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Climate proofing urban development: a global overview

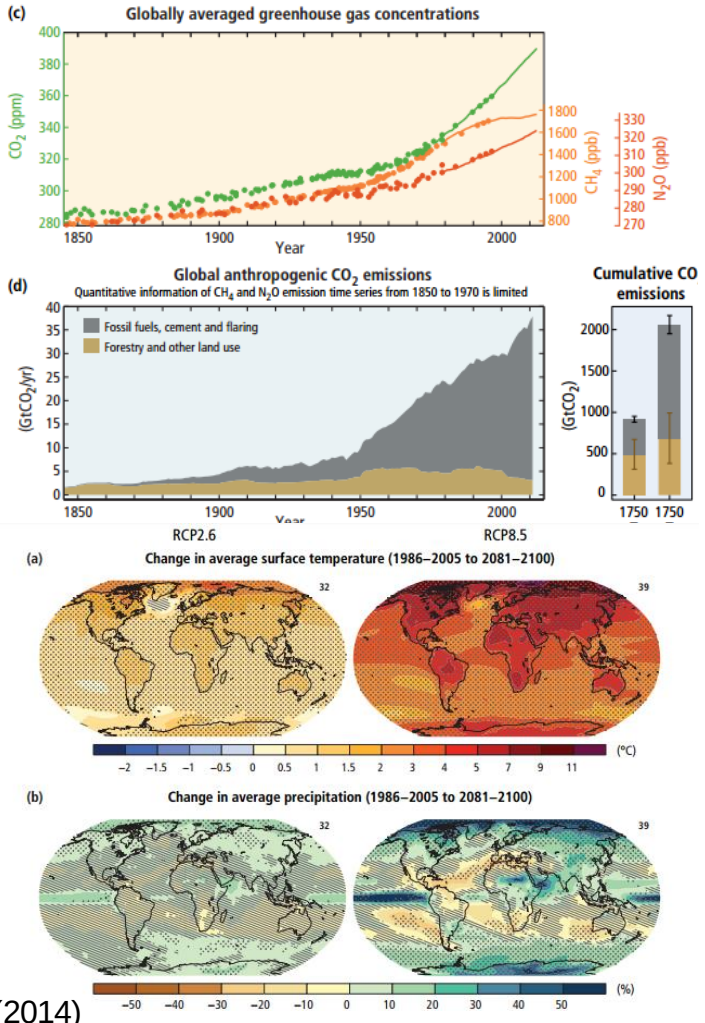
Stefan Greiving

Agenda

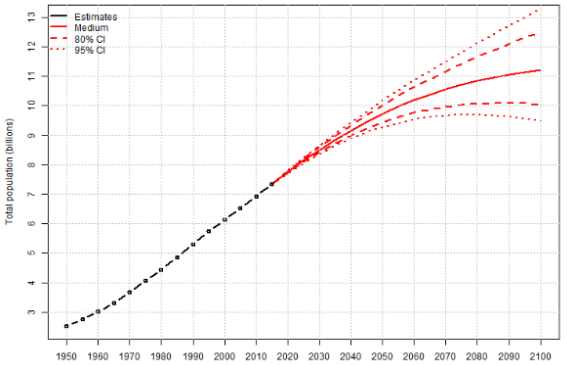
1. Changing baseline trend
2. Creating the evidence basis
3. Spatial patterns of climate change in Europe and Germany
4. How to adapt?
5. Transformative adaptation
6. Conclusions

1. Changing baseline trend

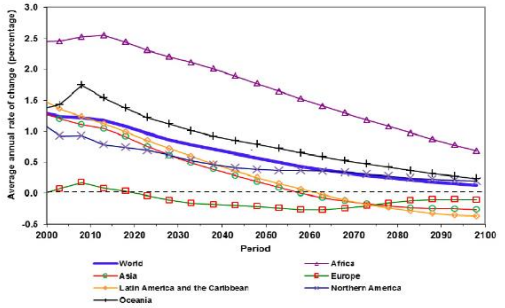
- The environment is changing due to climatic as well as societal changes.
- Complex interactions between human and environmental changes.
- Population growth and urbanisation are major drivers for climate change and its impacts.



IPCC (2014)



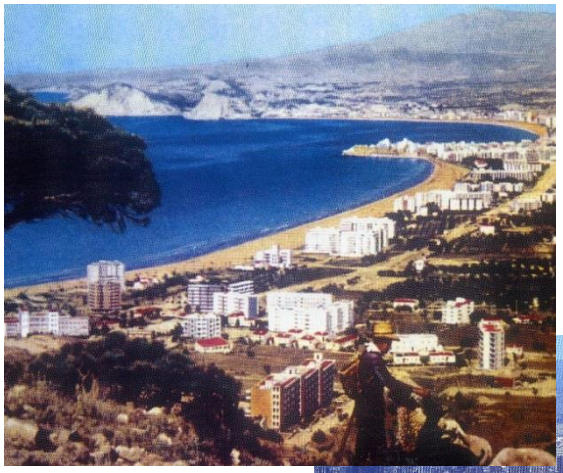
Source: United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision*. New York: United Nations.



Source: United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision*. New York: United Nations.

