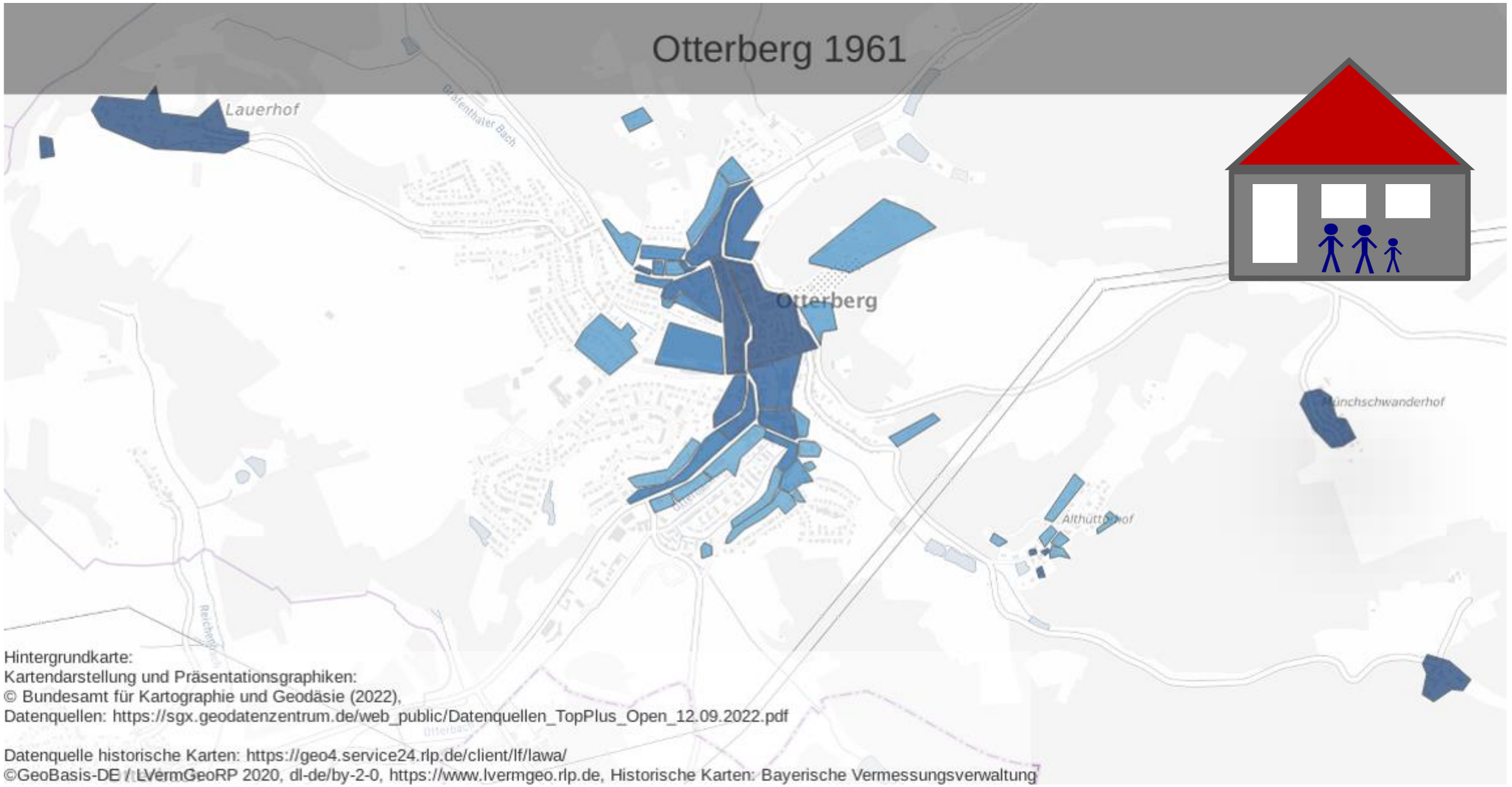
Goal: Tools for small-scale monitoring of single-family neighborhoods with regard to demographic shifts and supply planning based on these processes

Precondition: Identification & integration of heterogeneous data and relevant indicators

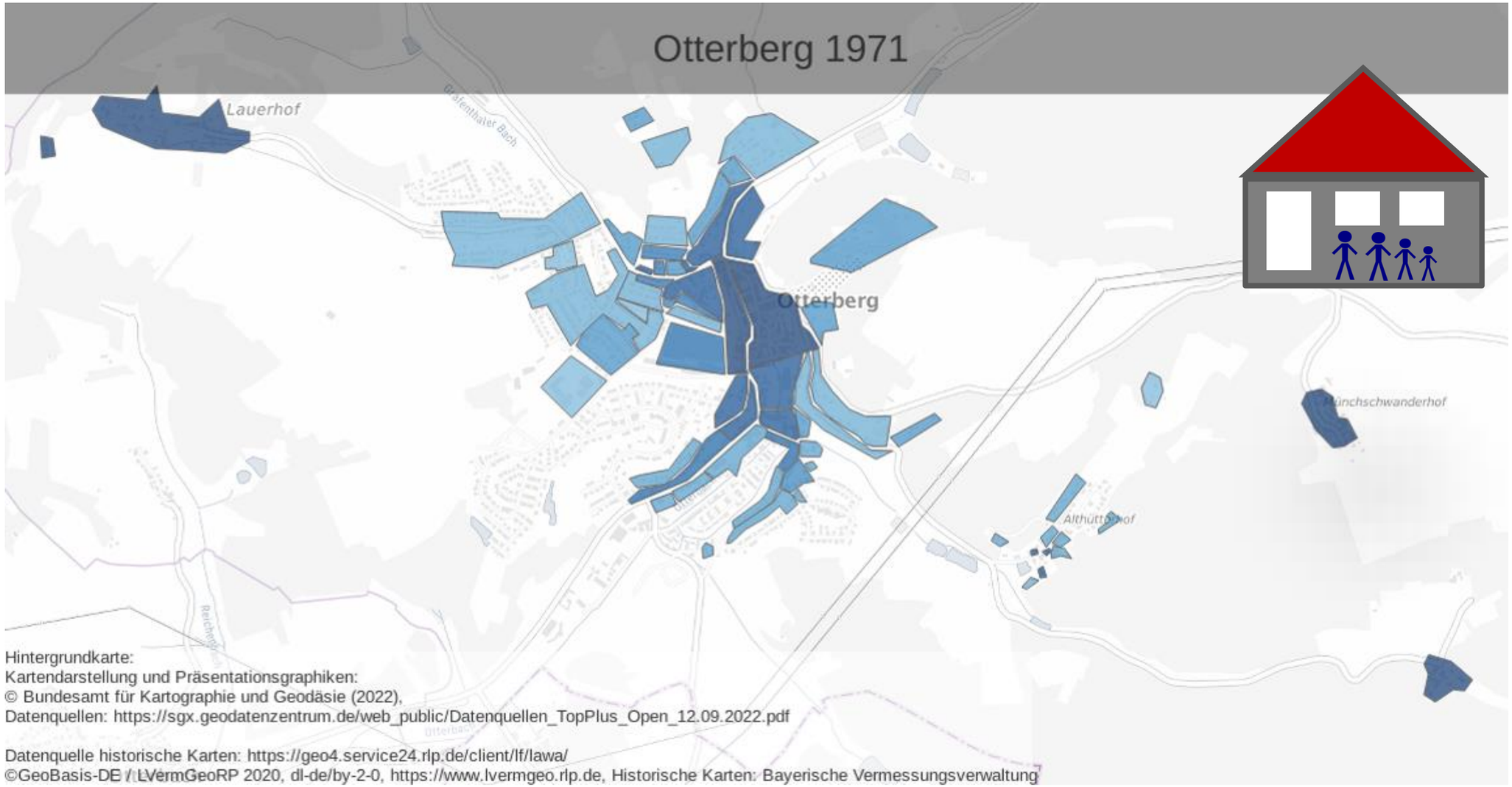
Focus: Information platform for planners in rural municipalities

