



How Bavarian Cities adapt to Climate Change: The example of Munich

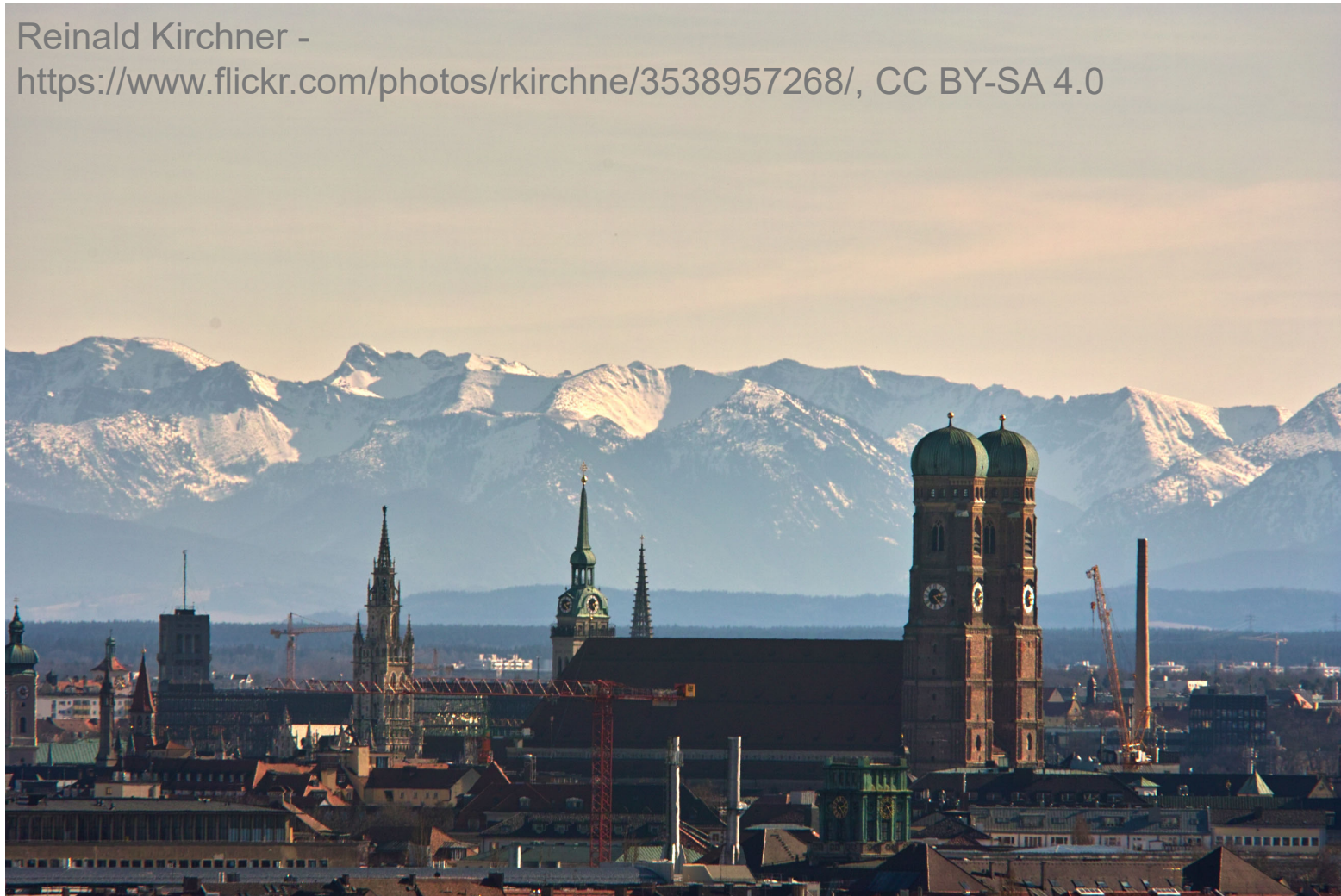
Prof. Dr. Julia Laube, Dr. Veronika Wirth, Dr. Teresa Zölch, Paul Depner