UN (2015)

1965



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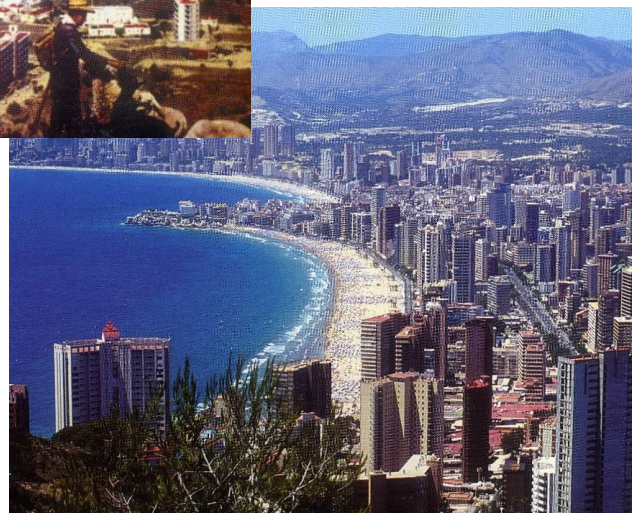

Benidorm (Spain)

- Indonesian government is seeking for a new capital.
- It is not climate change/sea level rise, but urbanization!
- Jakarta is one of the fastest-sinking cities in the world (25 cm/year) due to over-use of groundwater resources and sealing of surface.

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World Scientific
www.worldscientific.com

2. Creating the evidence basis

- Good adaptation calls for sound evidence basis.
- Legally required by EIA and SEA Directives.
- Sensitivity in its current and potential future status more relevant for impacts than climate change itself.
- Conceptual framework that considers temporal dimension of changes: “parallel modelling approach” (Greiving et al 2018).
- Assessment of potential impacts on basis of scenario combinations for each time slice.

➢ Significance of already existing sensitivities and its potential changes becomes clear.

➢ Consideration of deep uncertainties.

➢ Inclusion of environmental justice.

Improving the Assessment of Potential and Actual Impacts of Climate Change and Extreme Events Through a Parallel Modeling of Climatic and Societal Changes at Different Scales

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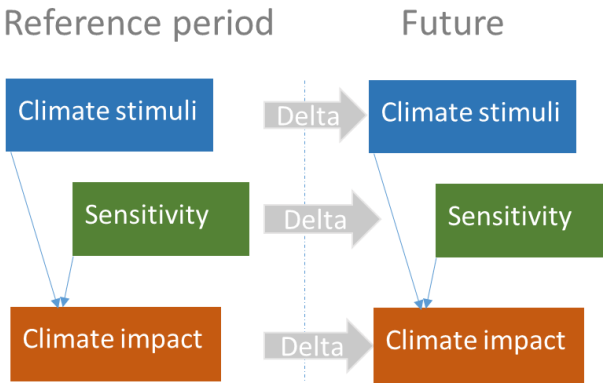
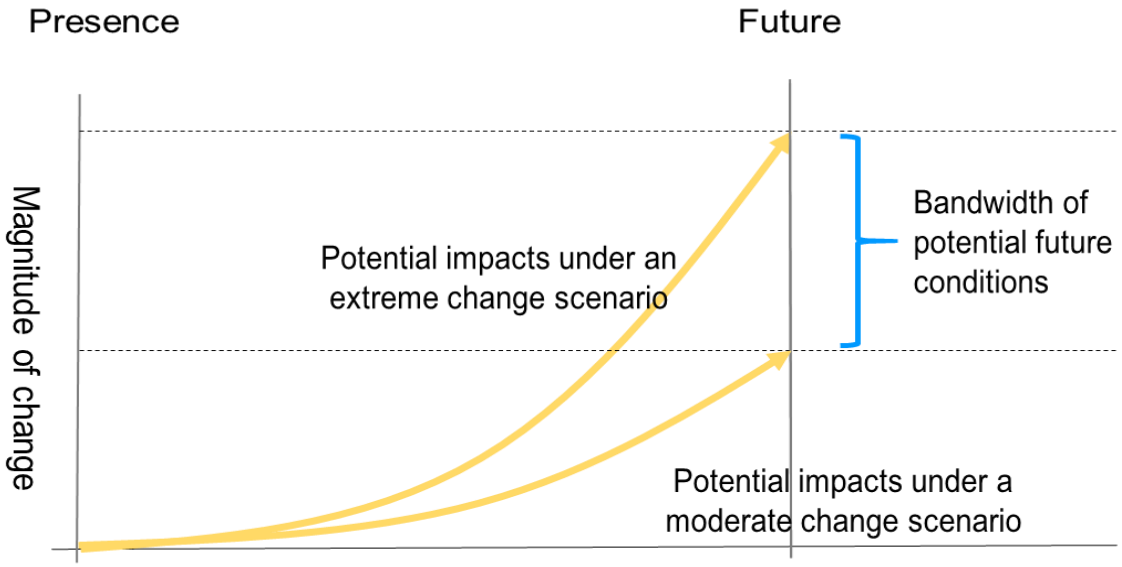
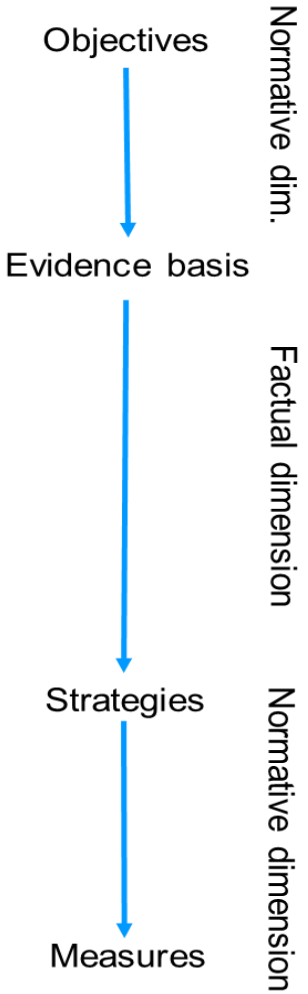
Any adaptation activity needs a reliable evidence basis for the climate itself as well as for the exposition and sensitivity of the social, economic or ecological system and its elements. This requires an assessment of recent climate impacts as well as potential future climate change impacts in order to select tailor-made adaptation measures. For a methodologically coherent assessment, the Intergovernmental Panel on Climate Change (IPCC) had introduced the requirement of a parallel modeling approach which means that demographic and socioeconomic changes are projected in parallel to the changes of the climatic system. This paper discusses a conceptual framework of a parallel modeling approach and presents its application in four case studies of climate change impact assessments in Germany, covering the national, regional and local scale. The results from the different applications prove the hypothesis that the change in sensitivity (i.e., demographic change, economic change and change in land-use patterns) often determines the magnitude of climate- and weather-related impacts in the near future significantly. The case studies, however, also show that adaptation processes have to be organized in a collaborative way which takes the



Relevance of normative judgements





Strategic decisions:

- Adaption to be based on precautionary principle/extreme change scenario or just a moderate scenario?