Source: Schaffert et al. 2021

BACKGROUND | Rurality in Transition



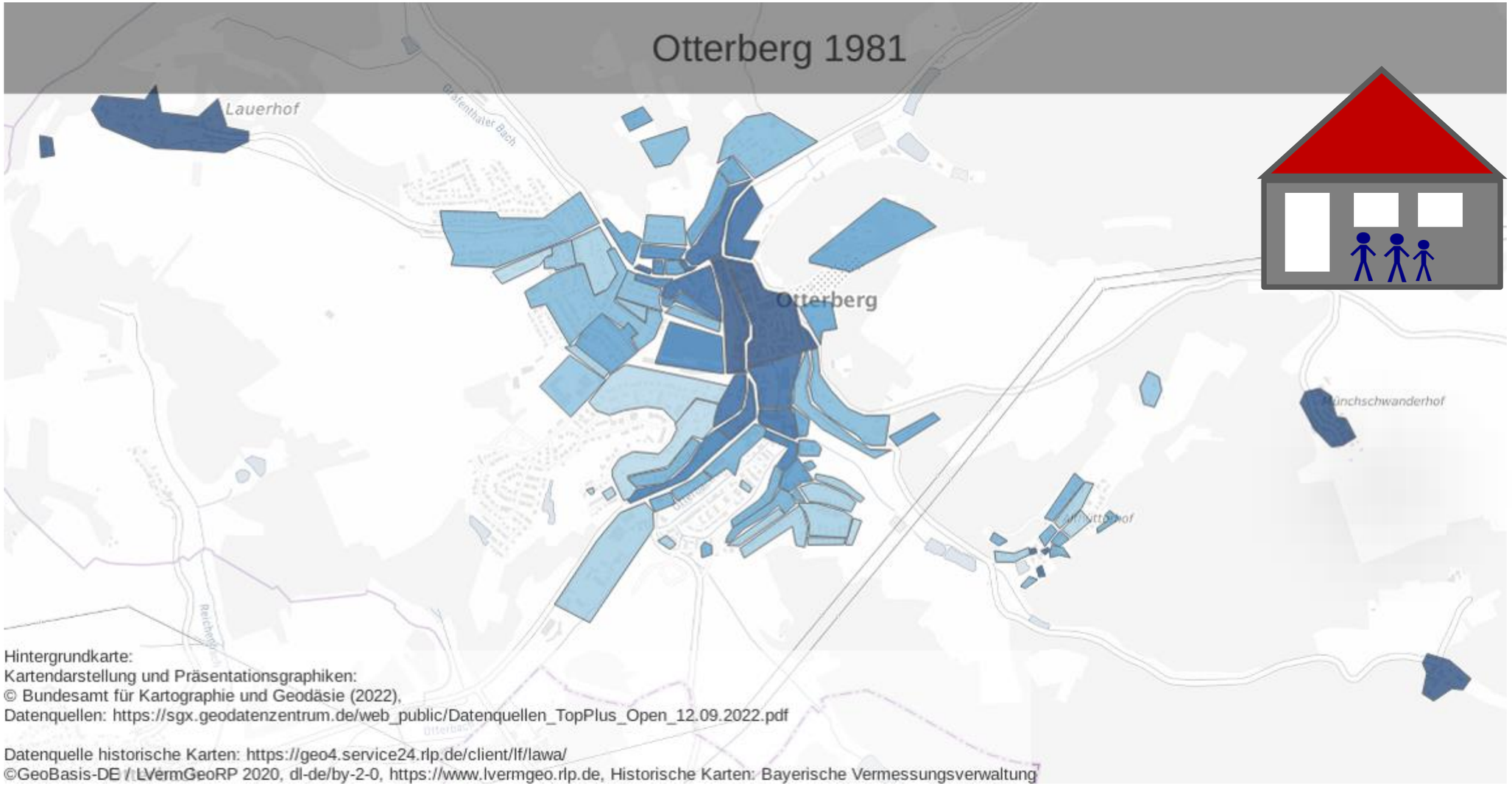
BACKGROUND | Rurality in Transition



Hintergrundkarte:
Kartendarstellung und Präsentationsgraphiken:
© Bundesamt für Kartographie und Geodäsie (2022),
Datenquellen: https://sgx.geodatenzentrum.de/web_public/Datenquellen_TopPlus_Open_12.09.2022.pdf

Datenquelle historische Karten: https://geo4.service24.rlp.de/client/lf/lawa/
©GeoBasis-DE / LVermGeoRP 2020, dl-de/by-2-0, https://www.lvermgeo.rlp.de, Historische Karten: Bayerische Vermessungsverwaltung

