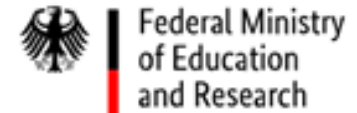


13:30 – 13:40	Introduction and Statement BMBF	Birkmann (ireus) and Mr. Frank (BMBF)
13:40 – 13:52	Urban climate and vulnerability: innovative assessment and scenario approaches – the ZURES project	Birkmann, Puntub, Burmeister, Garschagen
13:53 – 14:05	Bridging science, policy and planning: Bonn and Ludwigsburg – the ZURES project	Löffler, Helbig, Burkhardt, Sandholz, Göttsche, Laranjeira
14:06 – 14:18	Innovative measuring and microscale modelling – the iSCAPE project	Fuchs, Christian
14:19 – 14:31	Air quality, heat stress and human vulnerability in cities: an international perspective	Martayan (Global Urban Air Pollution Observatory GUAPO)
14:32 – 14:45	Discussion	All



11 SUSTAINABLE CITIES
AND COMMUNITIES



3 GOOD HEALTH
AND WELL-BEING



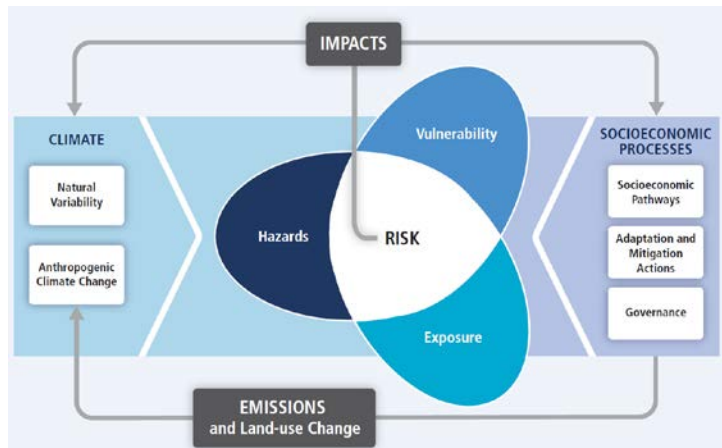
13 CLIMATE
ACTION



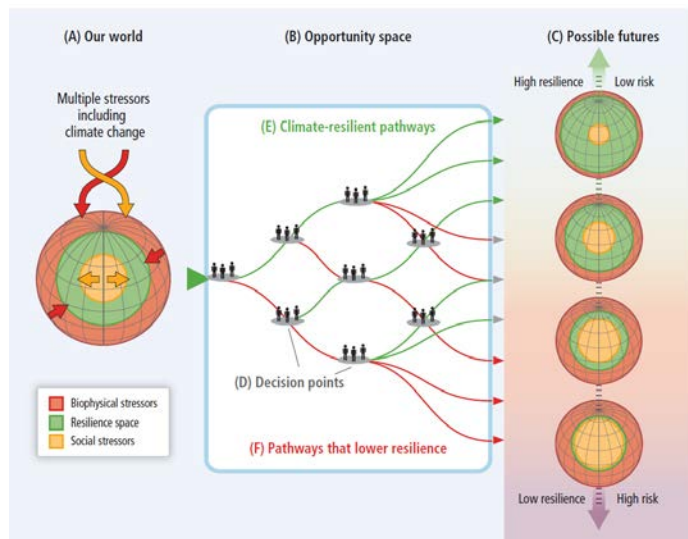
Vulnerability and risk analysis as a tool for enhancing the resilience of cities and urban infrastructures

Key questions

- How to assess present and future heat stress in growing medium-sized cities?
- How do future climate change and urbanization interact?
- How do different population groups perceive heat stress?
- What methods and indicators can be used to develop scenarios for human vulnerability at the local scale?
- How to link local scenarios of human vulnerability and climate?
- What is the added value of the information for decision making?



Source: IPCC 2014



Source: IPCC 2014

- Growing medium-sized cities have to conserve open green space, but also provide new space for housing
- Challenges: present climate and vulnerability scenarios often focus on national and international scales
- Urban growth and/or densification are inherent characteristics of growing medium-sized cities – is that an entry point for local scenarios?
- Which data is available at the local level for assessing climatic and societal change?

Urban Climate and Human Vulnerability

Presenters:

Ms. C. Burmeister (Geo-Net)

Prof. Garschagen (UNU; now: LMU)

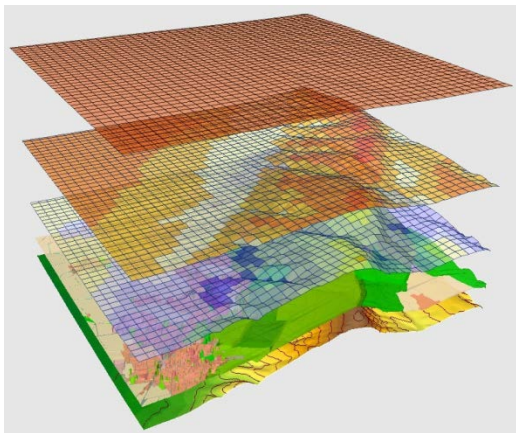
Ms. W. Puntub (IRPUD, Technical University Dortmund)

Prof. Birkmann (IREUS; University Stuttgart)

To quantify the heat exposure model simulations are conducted of the present and future situation. As initialisation a dry and hot weather situation with no cloud cover is used to present the „worst case“

FITNAH – 3D model

Flow over Irregular Terrain with
Natural and Anthropogenic Heat
Sources = **FITNAH**



Source: Gross 1989, 1993, 2002

Resolution:

Bonn - 10m □ Ludwigsburg – 25m

Climate Change

Ludwigsburg: RCP2,6 $\Delta +0.7$ | RCP8,5 $\Delta +2.2$

Bonn: RCP2,6 $\Delta +0.5$ | RCP8,5 $\Delta +2.0$

Input data

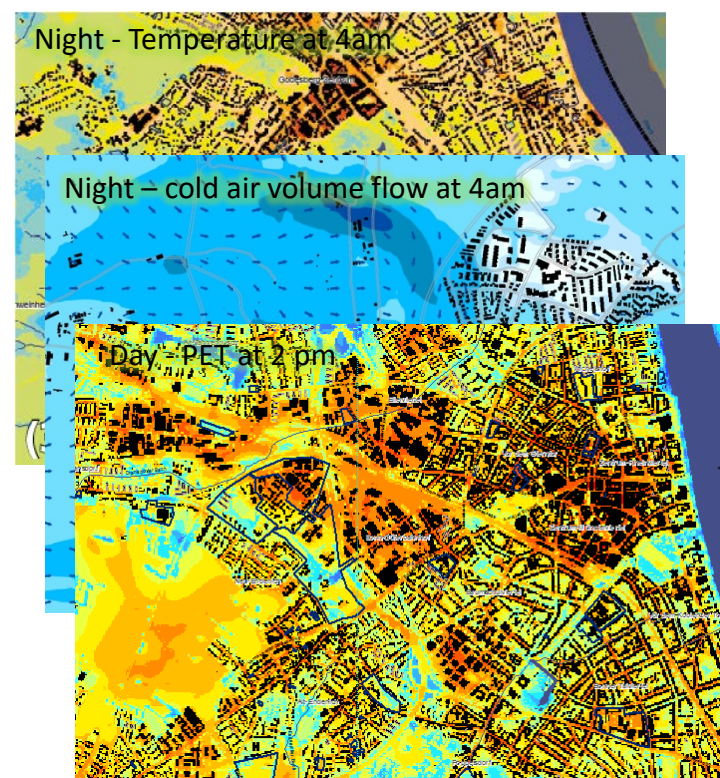
Present and Future



+ sealing degree

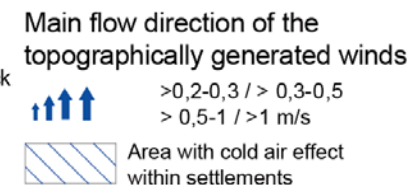
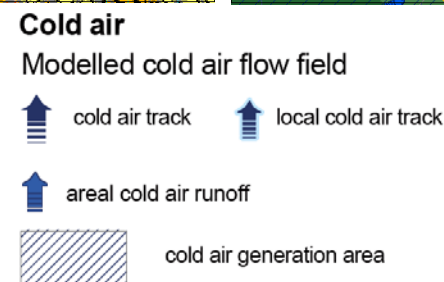
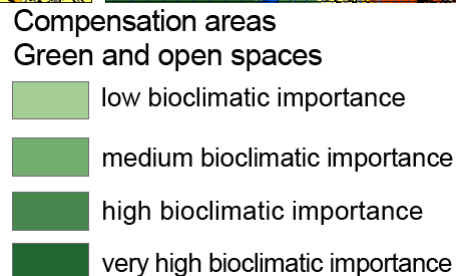
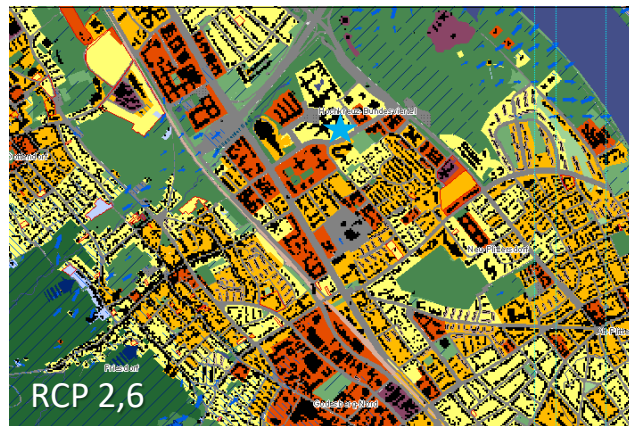
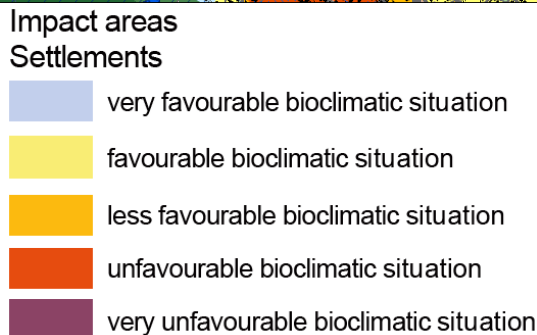
Results of climatic parameters

Present and Future



Guidance Map – night situation 4 am (Zoom Gustav-Stresemann-Institute) Spatial Base = real land use layer

Today  Future 2030 with climatic change and growing settlement development

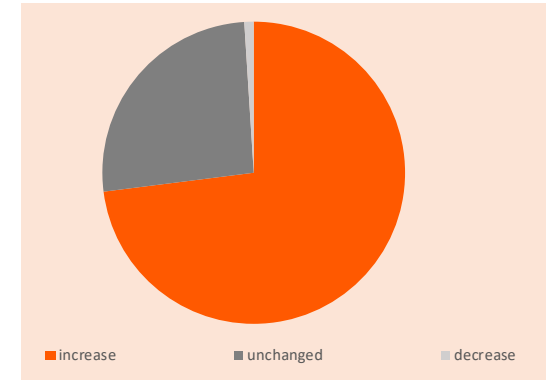
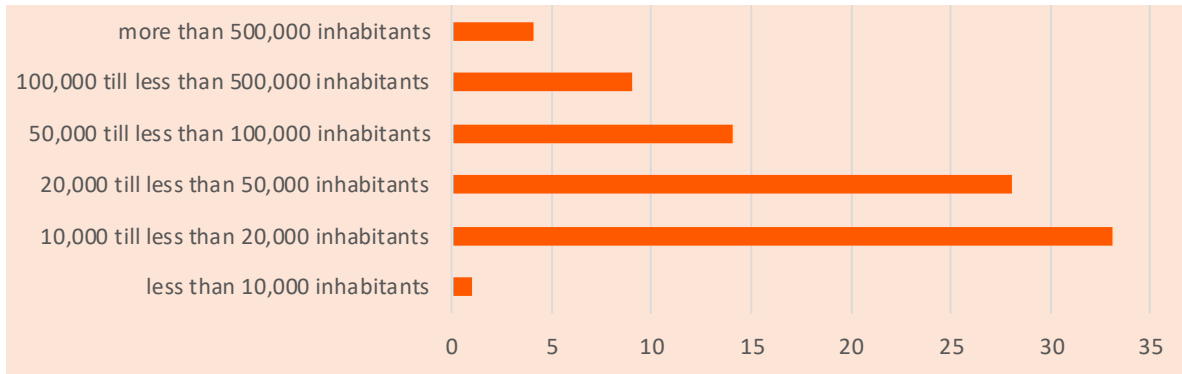


- bioclimatic conditions will become severe under climate change and under compaction and sealing
- the importance of green and open spaces will grow
- present cold air tracks are the same in the future

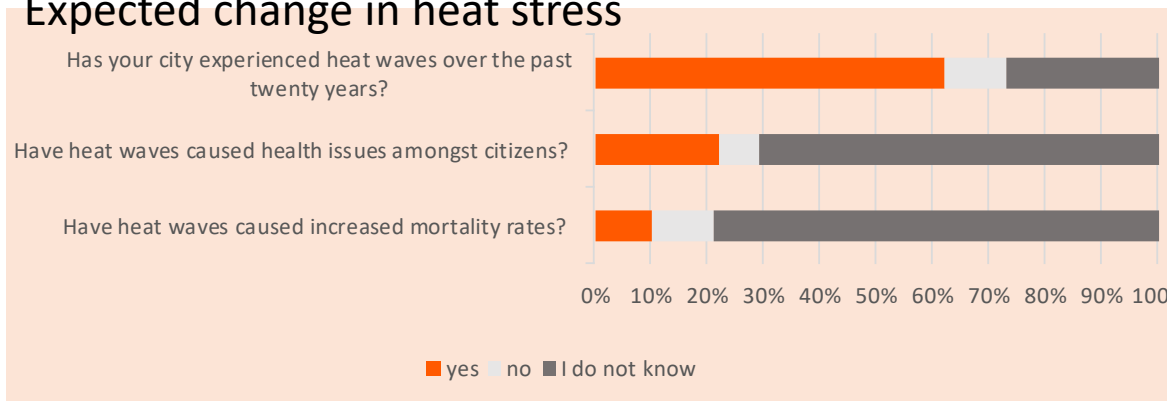
Heat & vulnerability: Importance vs. current practice