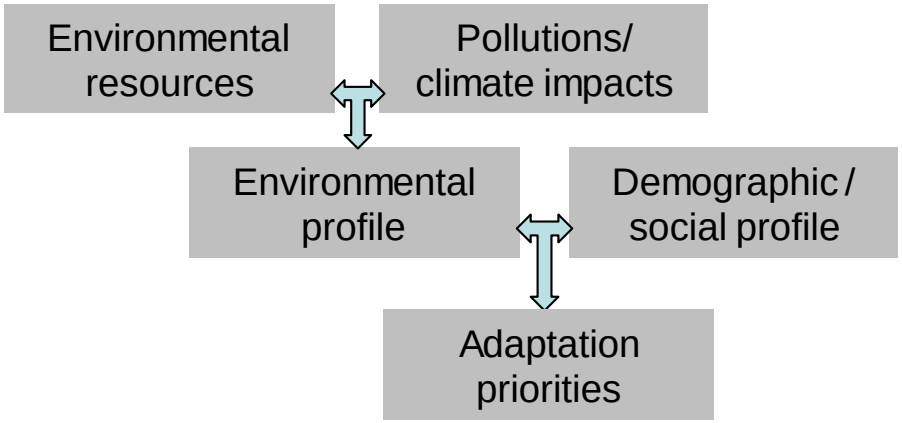
Selection of adaptation measures:

- What are necessary actions if an extreme change becomes a reality?
- What are suitable no-regret measures?
- What is about conflicts and synergies of adaptation with other trends like demographic change?

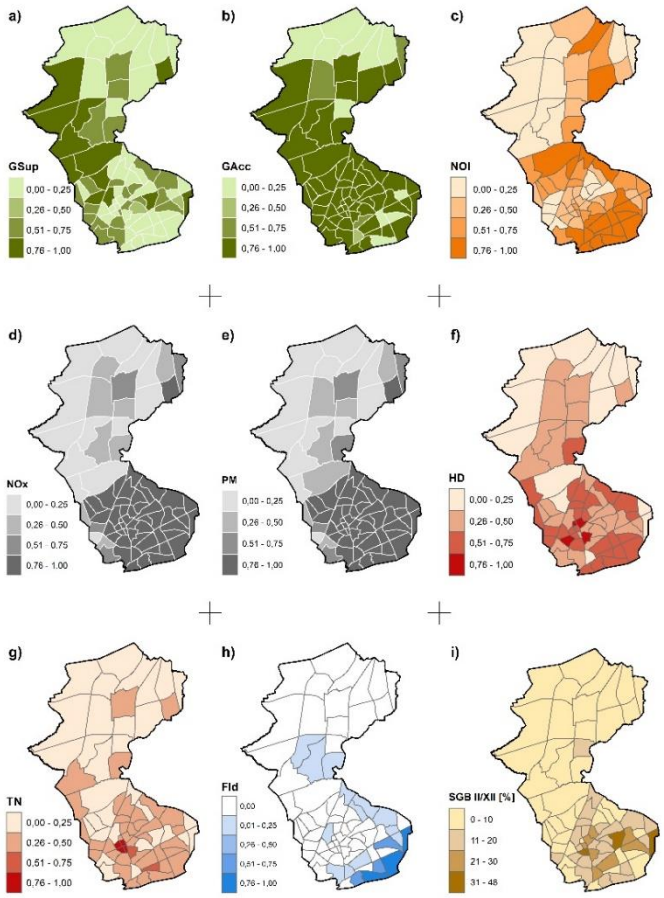
Source: Greiving et al (2018)

Assessment of environmental justice: ZUKUR project

- ZUKUR: Future of the region Ruhr: collaborative project with regional association Ruhr, City of Bottrop + City of Dortmund.



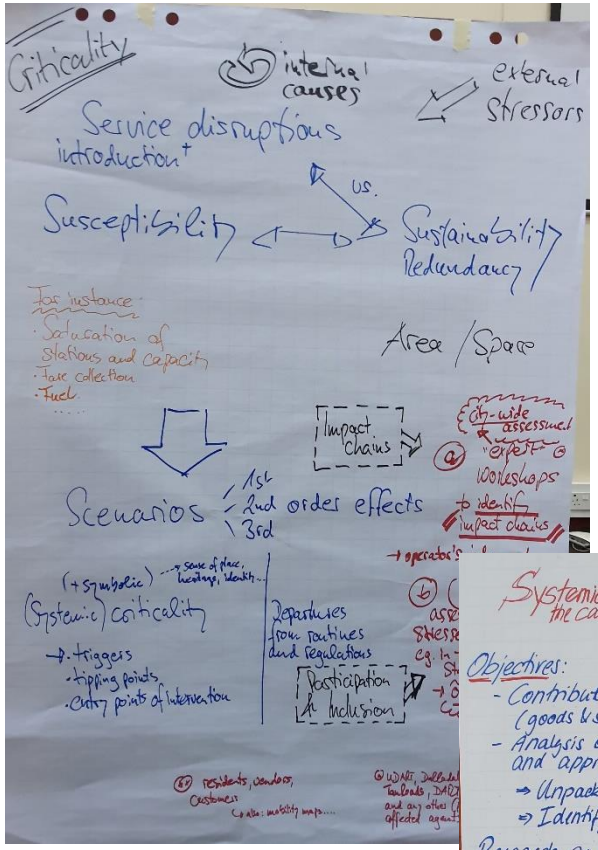
➢ Social concerns need to be considered when developing adaptation options!