Joint Talk HSWT & City of Munich, Department Climate & Environment

04.11.2021

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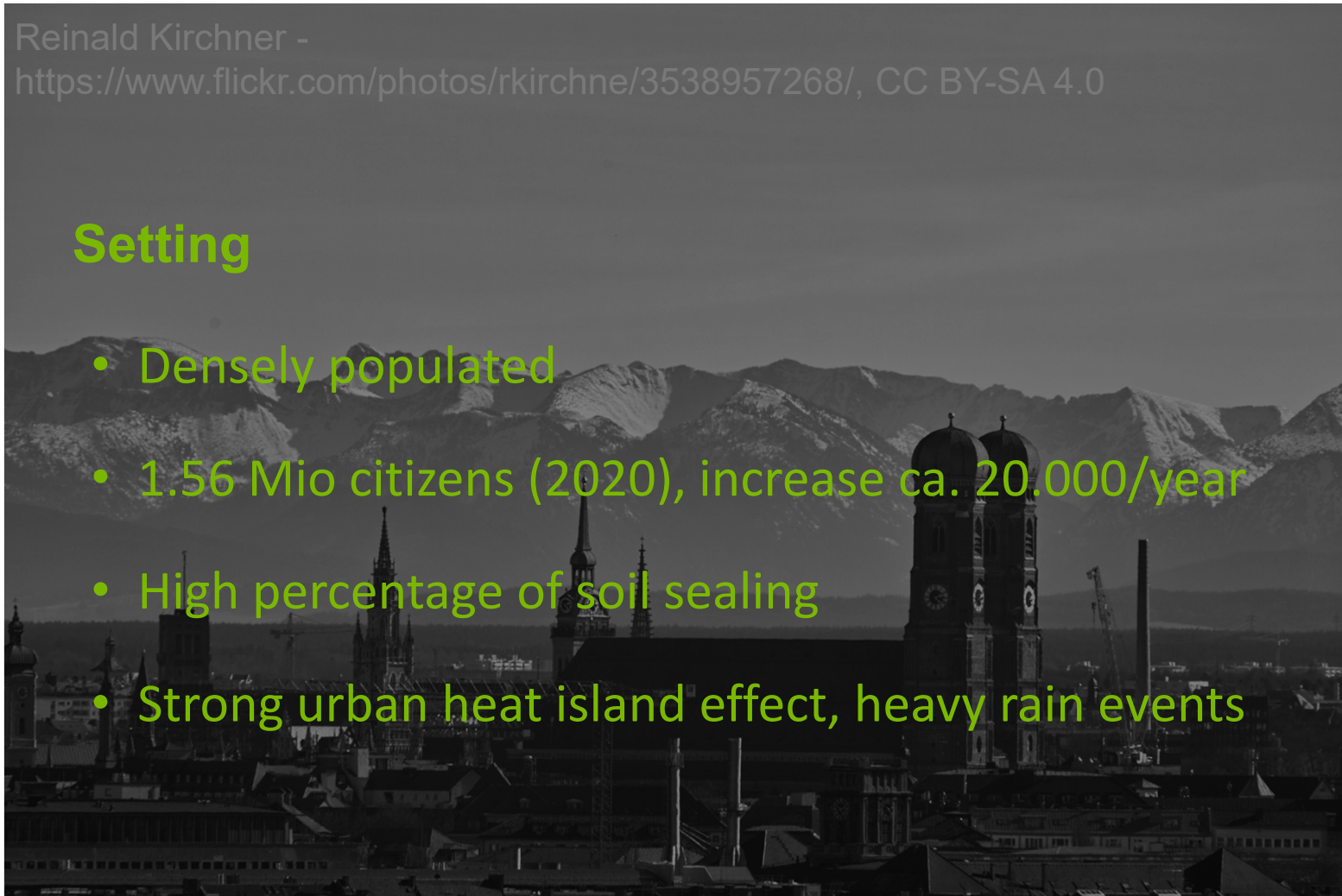