Respondents: 89 city administrations in Germany

Expected change in vulnerability towards heat stress

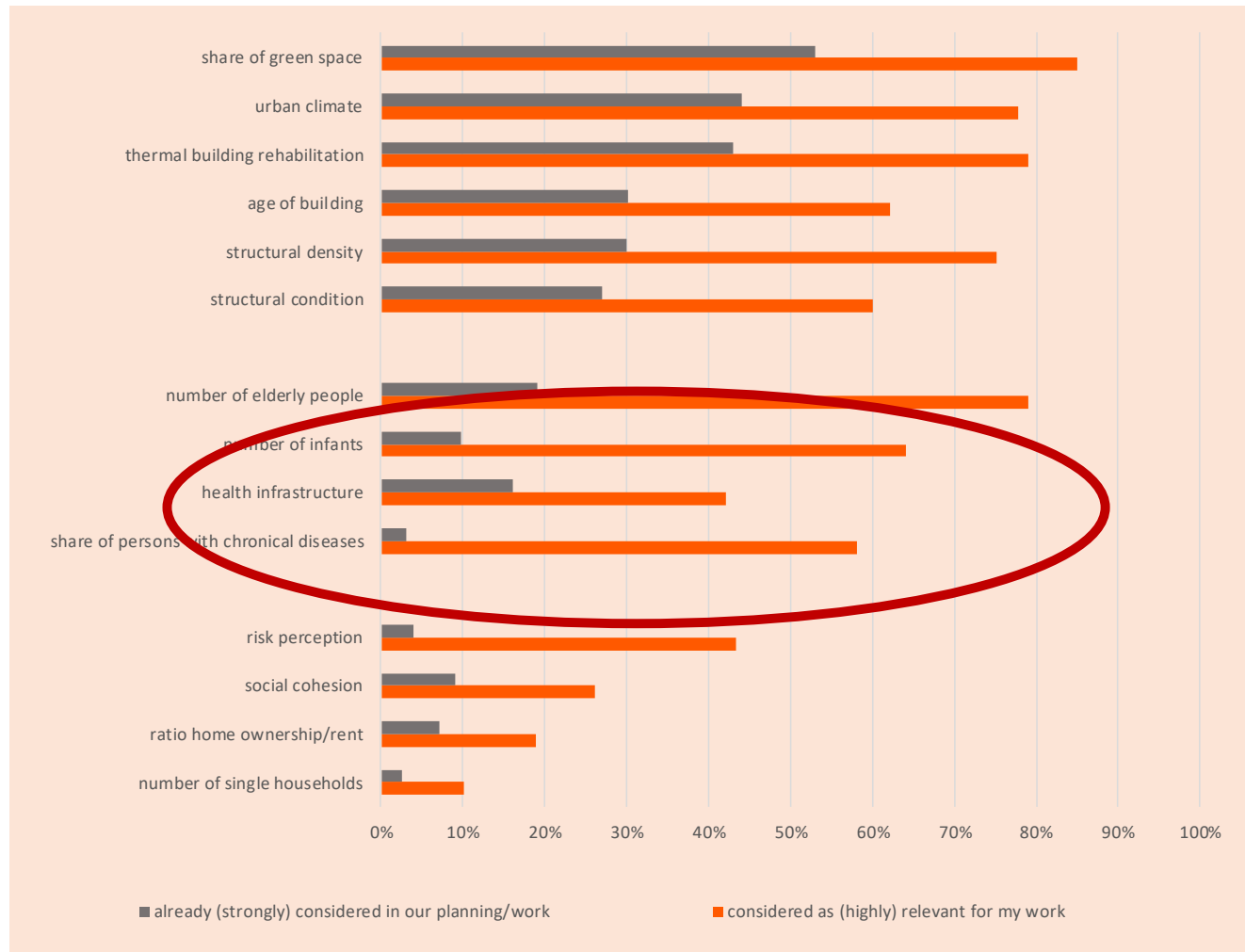


Expected change in heat stress



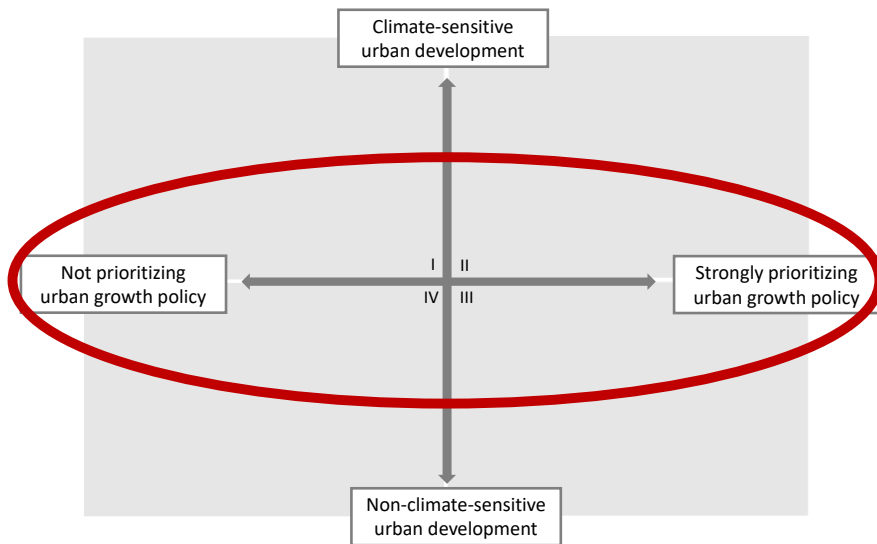
Most cities expect both: an increase in heat stress (hazard) as well as in vulnerability!

Important aspects: theoretical appraisal vs. application in planning

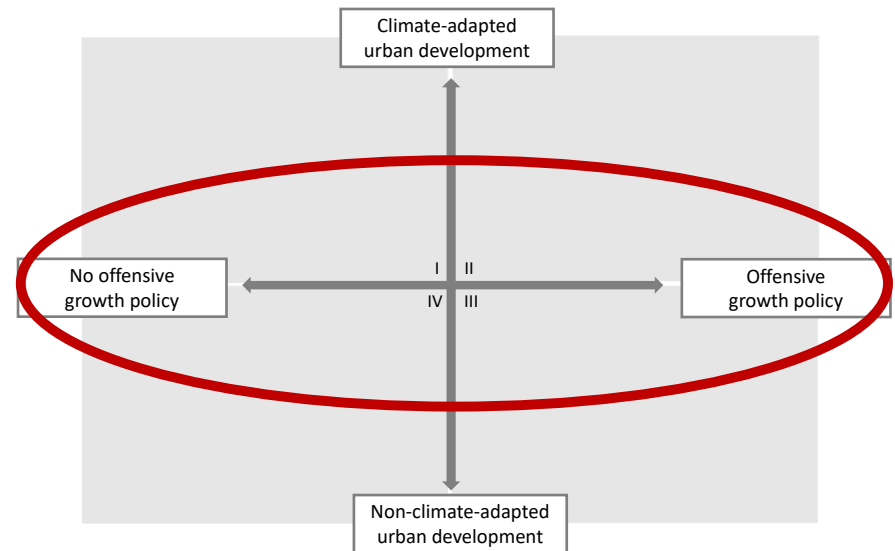


The gap between perceived importance and actual consideration in planning practices is widest with regards to aspects of social vulnerability!