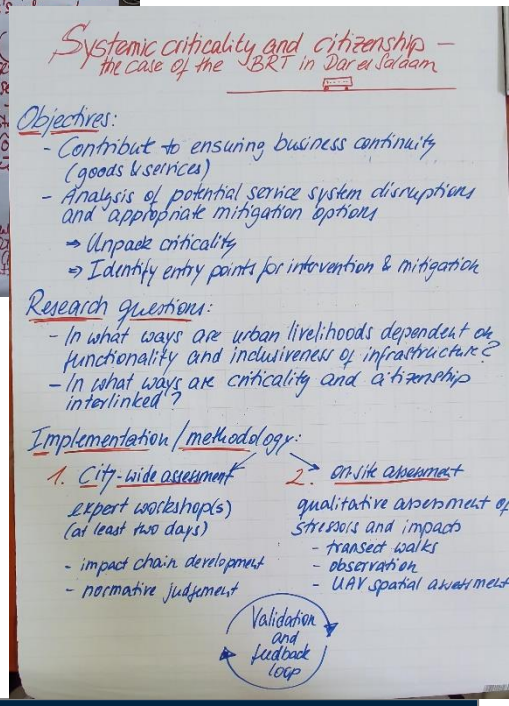
Source: ZUKUR project

Systemic criticality: LIPSINDAR

- Sendai Framework for Disaster Risk Reduction: “Substantially reduce disaster damage to critical infrastructure and disruption of basic services […] including through developing their resilience by 2030” (UN ISDR 2015: p. 12)
- Cascading effects may take place elsewhere outside the exposed area.
- Systemic criticality of CI determined by its importance for the functioning of services.
- Ongoing project on BRT in Dar Es Salam, Tanzania (and some pending applications with KNUST as well!).
- Project with GIZ in Lima (Peru) and Latacunda (Ecuador).



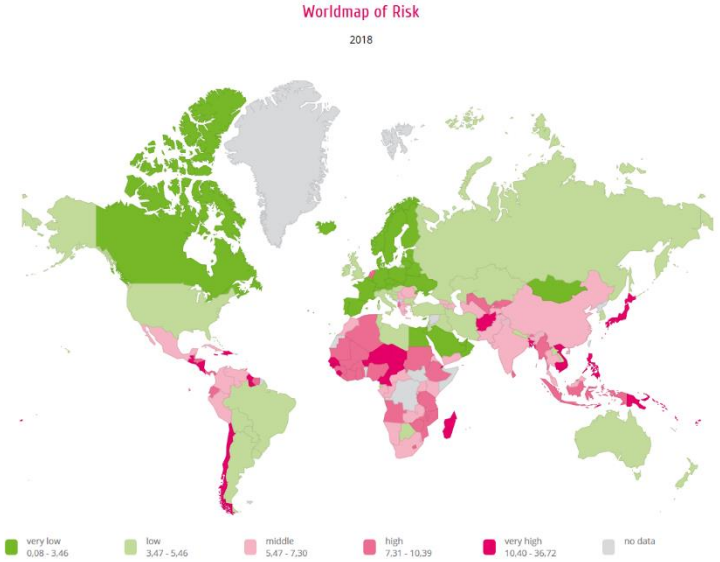
Source: own figures

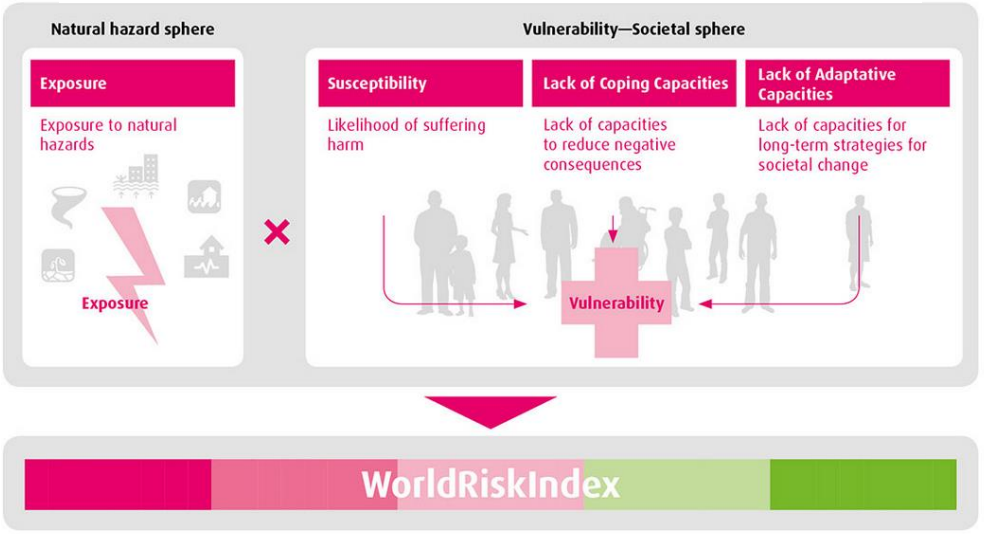


3. Spatial pattern of climate change (I)

Planet Earth

- Global south (currently) most affected.
- Exposure is assessed by the proxy indicator: number of (today's) exposed people.
- Susceptibility of livelihoods and infrastructures.
- Many countries in the Global South lack of coping + adaptive capacity.