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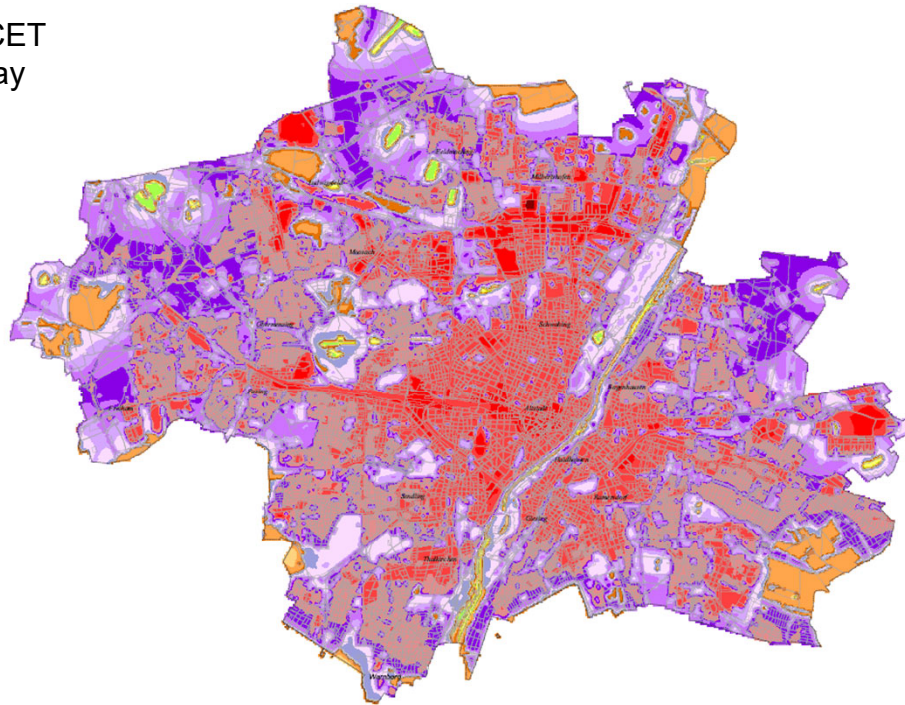
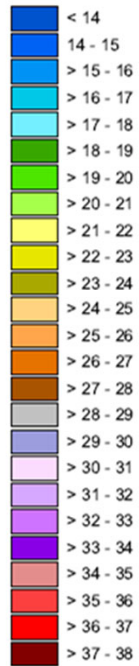
Setting

- Densely populated
- 1.56 Mio citizens (2020), increase ca. 20.000/year
- High percentage of soil sealing
- Strong urban heat island effect, heavy rain events