Ludwigsburg



Bonn



Core Indicators



Ratio of inhabitants in residential areas (person/ha)

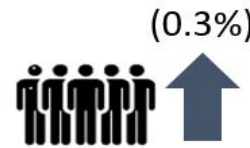


Ratio of population age 65-year-old and above (%)

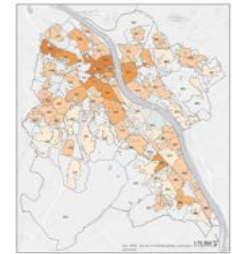


Number of SGB2 recipients per 1,000 employable residents

Population



New Living Units



Future population

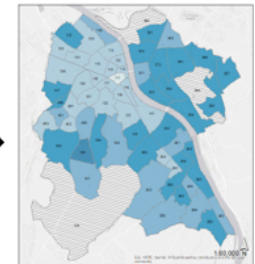
Elderly



Number of people who lives in 2016 and expected to be still alive in the future



Future total population



Poverty

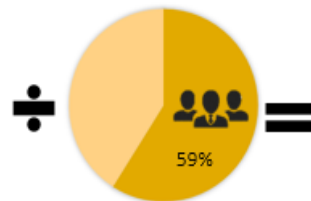


Scenario 2

Scenario 3a-2

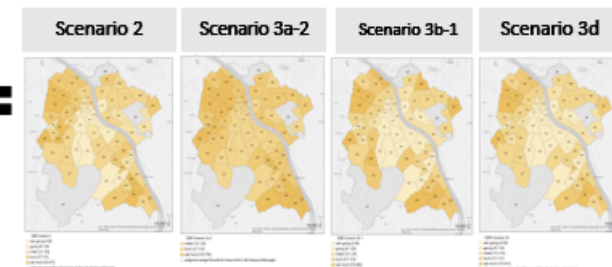
Scenario 3b-1

Scenario 3d



Ratio of employable residents in 2035

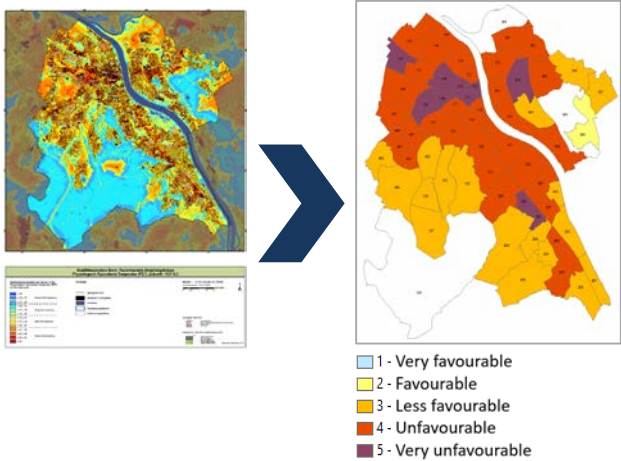
SGBII recipients per 1,000 employable residents in 2035



Coupling scenarios: core indicators - Bonn

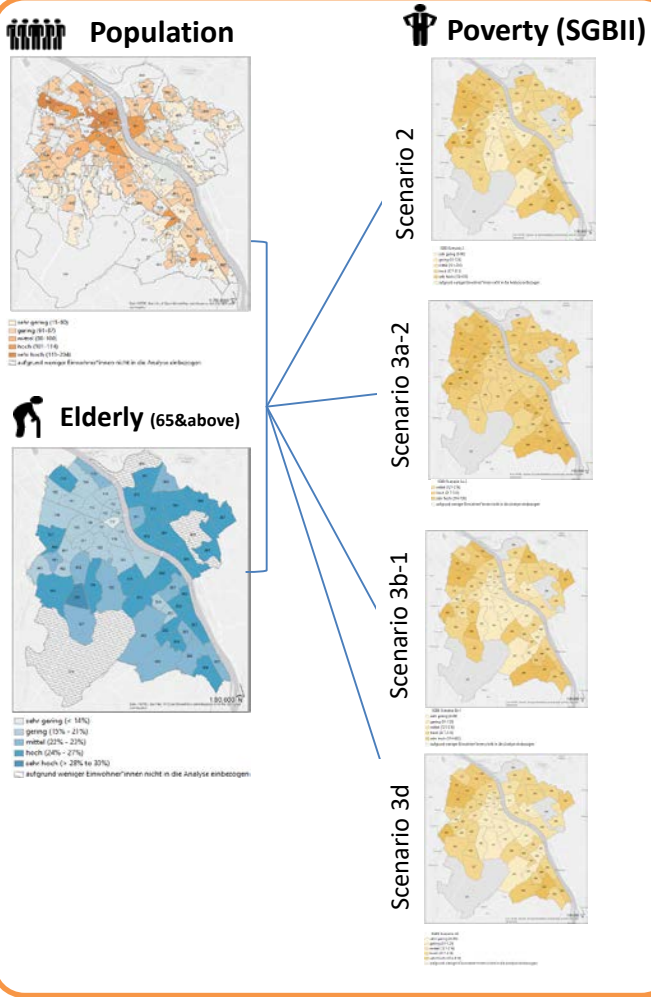
Future climate (RCP 8.5)

RCP 8.5

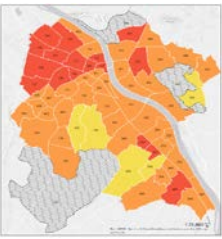


e.g. **Overall**
Day-time
Night-time

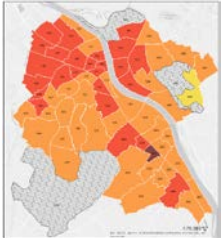
Future socio-economic scenario



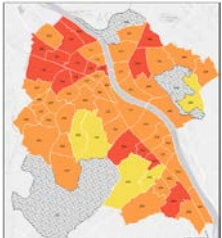
Scenario 2



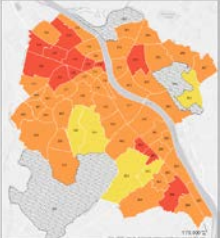
Scenario 3a-2



Scenario 3b-1



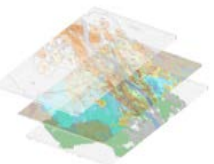
Scenario 3d



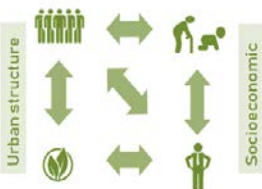
Very low
Low
Moderate
High
Very high

Lessons learned - Bonn

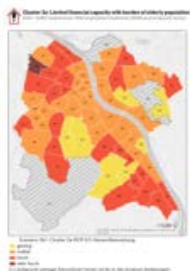
Good practices



Double analytical models through integrated future climate and socio-economic scenarios



Multifaceted consideration of the problem with spatio-temporal illustration



Tool for supporting urban development policy debate and promoting risk informed planing

- Initial hotspots' identification of possible vulnerable area in the future
- Support long-term investment and mitigation measures



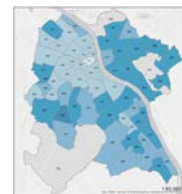
Simple technique & dataset and transferable