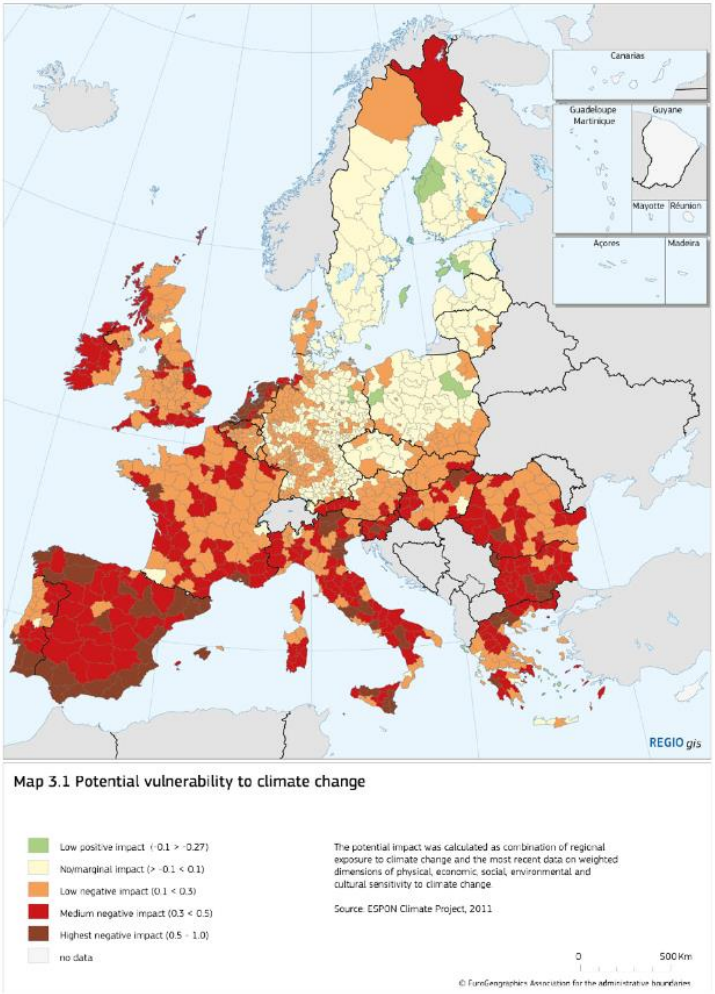


3. Spatial pattern of climate change (II)

Europe

- Adverse regional variations of adaptive capacity lead to high vulnerabilities in Southern and South-eastern Europe.
- Patterns roughly correspond to socio-economic patterns in Europe.
- Scenario runs counter to territorial cohesion.
- Climate change triggers a deepening of existing socio-economic imbalances between core of Europe and its periphery.
- Inner-German differences less relevant than those on European scale.

➢ Indicator based assessments are always scale-dependent! (normalization of values).



Source: EC (2014): 6th cohesion report, p. 101

3. Spatial pattern of climate change (III) - Germany

- Cities with a growing population are mainly located in climatic types which are exceptionally warmer than others and will heat up further in future.

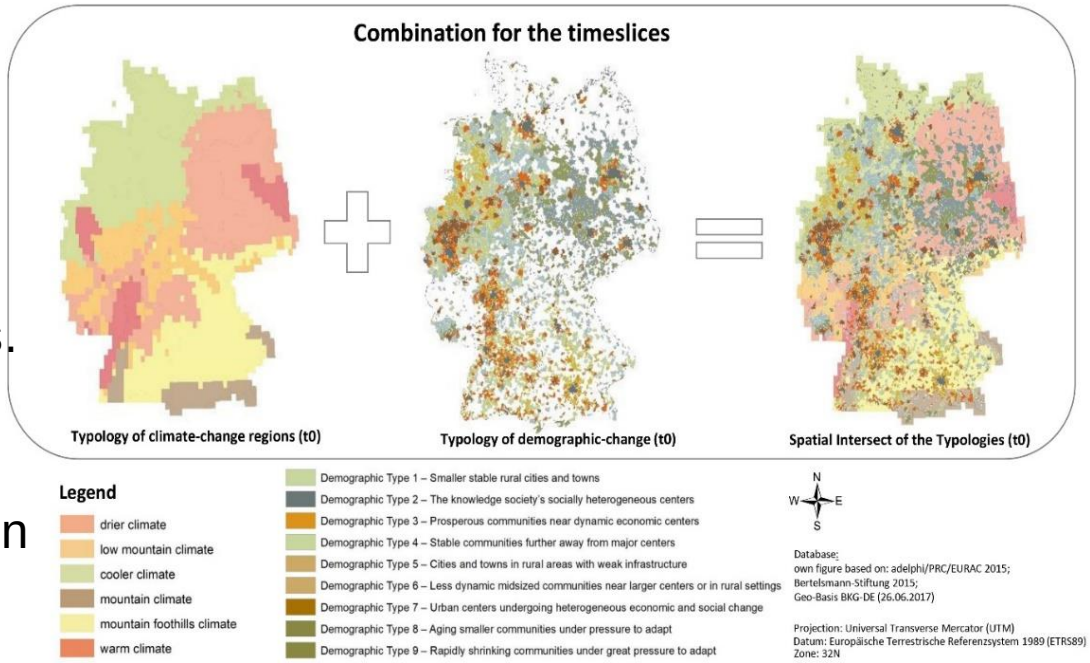
➢ Severe conflict with emerging housing demands.

- Climate change regions with a significant trend for droughts are mainly facing a decline of population.

➢ Maintenance/adaptation of technical infrastructures main challenge.

- Patterns calls for territorially differentiated adaptation actions.
- Linked with ongoing debate on equal living conditions.

➢ Mitigation of further out-migration most effective adaptation strategy!