Current climate & trends

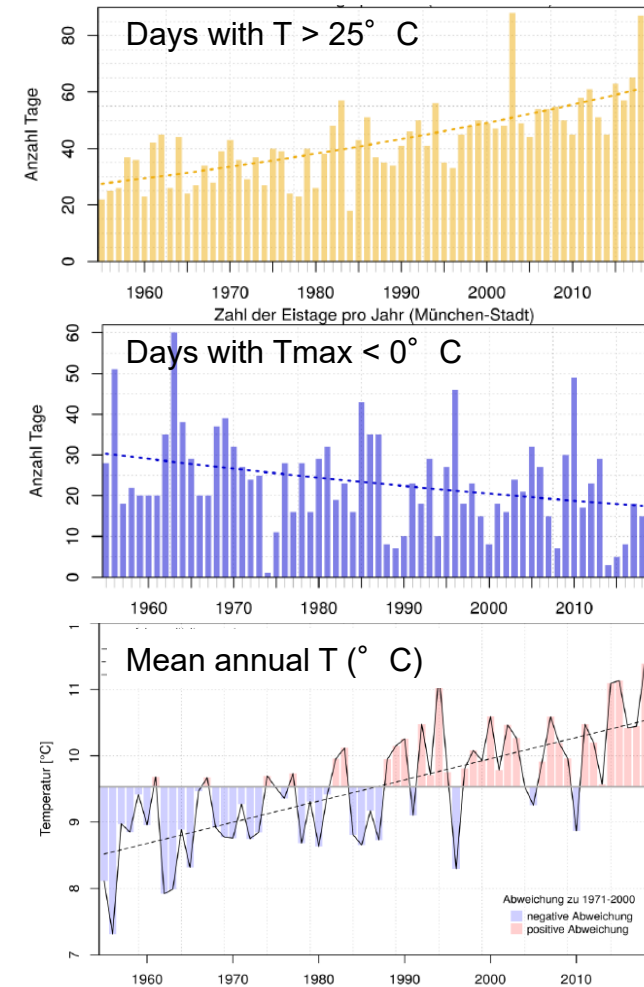
Temp
at 14:00 CET
summerday



Urban Climate Map, City of Munich 2014

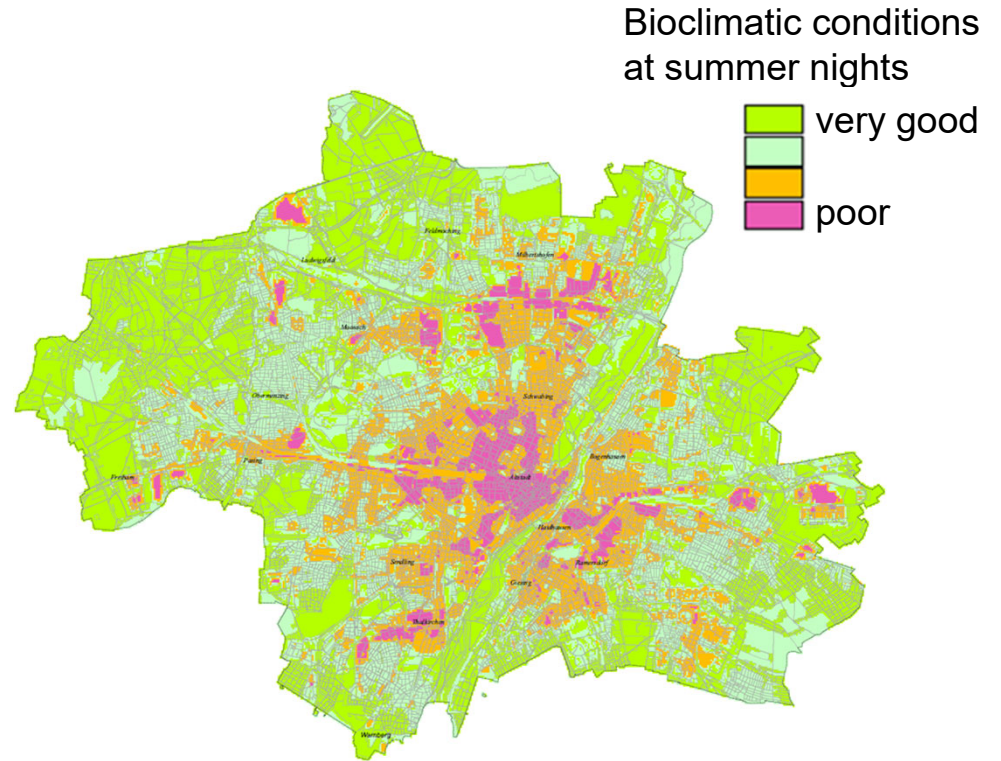
Hochschule Weihenstephan-Triesdorf | Climate Change Adaptation Munich |

Graphs: German Met. Service (DWD)