Challenges

Scale does matter

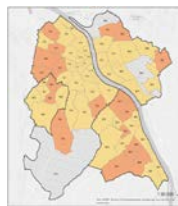


VS



- **Personal perception** VS **Sub-district socioeconomic** VS **Global climate downscaling and development pathways**
- **Limited access of socio-economic data in household or building block level (privacy confidentiality and disclosure)**

Uncertainty is certain



Source: Adapted from google map 2019

- **Social development dynamic in the future (e.g. young people mobility, immigrants, aging society)**
- **Interaction with neighboring cities or nodes**

Day-time & night-time social activities



Source: https://www.freepik.com/premium-vector/day-night-sky_2589626.htm

- **Social vulnerable groups and social sensitive infrastructure**
- **Pollutions (Noise & Air)**

Guidance Map Zoom to the City Center – Spatial Base = statistical ward layer

Today → Future 2030 with climatic change and growing settlement development

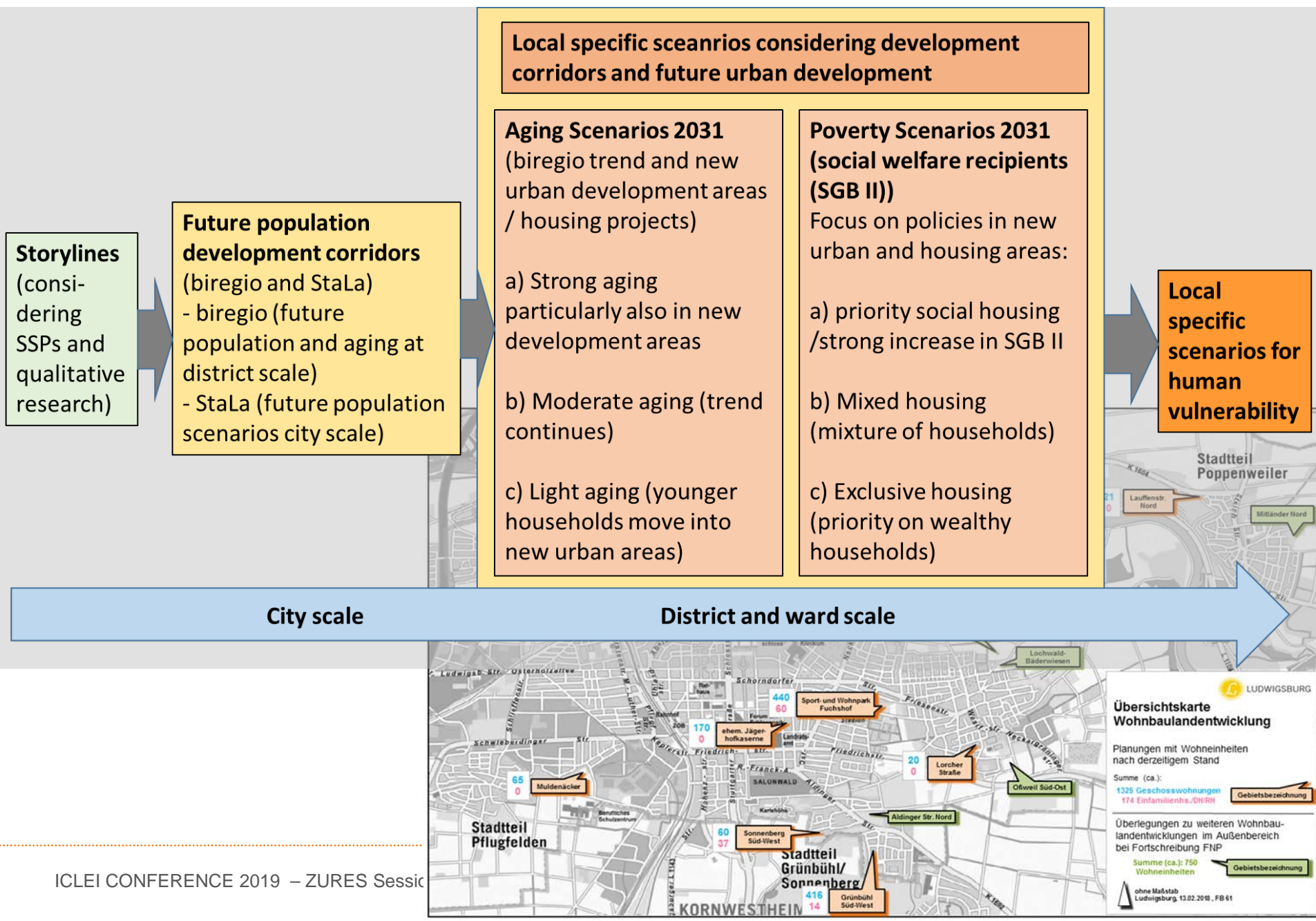


Heat Stress Assessment Classes

- very favourable bioclimatic situation
- favourable bioclimatic situation
- less favourable bioclimatic situation
- unfavourable bioclimatic situation
- very unfavourable bioclimatic situation
- future settlement areas

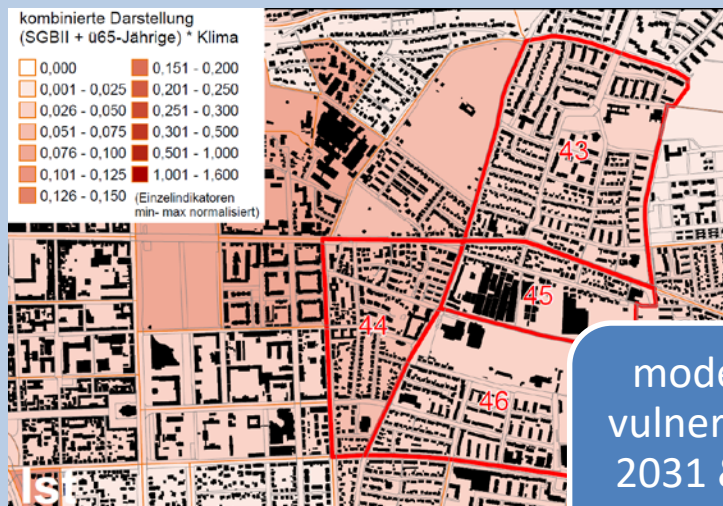
- bioclimatic conditions will become severe under climate change
- this process will be intensified by more compaction and sealing
- some structures are more robust (resilient) against climate change

Methodology: assessing future vulnerability



Climate and vulnerability at ward scale 2031

Present conditions (2017)



moderate
vulnerability
2031 & RCP
8,5

- Trend continuation
- New housing areas contain mixed HH.