Source: Greiving et al (2018)

4. How to adapt?

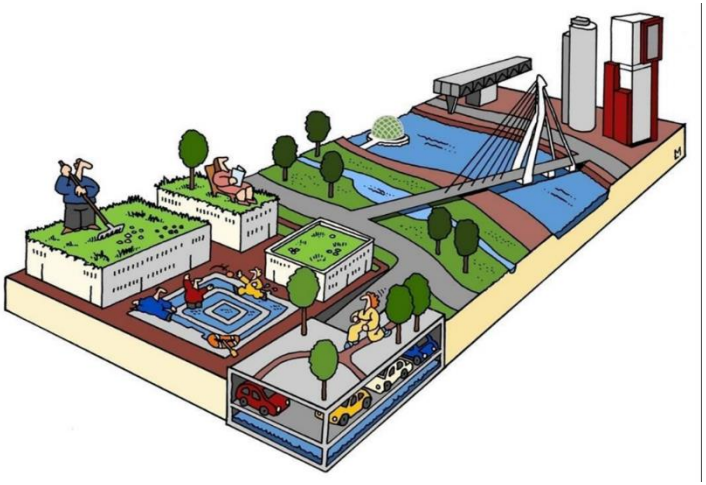
- Deep uncertainty of the future status of both climate and society calls for flexible, resilient adaptation strategies.
- "no-regret": multifunctionally justifiable solutions promise a net-benefit for the today's population.

➢ Sponge City Rotterdam, The Netherlands.

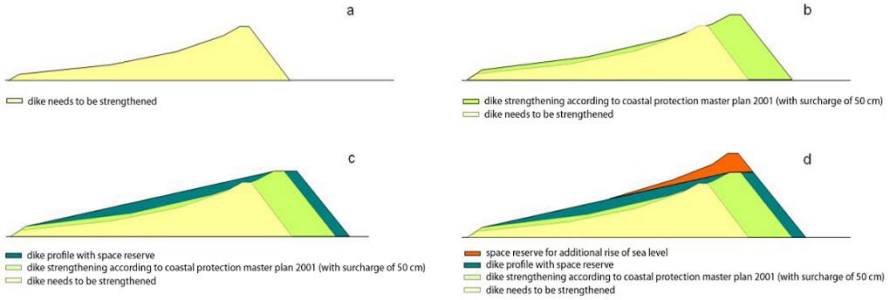
- Sequential realisation: step-by-step implementation of plans or physical infrastructures.

➢ "Klimadeich" Schleswig-Holstein, Germany.

➢ Preparatory land-use plans (City of Hagen, City of Regensburg).



Source: www.rotterdamclimateinitiative.nl

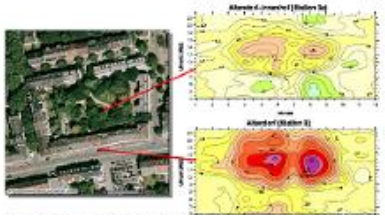


Source: http://www.schleswig-holstein.de/UmweltLandwirtschaft/DE/WasserMeer/09_KuestenschutzHaefen/06_Bemessungsverfahren/ein_node.html

Elements of Cool City Concept in Essen

Making use of demographic change and structural change for a climate change oriented urban development

- Use potentials of greening roofs, facades, courtyards and streets
- Development and opening of lanes for flows of cool air
- Integration of climate change adaptation into existing measures



Greening of courtyards

Demonstration quarter with climate change oriented urban land-use plan

Green in the city: University quarter

Urban reconstruction new Niederfeld lake

Former railway track used as cycling path and lane for cool air flow

Climate change adaptation in old peoples' homes

New green and blue spaces

ExWoSt demonstration project „Tackling climate change – Integrated strategies for the City of Essen“

- Scenario „Cool City“ at the „Innovation City“ site in Essen, North Rhine-Westphalia
- Examples of optional measures
- Source: Stadt Essen

Example from the City of Essen: Adaptation to the urban heat island

Development of a heat warning system

- Forwarding heat warnings of the German Weather Service (DWD) to the public
- Specific information provided to sensitive facilities (old peoples/retirement homes, hospitals, nursery day cares/kindergartens, schools)
- Information accessible to everybody on an internet website