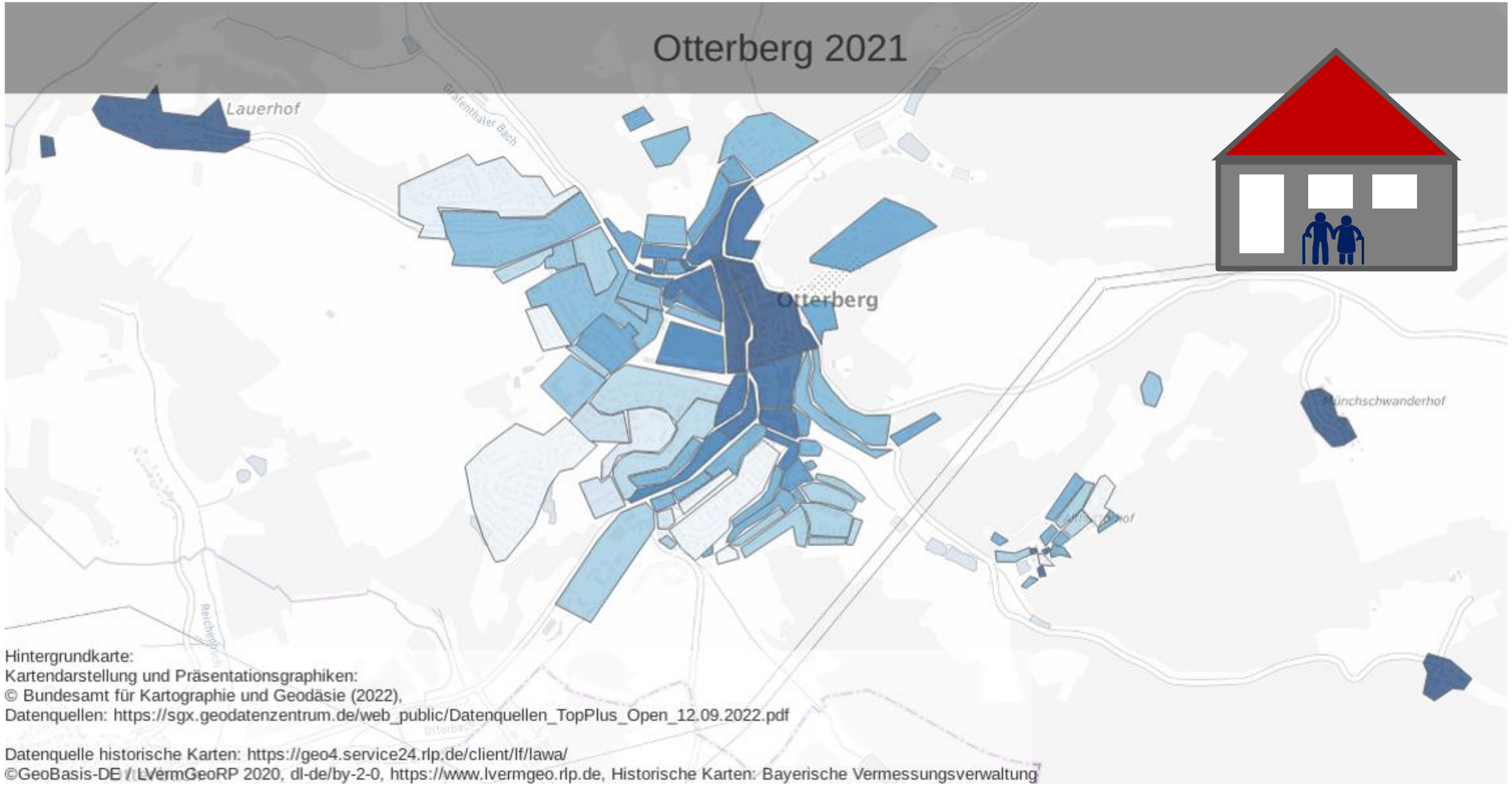
BACKGROUND | Rurality in Transition



Hintergrundkarte:
Kartendarstellung und Präsentationsgraphiken:
© Bundesamt für Kartographie und Geodäsie (2022),
Datenquellen: https://sgx.geodatenzentrum.de/web_public/Datenquellen_TopPlus_Open_12.09.2022.pdf

Datenquelle historische Karten: https://geo4.service24.rlp.de/client/lf/lawa/
©GeoBasis-DE / LVermGeoRP 2020, dl-de/by-2-0, https://www.lvermgeo.rlp.de, Historische Karten: Bayerische Vermessungsverwaltung