Same Climatic Change RCP 8,5



2. Scenarios

high
vulnerability
2031 & RCP
8,5

- Strong aging
- Increased SGB II in new urban areas



Bridging science, policy and planning

Presenters:

Ms. J. Löffler and Mr. Helbig (City of Bonn)

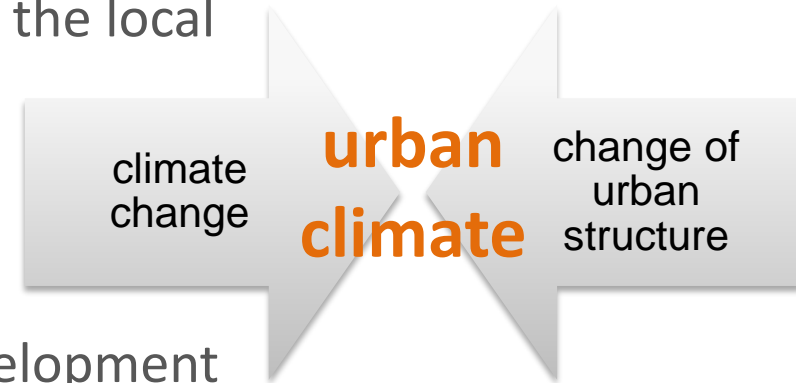
Mr. A. Burkhardt (City of Ludwigsburg)

Ms. Sandholz (UNU) - Expertenbefragung

Ms. F. Götsche (IREUS) – HH Befragung

Mr. K. Laranjeira (IREUS) – HH Befragung

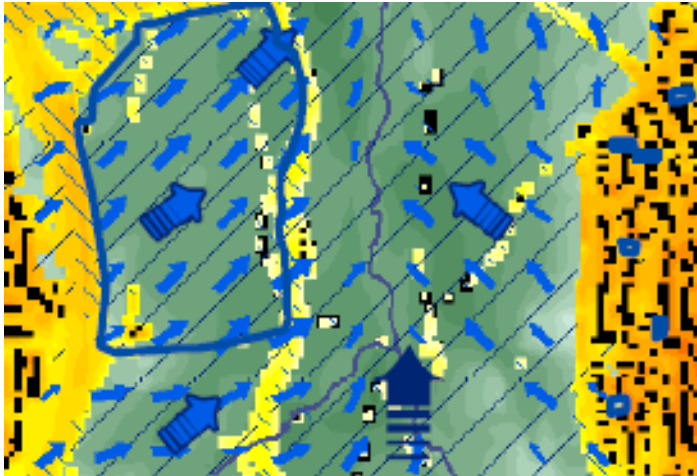
- urban heat stress is already a problem in both cities
- significant and measurable change of the local climate
- growing municipality
 - e.g. need for new housing areas
- political resolution regarding the development (activation) of new urban areas
- goal conflict: structural development vs. preservation/optimisation of important compensation functions / areas
- necessity to develop valid information for political decision-making for urban development and land-use planning



- Further development of the assessment – integration of suggestions from various departments
- intensive dialogue between practice and science moderated by ZURES project partners



Translation of the climate analysis into specific recommendations for urban development and decision making (e.g. guidance map for planning)



- Evaluation of potential new urban areas in terms of the urban climatic situation / function (e.g. cold air generation, etc.)
- Analysis of the impact of selected measures
- Advice regarding the best implementation of measures (e.g. roof / facade greening, opening of sealed surfaces to reduce urban heat island effect)



Climate Analysis map Workshop, 11.6.2018; Picture: agl



Integrated planning advice map Workshop, 9.4.2019; Picture: City of Ludwigsburg

- Three science-practice workshops in the City of Ludwigsburg
- Climate analysis map, planning guidance map, integrated planning advice map
- Discussion and further development of the maps with representatives from different departments (urban planning, green areas, district commissioners, etc.)

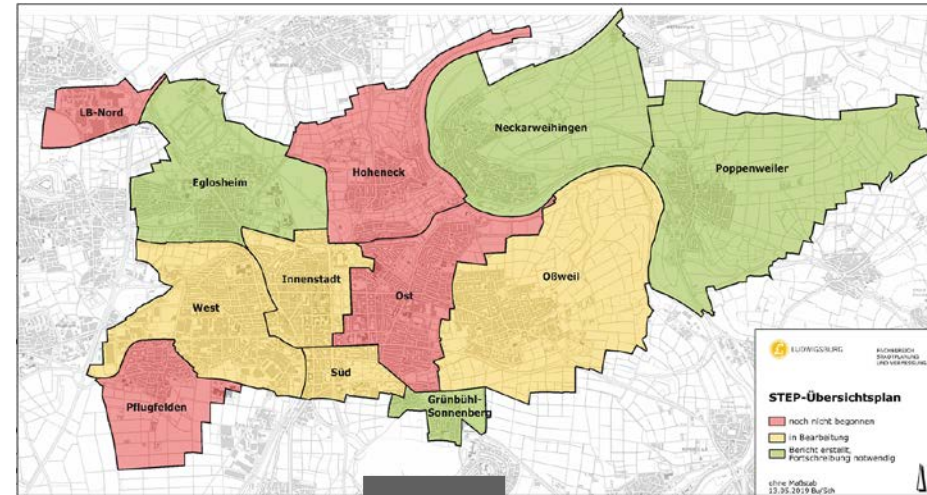
Potential application for integrated planning

- Land use plan and development plans at district scale

Outlook

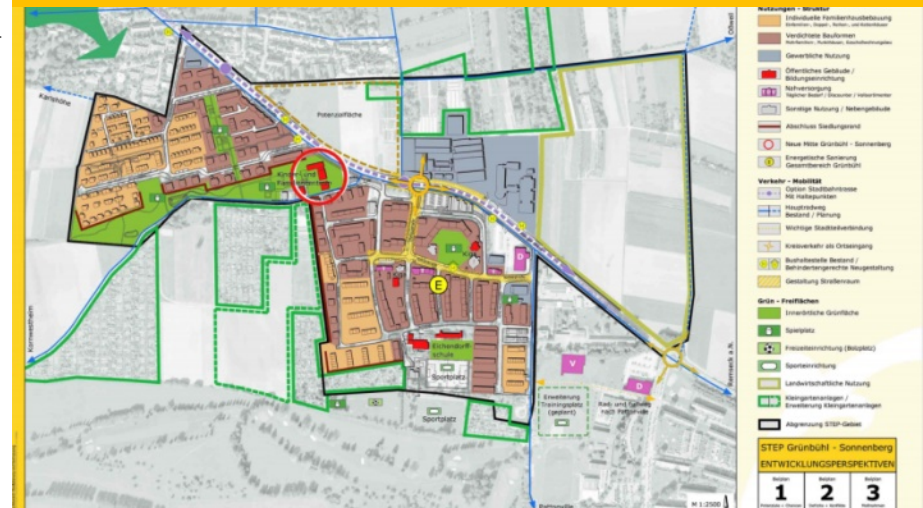
- In the next 2 years further development of the STEPs (District Development Plans)
- Integration of climate and socio-economic indicators and scenarios - district level