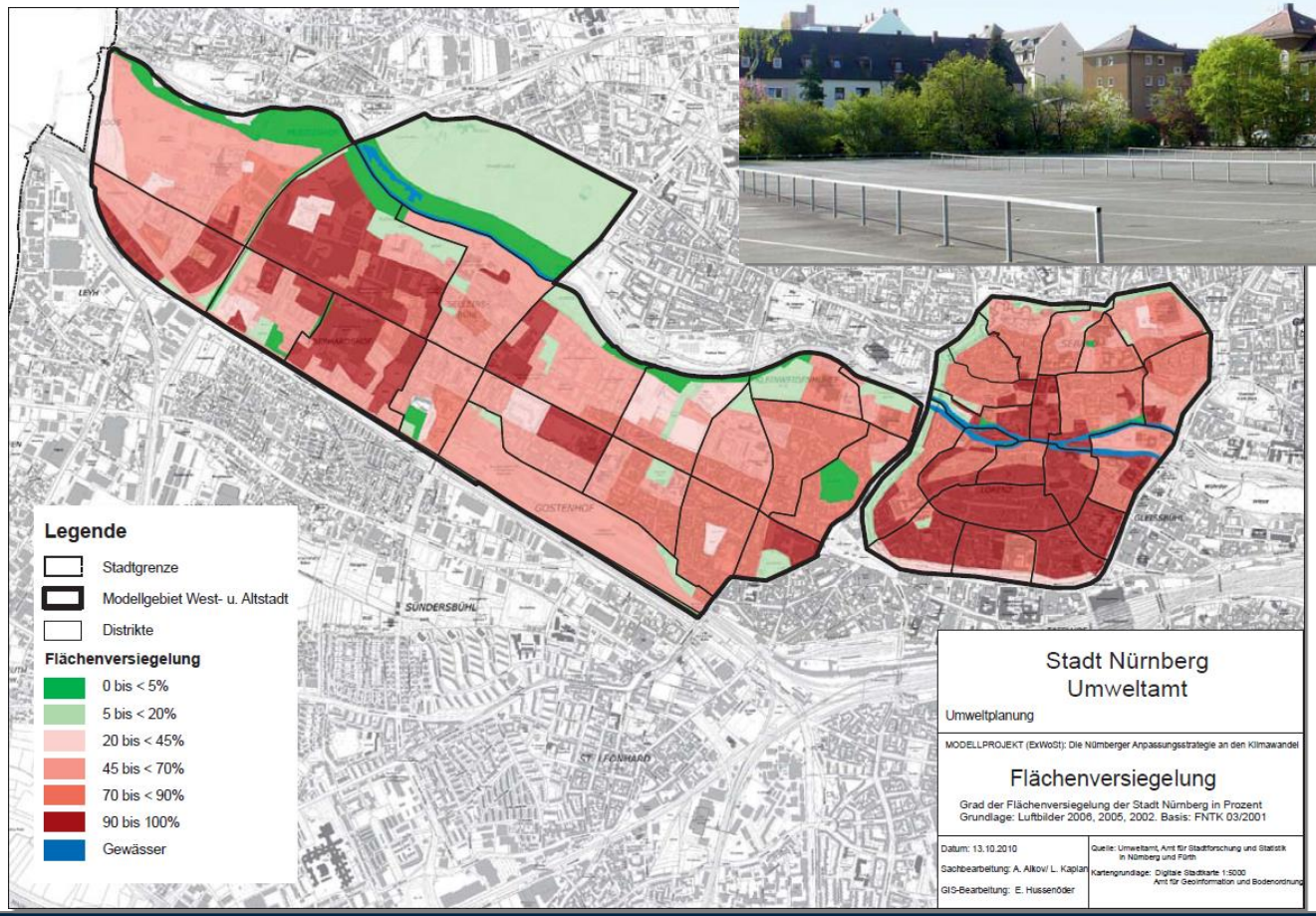
Distribution of information for behaviour during heat waves

- Information on what to do for the population and social facilities

Planning and housing related recommendations

- Construction of old peoples homes: selected sites ideally not in the centre of the urban heat island but close to heat compensating green spaces
- Buildings for social facilities with sensitive persons: sun protection, use of materials that reduce heating effects

Example from Nuremberg: Redevelopment



ExWoSt demonstration project „Climate change adaptation strategy for Nuremberg – the example of inner city quarters“

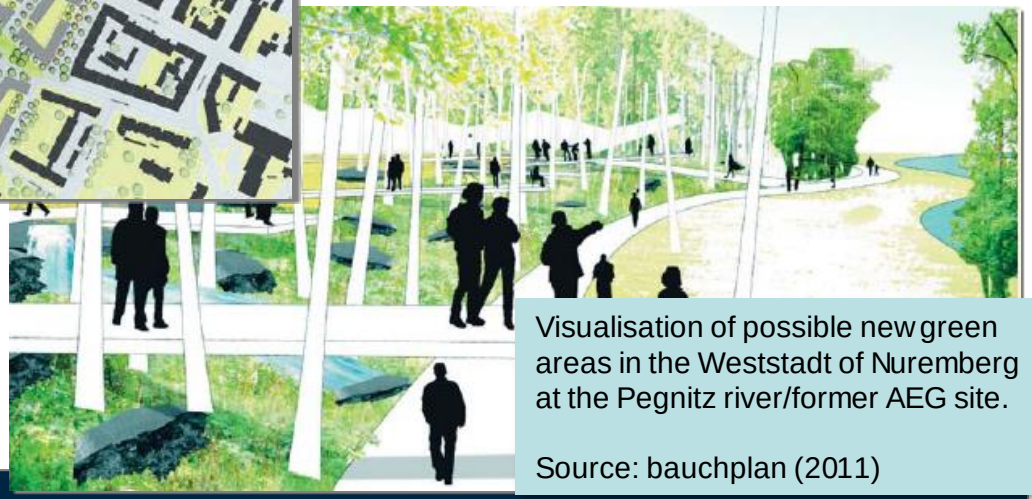
- Redevelopment of brownfield areas in the „Weststadt“ of Nuremberg, Bavaria
- Reduction of sealed surface area

Source: Stadt Nürnberg

Example from Nuremberg: Redevelopment of brownfield areas (former Quelle and AEG sites)

Urban design competition for the former Quelle site: Draft of the 1st award with new green areas on former parking lots

Source: AG Messmer + Franke, Rössner + Waldmann, Tautorat (2011)