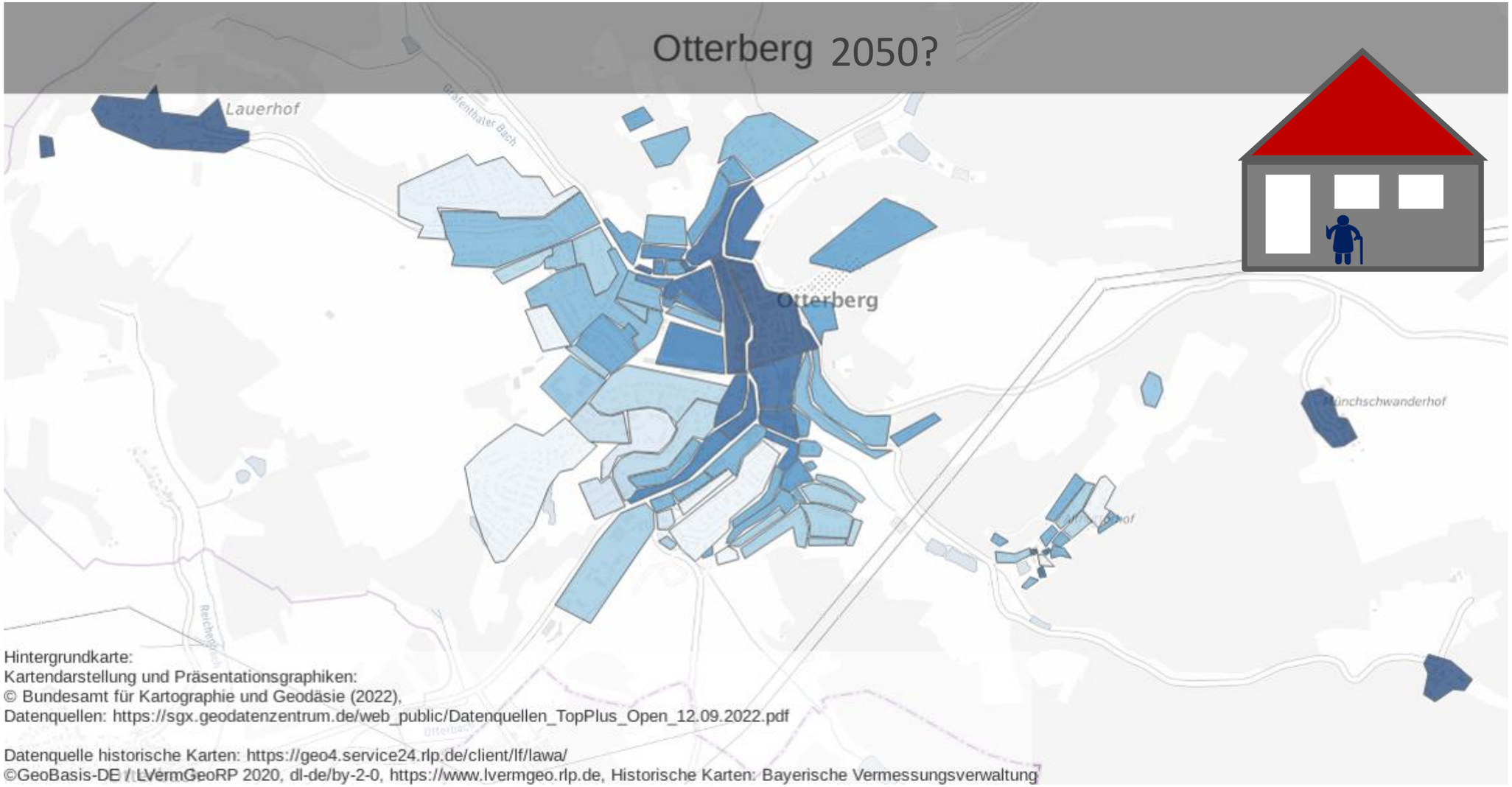
BACKGROUND | Rurality in Transition



Hintergrundkarte:
Kartendarstellung und Präsentationsgraphiken:
© Bundesamt für Kartographie und Geodäsie (2022),
Datenquellen: https://sgx.geodatenzentrum.de/web_public/Datenquellen_TopPlus_Open_12.09.2022.pdf

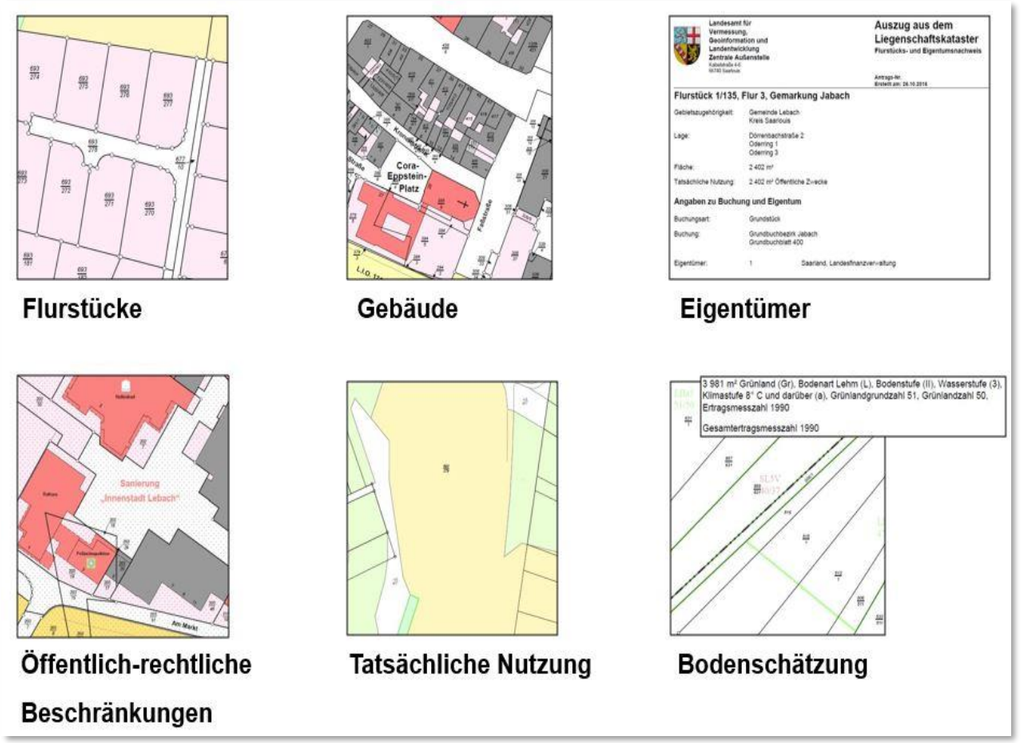
Datenquelle historische Karten: https://geo4.service24.rlp.de/client/lf/lawa/
©GeoBasis-DE / LVermGeoRP 2020, dl-de/by-2-0, https://www.lvermgeo.rlp.de, Historische Karten: Bayerische Vermessungsverwaltung

BACKGROUND | Rurality in Transition



BASIS OF DATA | ALKIS

- Official Real Estate Cadastre Information System (ALKIS, Amtliches Liegenschaftskatasterinformationssystem)
  - Parcels
  - District and municipality boundaries
  - Geo-referenced building address and usage types via building footprints
  - Types of land use



Source: State Office for Surveying, Geographic Information and Land Development Saarland (LVGL, Landesamt für Vermessung, Geoinformation und Landentwicklung Saarland)

BASIS OF DATA | OpenStreetMap

- Free VGI project
- OpenStreetMap (OSM) attributes in tags on e.g., building polygons
- Addresses are a central component for building reference
- Building type *building* as assignment element
- Additional attributes as supporting assignment elements