City Development Concept



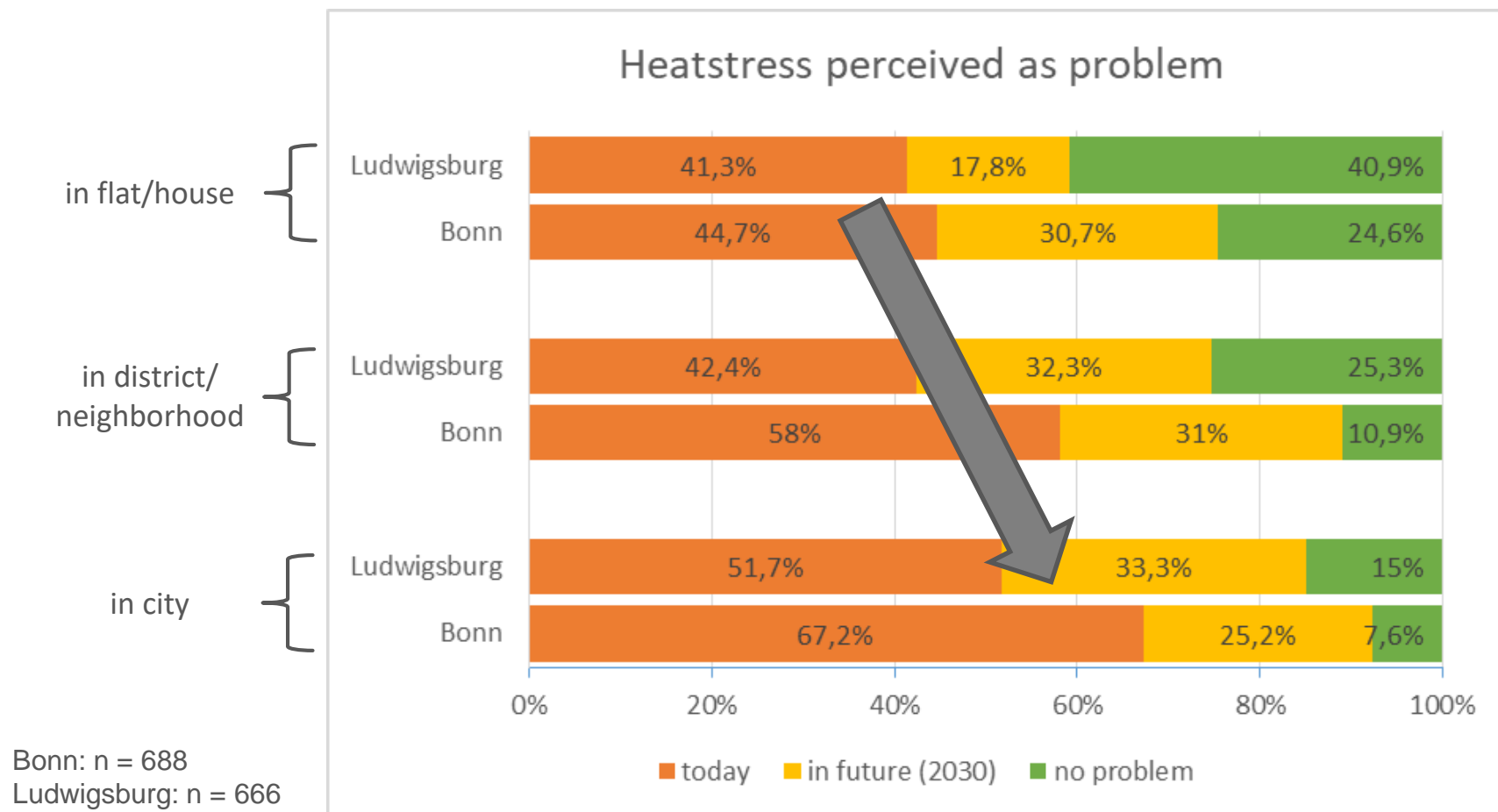
Map from the District Development Plan Grünbühl-Sonnenberg, 2009; City of Ludwigsburg

District Development Plan



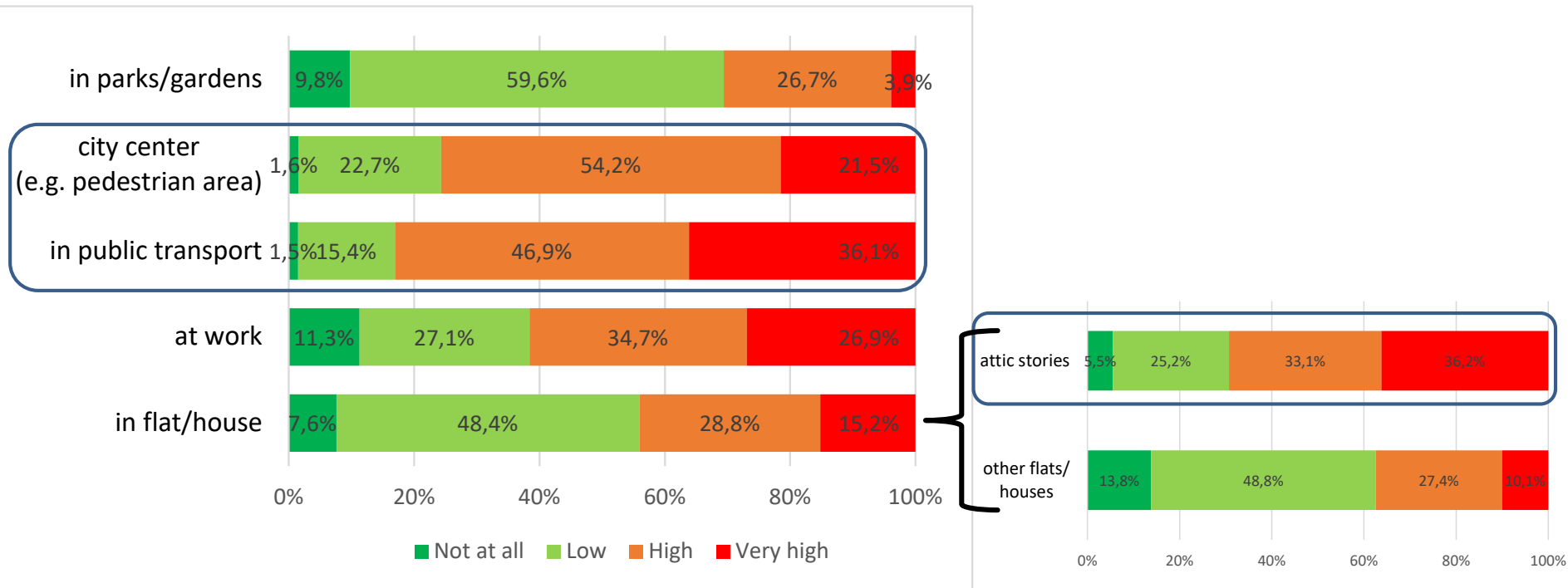
Relevance of urban heatwaves

– results from household surveys in Bonn and Ludwigsburg



Hotspots of urban heat stress

– results from HH surveys



Social groups at risk to urban heat stress – results from HH surveys



Elderly



Students

Why affected?