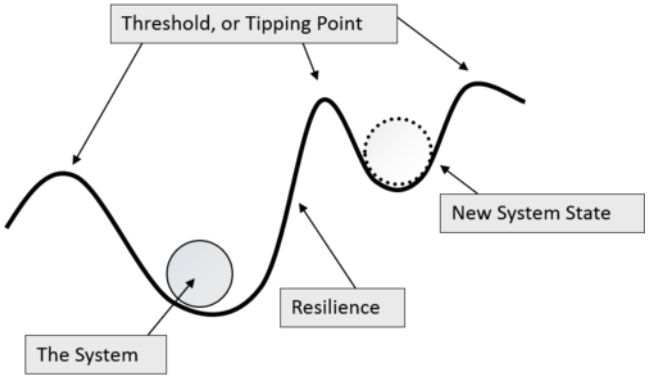


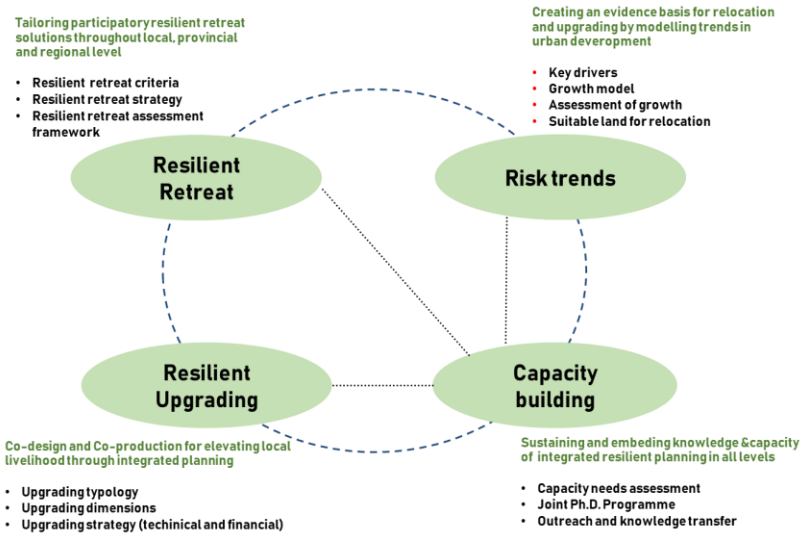
Visualisation of possible new green areas in the Weststadt of Nuremberg at the Pegnitz river/former AEG site.

Source: bauchplan (2011)

5. Transformative Adaptation

- Temporal dynamics of change require a fundamental transformation of societies and landscapes.
- IPCC links concept of resilience with transformation (2014): “Bounce forward” to a new system state.
- New Urban Agenda (UN 2017) “commit ourselves to strengthening the resilience of cities and human settlements, including through the development of quality infrastructure and spatial planning […], especially in risk-prone areas of formal and informal settlements […].”
- May require retreat from highly endangered areas (see Jakarta!).
- Ongoing research activities in Manila, the Philippines and Lima, Peru.





Own figures

Deconstruction and reconstruction in safe areas

- Requires a specific funding scheme and/or managed realignment as incentive or full compensation in case of expropriations.
- Prohibition of reconstruction of demolished building stock. Legally possible in various countries in case of loss of live risks, flanked by a withdrawal of given building rights.

Selective retreat

1) Further use of the hazard prone area due to economic interests and relatedness of population with their land: Selective retreat of those infrastructures that are particularly susceptible or dangerous.
2) Retreat of ordinary land-uses in combination with selective continuance of those structures whose relocation would be economically unfavorable.

Greiving et al (2018a)

6. Conclusions

- Emerging need for evidence-based decision-making.
- Holistic view on changes: consideration of temporal dynamics and social concerns.
- Iterative/colloberative character of climate impact assessments.
- Climate proofing should consider potential future adaptation needs = transformation.
- In Germany, retreat will be addressed by the upcoming first federal spatial plan on flood protection.

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Thank you for your attention!

GREIVING, S., ARENS, S., BECKER, D., FLEISCHHAUER, M., HURTH, F. (2018): Improving the assessment of potential and actual impacts of climate change and extreme events through a parallel modelling of climatic and societal changes at different scales. In: Journal of Extreme Events. DOI 10.1142/S2345737618500033

GREIVING, S., JUAN, D., PUNTUB, W. (2018A): Managed retreat – international and comparative perspectives. In: Journal of Extreme Events. Vol. 05, No. 02 (2018). DOI: 10.1142/S2345737618500112

BECKER, D., **GREIVING, S.** (2018): Climate and Social Demographic Change – Interrelations and the need for an integrative approach for spatial planning – a German case study. In: Metropolitics, 25 April 2018. URL: http://www.metropolitiques.eu/Climate-and-Demographic-Change-The-Need-for-an-Integrative-Approach-to-Spatial.html

GREIVING S., TESLIAR, J., UBAURA, M. (EDS. 2018): Spatial Planning and resilience following disasters – international and comparative perspectives. Policy Press. Bristol, 354 pp

TRA, T. V., THINH, N. X., **GREIVING, S.** (2018): Combined top-down and bottom-up climate change impact assessment for the hydrological system in the Vu Gia Thu Bon River Basin. In: Science of the Total Environment 630 (2018) pp. 718–727.

GREIVING, S., HARTZ, A., SAAD, S., HURTH, F., FLEISCHHAUER, M. (2016): Developments and Drawbacks in Critical Infrastructure and Regional Planning: Case Study on Region of Cologne, Germany. In: Journal of Extreme Events, Vol. 3, No. 4 (2016) DOI: 10.1142/S2345737616500147.

GREIVING, S., ZEBISCH, M., SCHNEIDERBAUER, S., LINDNER, C., LÜCKENKÖTTER, J., FLEISCHHAUER, M., BUTH, M., KAHLENBORN, W., SCHAUSER, I. (2015): A consensus based vulnerability assessment to climate change in Germany. In: International Journal of Climate Change Strategies and Management. Volume 7 Issue 3, S. 306 – 326

SCHMIDT-THOMÉ, P., **GREIVING, S.** (EDS. 2013): European climate vulnerabilities and adaptation: A spatial planning perspective. Wiley & Blackwell. London.

GREIVING, S., PRATZLER-WANCZURA, S., SAPOUNTZAKI, K., FERRI, F., GRIFONI, P., FIRUS, K., AND XANTHOPOULOS, G. (2012): Linking the actors and policies throughout the disaster management cycle by "Agreement on Objectives" – a new output-oriented management approach, Nat. Hazards Earth Syst. Sci., 12, 1085-1107, doi:10.5194/nhess-12-1085-2012

GREIVING, S., FLEISCHHAUER, M. (2012): National climate change adaptation strategies of European states from a spatial planning and development perspective. In: European Planning Studies Vol. 20 No. 1, pp. 27-47.

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