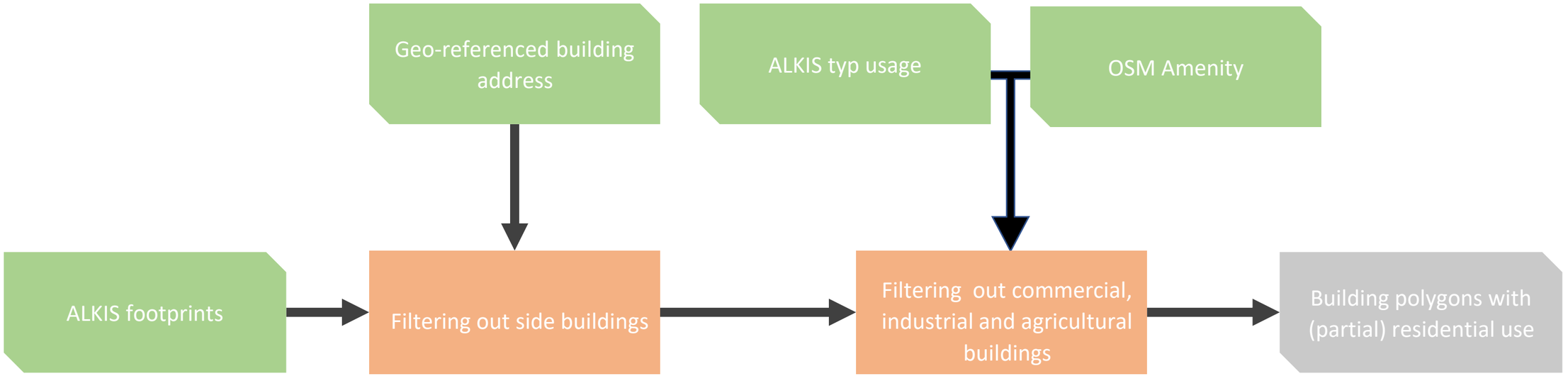
Tags

addr:city	Mainz
addr:country	DE
addr:housenumber	1
addr:postcode	55128
addr:street	Dombaumeister-Schneider-Straße
building	detached
building:levels	1
roof:levels	1

Nodes

▾ 5 nodes
- 957931446
- 957931368
- 957931442
- 957931274
- 957931446

METHOD | Identification of Residential Buildings



BASIS OF DATA | 2011 Census

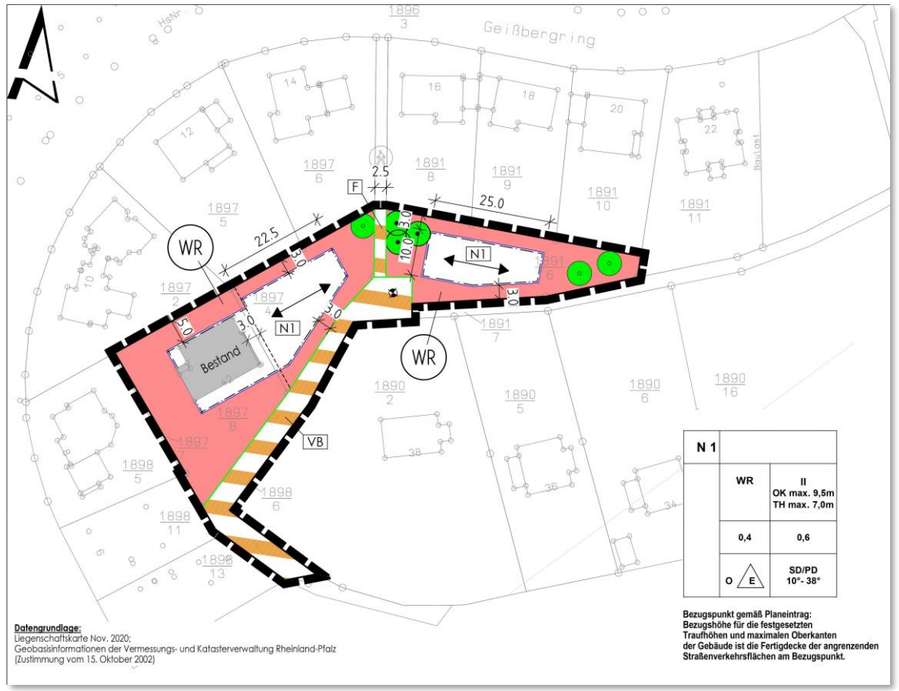
- Data set with, among other things, demographic information
- Tabular form, aggregated at the municipality level
- After amendment of the BStatG since 2015 also in parts as 1km and 100m grid
- Available in 100m grid among others
  - General population numbers
  - Demographic information (e.g., age, marital status, gender, religious affiliation)
  - Building attributes (year of construction, building type construction (e.g., single-family homes)

Coding in data set	Feature description
1	older than 1919
2	1919 – 1948
3	1949 – 1978
4	1979 – 1986
5	1987 – 1990
6	1991 – 1995
7	1996 – 2000
8	2001 – 2004
9	2005 – 2008
10	2009 onwards

Source: Statistical Offices of the Federal and State Governments (Statistische Ämter des Bundes und der Länder)

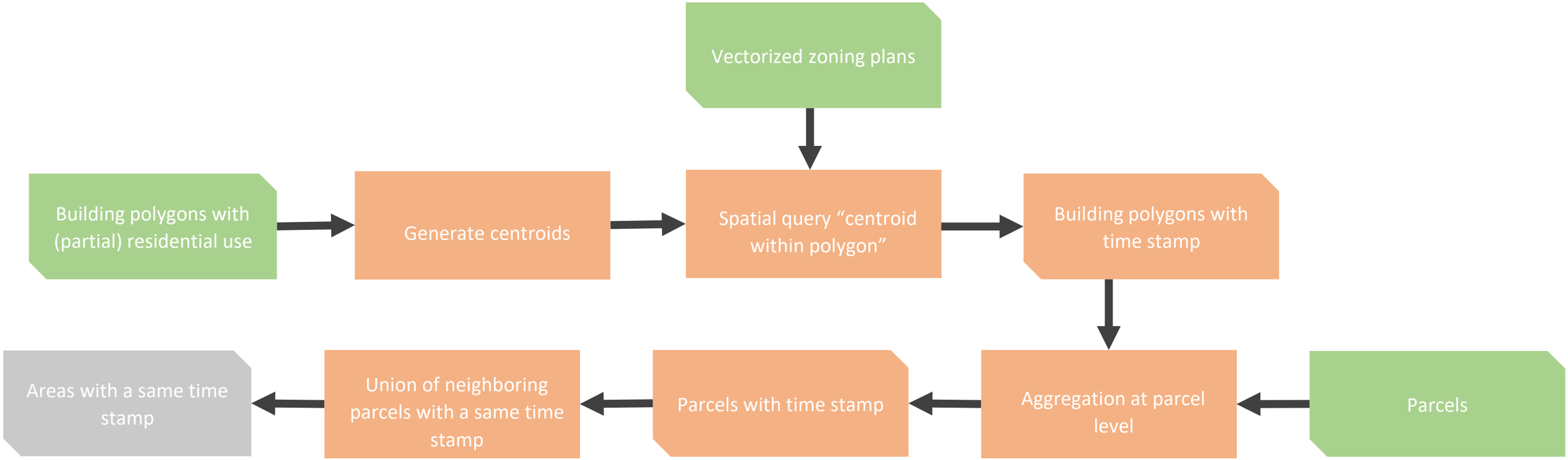
BASIS OF DATA | Zoning Plans

- Map sections enable a pre-evaluation for building construction years based on a time comparison of current residential buildings (from ALKIS and OSM) and digitized polygons
- Zoning plans have to be vectorized in different ways depending on their shape in order to obtain georeferenced polygons
- For the sample area, 22 development plans are legally binding and published on the Internet
- The effective date ranges from 1987 to 2019