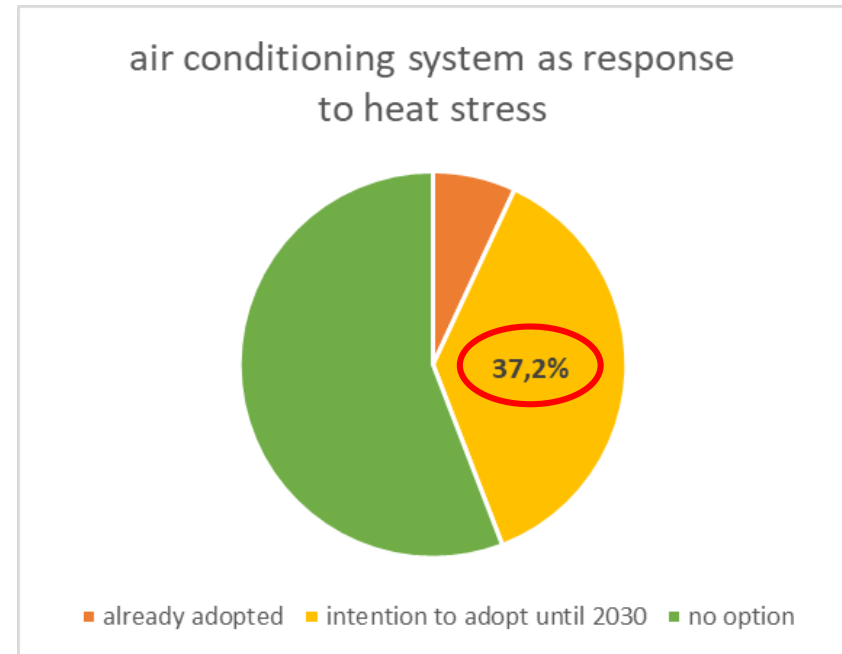
- Infrequent use of **parks** & public recreation areas; **restricted adaptation** options: low coping & adaptive capacity
- Often live in small flats (depending on income); high share of **attic stories**: high exposure
- Frequently use **public transport**; poorly adapted flats; low income: high exposure and low adaptive capacity

How affected?

- 15% of all above 65y indicated frequent impacts on **cardiovascular** system: high potential health risk
- 1/4 of all 30-64y indicated frequent **problems to sleep** during heat waves: potential effects on mental health (LOHMUS 2018)
- 1/4 of all under 29y indicated **frequent headache** during heat waves

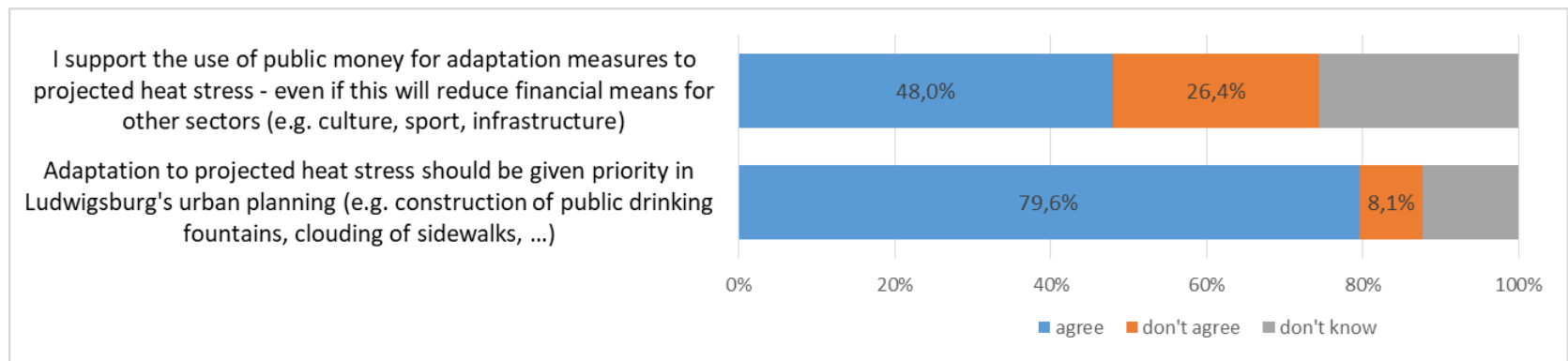
Policy recommendations – results from HH surveys

- Mix of “soft” and “hard” measures
 - Heat-sensitive large-scale **urban planning**
 - **Small-scale** measures, e.g. drinking fountains, trees, rooftop greening
 - **Incentives** for private adaptation while avoiding **maladaptation** -> **awareness** building through information transfer



Policy recommendations – results from HH surveys

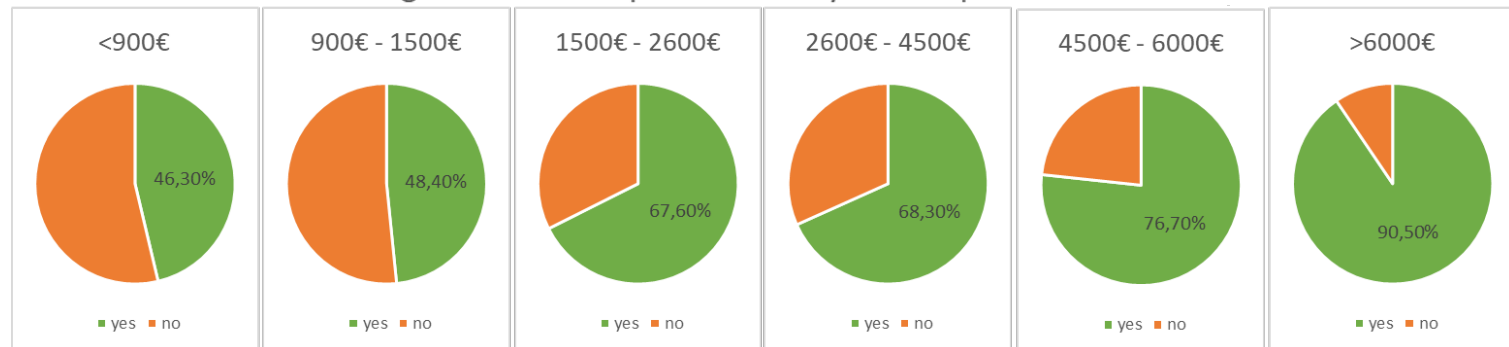
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- **Challenges**
 - Achieve one thing without abandoning others



Policy recommendations – results from HH surveys

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- **Challenges**
 - Achieve one thing without abandoning others
 - Leave no one behind

Willingness to invest private money for adaptation measures



- I. ZURES results provide better information on how to balance the need for new space for housing areas and the need to preserve open green spaces in the context of heat stress
- II. ZURES can help to identify relevant and local specific measures to optimise the thermic comfort in hotspots of urban heat
- III. Challenge: there is a need to improve the data-basis of socio-economic indicators as requirement for an equal and integrated assessment of climate and vulnerability – Bonn
- IV. Planning tools are needed (e.g. STEPs) that allow to represent and integrate a more comprehensive understanding of climate risks – capturing future climate and societal change



Verbundkoordination

Universität Stuttgart, Institut für Raumordnung und Entwicklungsplanung (IREUS) unter der Leitung von Prof. Dr.-Ing. Jörn Birkmann

Projektpartner



Technische Universität Dortmund, Institut für Raumplanung (IRPUD)



agl Hartz • Saad • Wendt
Landschafts-, Stadt- und Raumplanung,
Saarbrücken

GEO-NET Umweltconsulting GmbH,
Hannover



United Nations University – Institute for
Environment &
Human Security, Bonn

Projektlaufzeit

September 2016 – August 2019



Modellstädte

Bundesstadt Bonn, Amt für Umwelt,
Verbraucherschutz und Lokale Agenda,
Abt. Umweltvorsorge und -planung, Leitstelle
Klimaschutz



Stadt Ludwigsburg, Referat Nachhaltige
Stadtentwicklung, Europa und Energie

Projektförderung

Bundesministerium für Bildung
und Forschung (BMBF)

Eingereicht im Rahmen der Bekanntmachung
Sozial-ökologische Forschung im thematischen
Schwerpunkt Nachhaltige Transformation urbaner
Räume



Bundesministerium
für Bildung
und Forschung