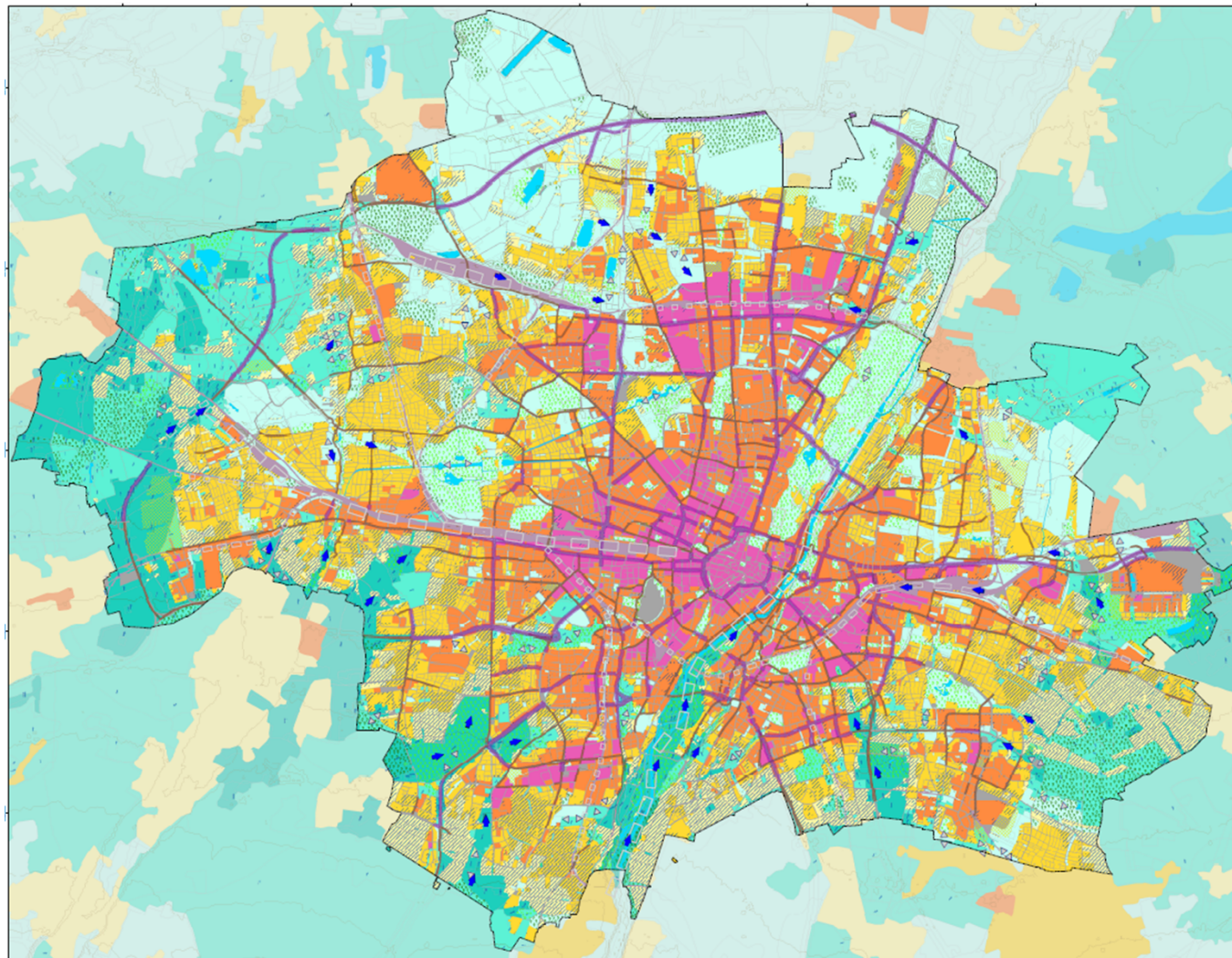


Climate Map

- Long-term climatic measurements
- Cooperation City & German Meteorological Service






Urban Climate Map, City of Munich 2014




Legend

Importance of Urban Green
fresh air flow (m³/s)

	very high	> 1500
	high	900 bis 1500
	medium	< 900

Residential areas
bioclimatic conditions

	very good
	good
	intermediate
	poor

 Major fresh air flow

Urban Climate Map,
City of Munich 2014

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Setting

- Excellent data
- Models of current climate & predictions
- Knowledge on vulnerable, unfavourable sites as well as on sites with high impact on cities' climate
- Political will to act

Decisions of the City Council

- 2013: develop a climate change adaptation strategy for the city
- 2014: sign Mayors Adapt
- 2016: implement adaptation strategy & action plan including funds needed
- 2019: climate emergency announced
- 2021: monitor & update adaptation strategy
- 2021: climate budget 100 Mio € / year to get climate-neutral & climate change adaptation