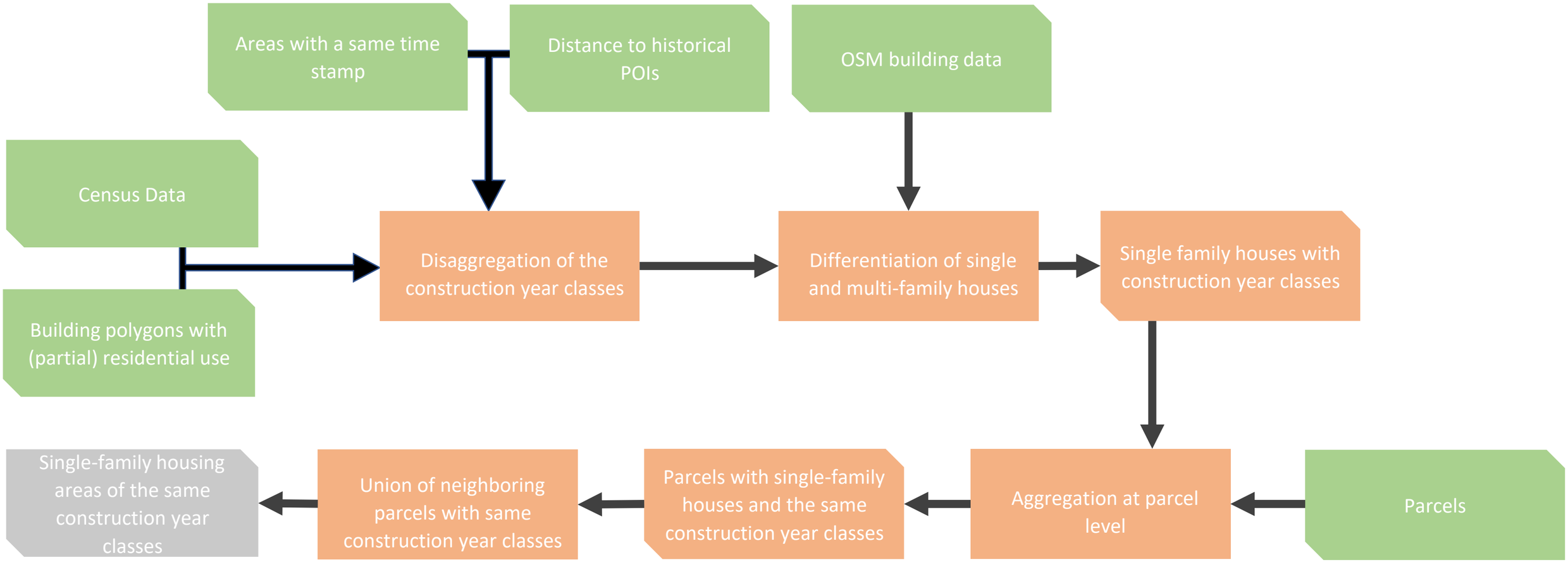


Source: Otterberg-Otterbach Municipality

METHOD | Comparison of Building Footprints and Zoning Plans

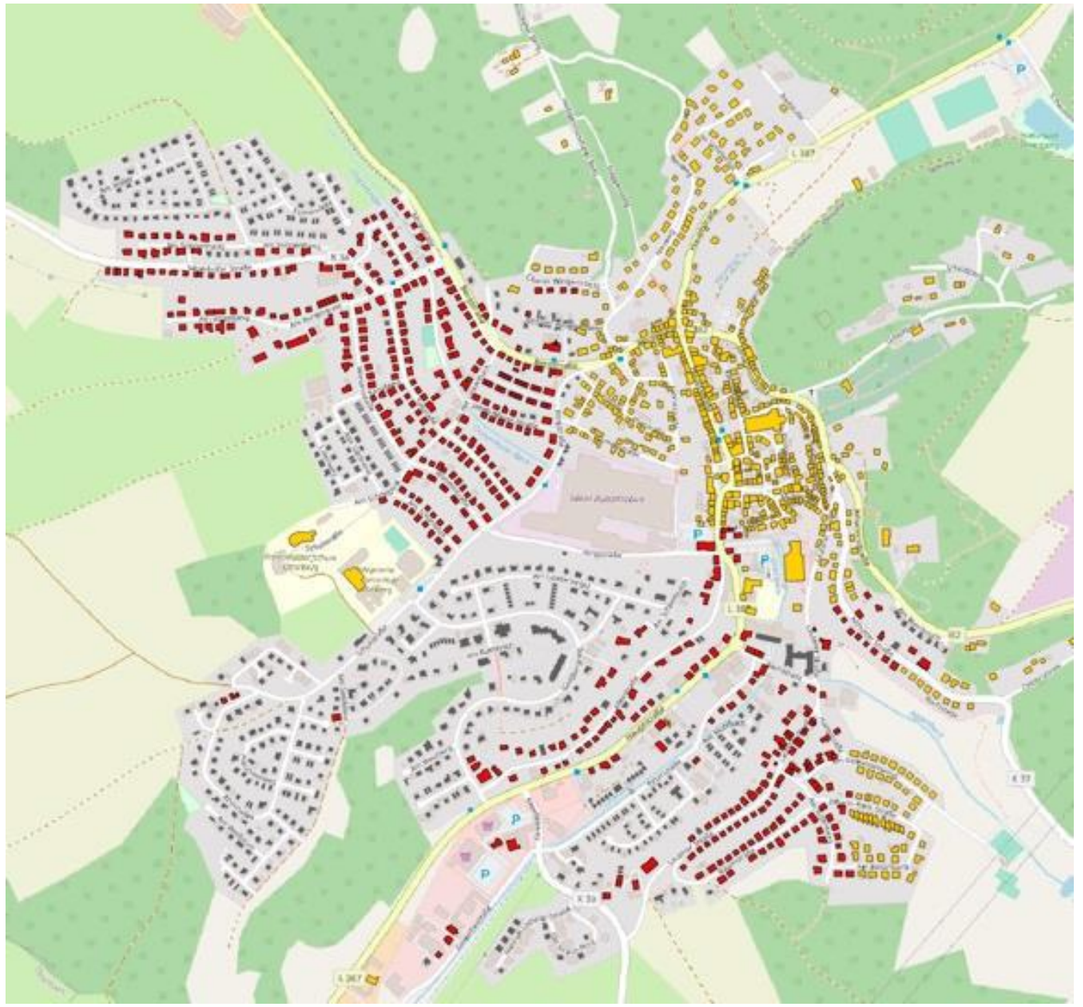


METHOD | Disaggregation of Census Data and Identification of Single-family Houses



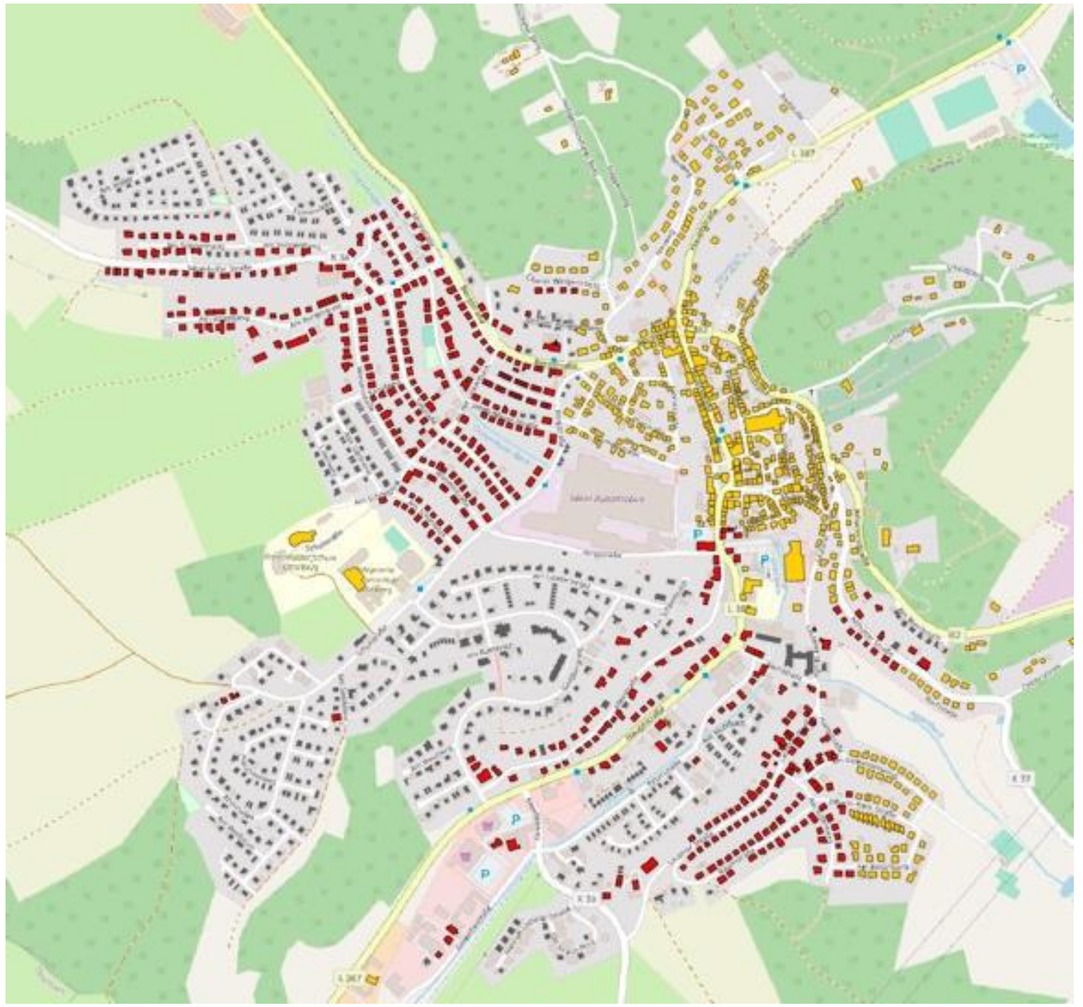
RESULTS

- The single-family house areas are characterised by a mixture of the building stock through redensification or new buildings
- 22 legally binding zoning plans
- The effective date ranges from 1987 to 2019
- 1,126 Buildings for disaggregation