City of Munich 2016

Climate Change Adaptation Strategy

Impact assessment

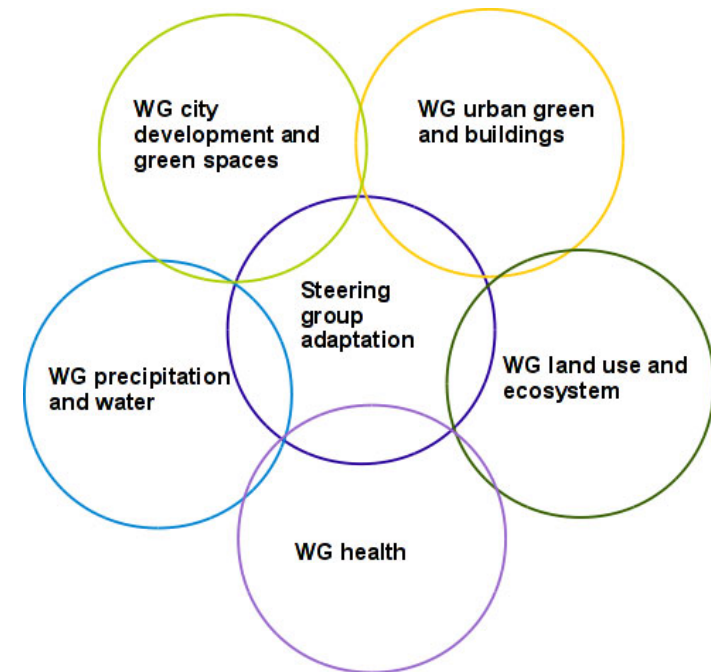


26 measures



Process monitoring

Structure: Working groups



more than 60 participants
from 7 administrative units

Impact assessment

	Increasing mean temperatures	Rising extreme temperatures	Increasing number of nights >20°C	Dry periods	Changing rain patterns*	Increasing heavy precipitation events*	Storms*	Extreme events e.g. hail, freezing rain**
City development and green spaces (district level)		- increasing heat stress - green spaces: increasing requirements	- no recreation during the night			- local flooding, - infiltration		- damage of houses and infrastructure
Urban green and buildings (object level)	- plant selection	- worse living and working climate - green spaces: increasing requirements	- no recreation during the night	- selection of plants and substrat - increasing demand for water and maintenance		- local flooding, - damage of houses	- damage of houses and infrastructure	- damage of houses and infrastructure
Health	- Increase in allergies, - Increase in infectious diseases	- increase in cardiovascular diseases - increase in respiratory diseases	- increase in cardiovascular diseases					
Water management	- Rising water temperatures			- fluctuating ground water level	- risk of flooding changes - rising ground water level, rising temperature	- risk of flooding changes, local flooding - rising ground water level, rising temperature		
Agriculture/ forestry	- longer vegetation period - changing growth conditions	- heat stress		- dry stress - danger of forest fires	- possible yield losses	- possible yield losses	- forest damage	- possible yield losses, damages

	Considerable negative impacts
	Moderate negative impacts
	Positive impacts

* still uncertainties in projections for future development

** still very considerable uncertainties concerning future development. Modelling efforts are still at the beginning.

Measures

WG city
development
and green
spaces

- Adaptation of existing spatial **planning instruments**
- **Simulations** for exemplary urban climate issues

WG urban
green and
buildings

- Adaptation measures for **trees** (tree stands, tree species)
- **Information for house builder** on heavy precipitation, **grants for greening** of private buildings/gardens
- Define **quality standards** for urban green

WG
precipitation
and water

- Improving **data base for extreme events**
- **Restoration of rivers and streams**
- Retrofit of **emergency fountains**

WG health

- Assessing vulnerability of **care facilities and hospitals**
- **Information for public / vulnerable groups:** What to do during heat waves

Adaptation of spatial planning instruments

1st planning step

e.g. urban design competitions, structural concepts, change of land-use plans



Early screening based on climate map:
Climatic functions? Air exchange?

If climate sensitive:
Advise further actions

2nd planning step

e.g. master plan, project-related zoning plan



Screening based on climate map:
Climatic functions? Air exchange?
Current bioclimatic conditions?