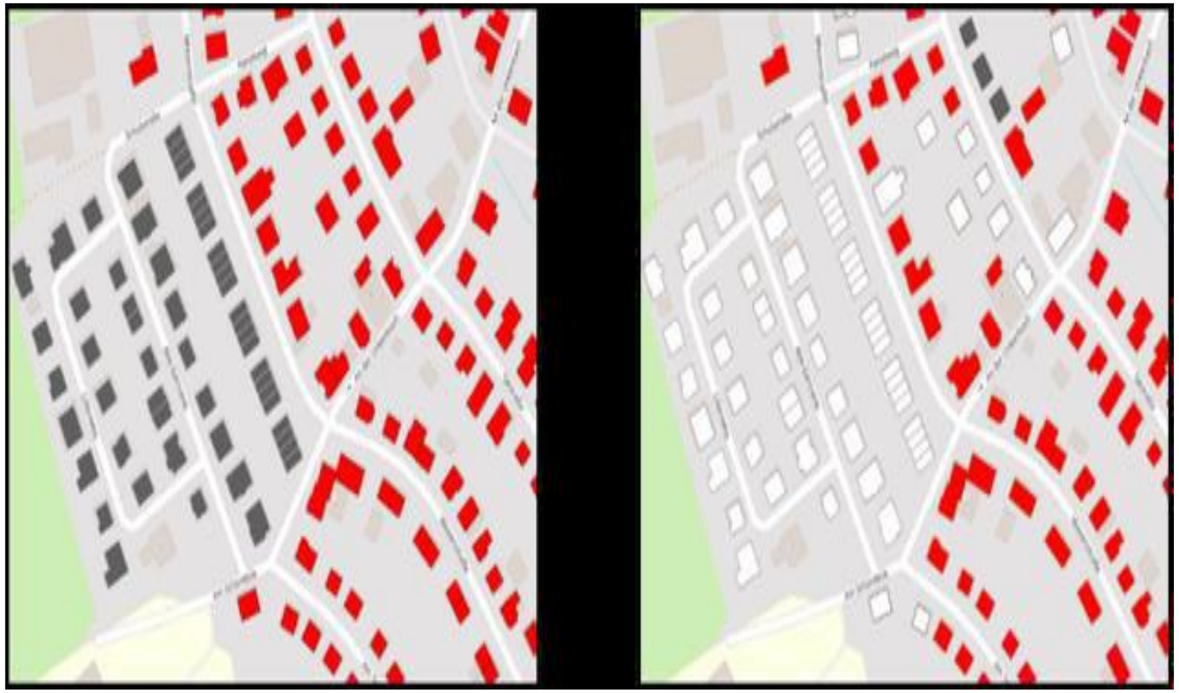
RESULTS

- 605 buildings footprints (grey) are younger than 1987 and do not qualify as older single-family residential areas
- 521 building footprints (red) could be in the period looked for
- 630 building footprints (yellow) in the non-zoned town center could have been built in the early phase of settlement zoning after 1945



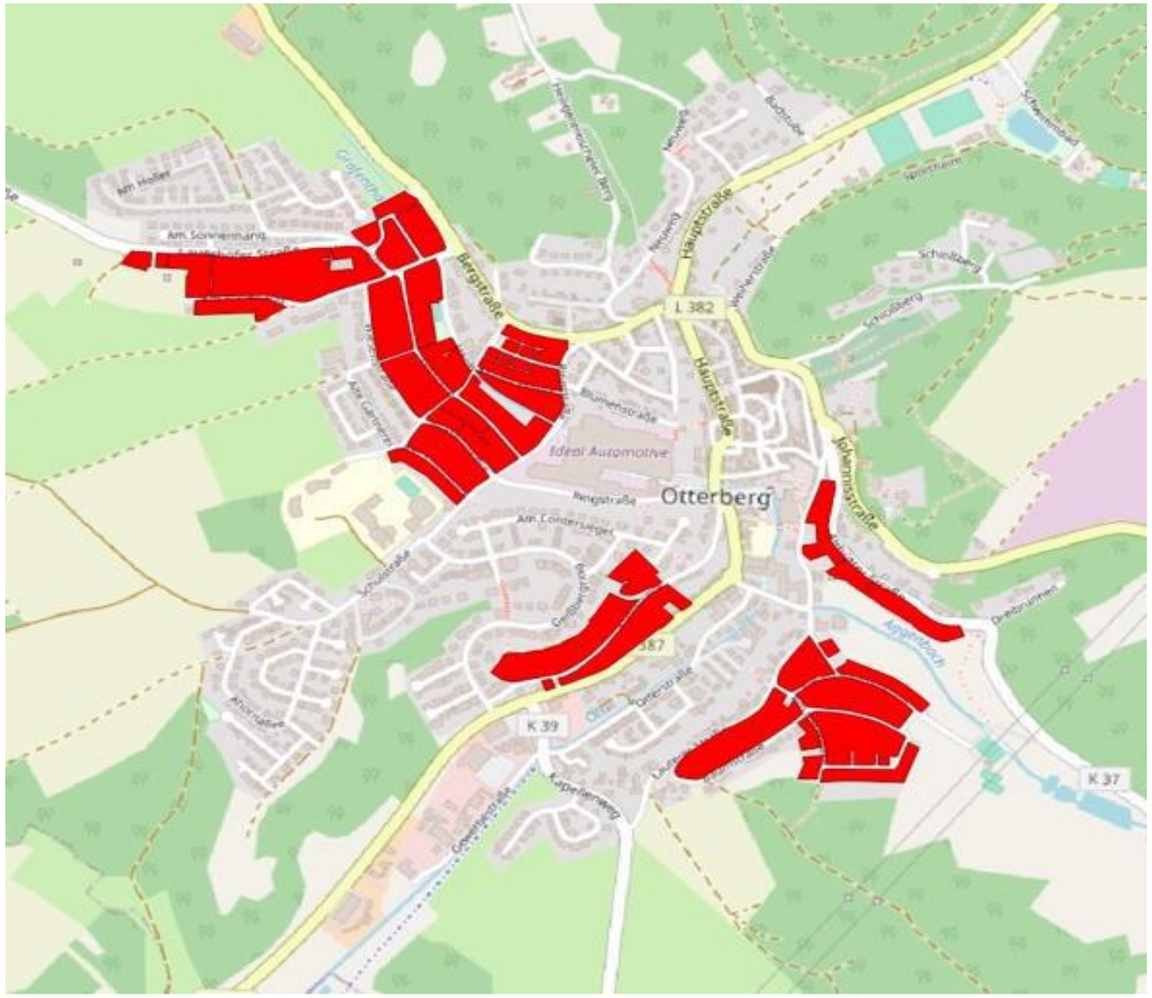
RESULTS

- Residential areas planned and built upon after the cutoff date of the 2011 census
- White-colored buildings footprints in the right-hand map section imply that there is no information in the census data
- Red-colored buildings are built between 1949 and 1978



RESULTS

- The determination of the year of construction also requires the identification of each individual single-family house
- OpenStreetMap holds little potential for success due to the tendency for data incompleteness in rural areas
- Aggregation (red) of larger single-family house areas from the 1950s to the 1970s for the town of Otterberg



OUTLOOK

- Updated building year classes will be available with the release of the 2022 Census results
- Due to the amendment of the BStatG, further grid cell-based results are to be expected
- A broader harmonization and an area-wide opening of the data sets would contribute to a better transferability of the demonstrated method

Source: Statistical Offices of the Federal and State Governments (Statistische Ämter des Bundes und der Länder)

Contact

Dominik Visca, Max Hoppe, Kevin Kaminski and Pascal Neis

Hochschule Mainz
i3mainz
Lucy-Hillebrand-Straße 2
55128 Mainz

dominik.visca@hs-mainz.de
max.hoppe@hs-mainz.de
kevin.kaminski@hs-mainz.de
pascal.neis@hs-mainz.de

https://www.hs-mainz.de
https://i3mainz.hs-mainz.de