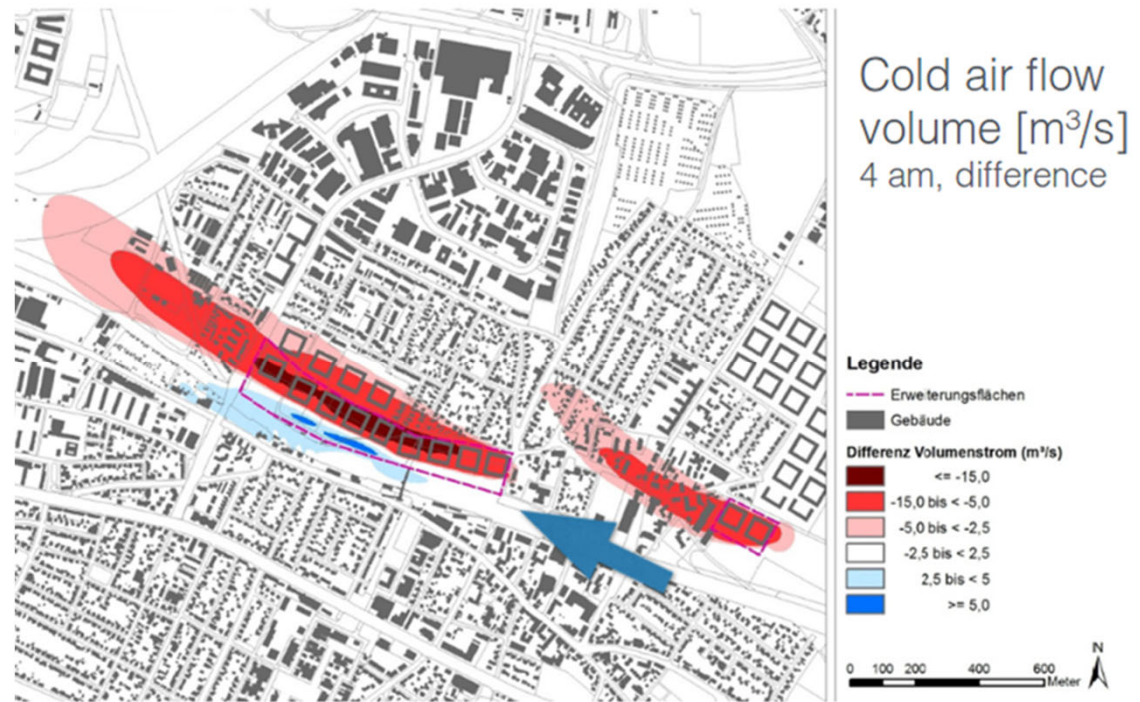
If climate sensitive:
Micro-climatic assessment,
Optimisation, Advise changes

Adaptation of spatial planning instruments

Detailed micro-climatic assessment and scenario modelling in climate-sensitive cases

Deduction of climate criteria for urban design competitions

Optimisation of buildings (size, location, massing)



City of Munich

Associated Research Projects

„Grüne Stadt der Zukunft“

Partner:

Technische Universität München,
Ludwig-Maximilians-Universität
München, Institute for Ecological
Economy Research

Funding: Federal Ministry of
Education & Research



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„Hitzeassoziierte Gesundheitsprobleme in der Pflege – Maßnahmenplan für vollstationäre Pflegeeinrichtungen zur Anpassung an den Klimawandel“

Partner: Ludwig-Maximilians-Universität München

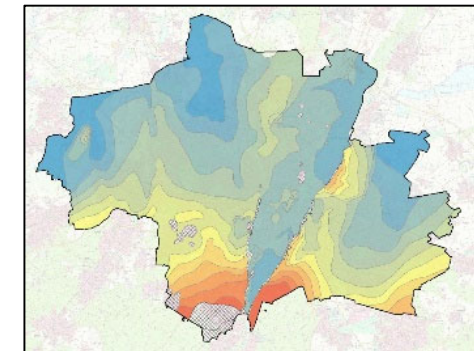
Funding: Federal Ministry for the Environment, Nature
Conservation and Nuclear Safety

„GEO.KW“

Partner: Technische
Universität München,
Universität Stuttgart,

...

Funding: Federal Ministry
for Economic Affairs and
Energy



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Preliminary conclusions

- Many climate change topics, vulnerabilities and chances to react are identified
- First measures implemented, further process has started
- Public attention is raised

THANKS

For your attention!

Prof. Dr. Julia Laube

04.11.2021

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for Life*