JENA
LICHTSTADT.

JenKAS – The Local Climate Change Adaptation Strategy

Activities of the Municipality of Jena (June 2014)

www.jena.de

The City of Jena – Facts & Figures

Source: City of Jena; Dr. Lerm

Facts …

- Country: Germany
- State: Thuringia
- District: Urban district
- Lord Major: Albrecht Schröter (SPD)
- Inhabitants: 106,915 (31.12.2012)
- Density: 940 inh./km² (2,400/sq mi)
- Area: 114,30 km² (44,13 sq mi)

Coat of Arms

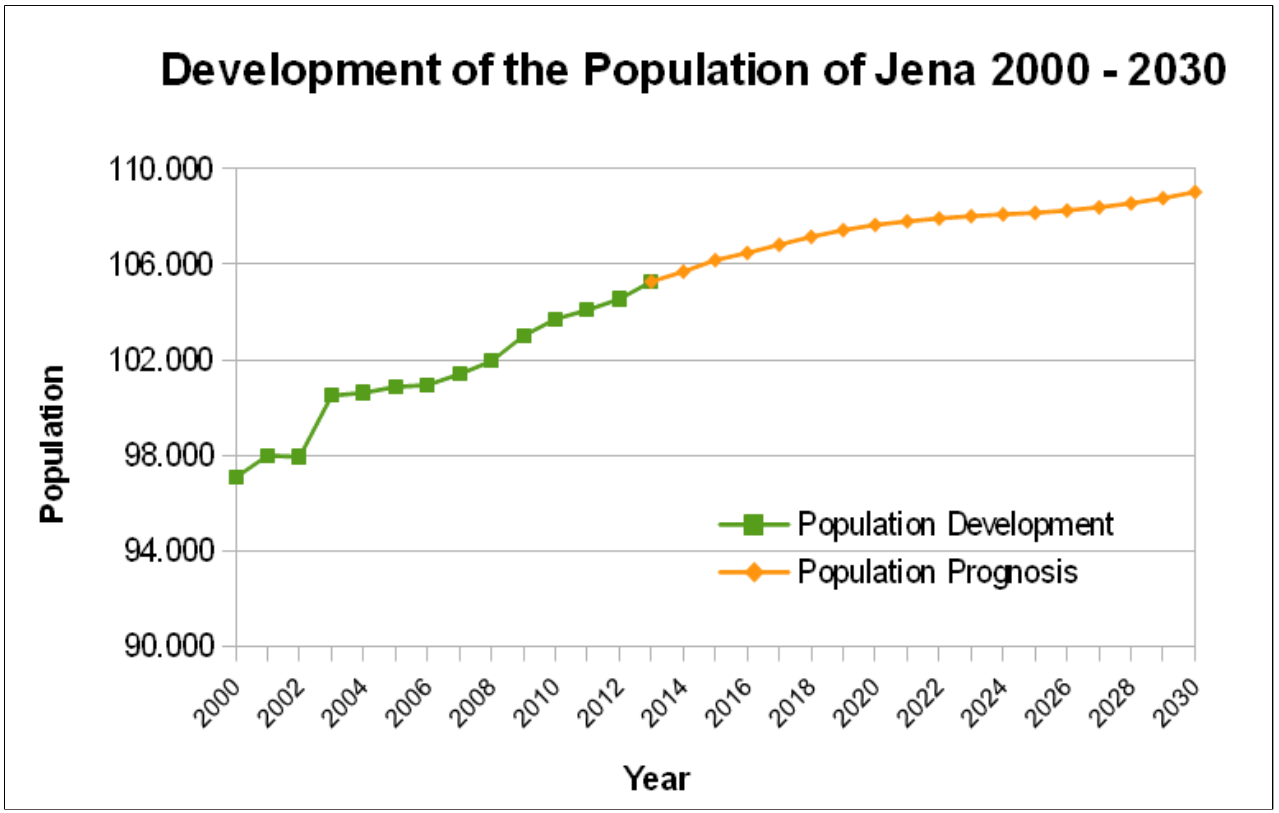
… and Figures

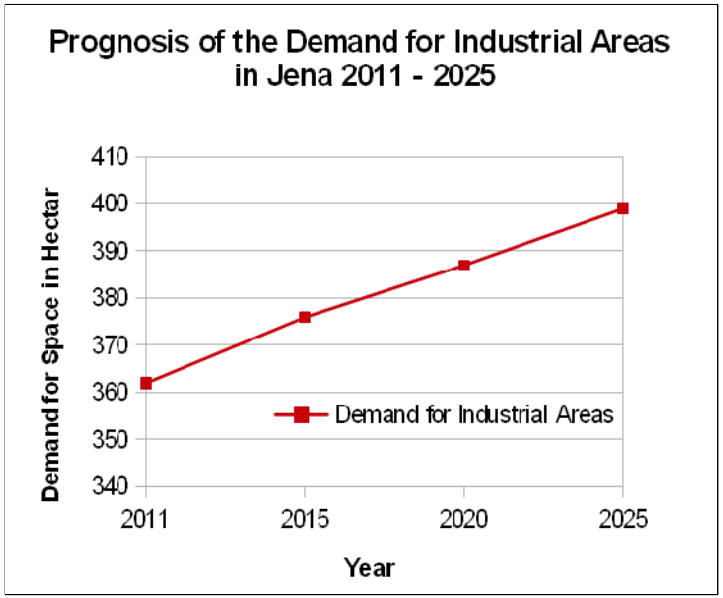
- Jena forms the **central metropolitan area of Thuringia** with approximately 500,000 inhabitants (together with the neighbour-cities Erfurt and Weimar).
- Jena is a **centre of education and research** – the Friedrich Schiller University has 21,000 students today, the Ernst-Abbe-Fachhochschule Jena counts another 5,000 students.
- Furthermore, there are many institutes of the leading German research societies.
- The city's economy is based on **high-tech industry** and research, making Jena an **innovation centre** in Germany.
- Optical and **precession industry** is the leading branch to date, while **software engineering**, other **digital businesses** and **biotechnology** are of growing importance.
- Furthermore, Jena is also a service hub for the bordering regions.

Current Developments in Jena

- Jena: growing city in a shrinking region
- **Population growth** from **97,000** in 2000 to **106,000** inhabitants in 2013
  - Population forecast for 2030: **109,090** inhabitants
- **Economic growth:**
  - Number of employees grows from **58,800** in 2002 to **74,300** in 2025 (2011: 69.300)
  - Demand for industrial and special areas from **362 ha** in 2011 to **399 ha** in 2025

Population and Economic Growth





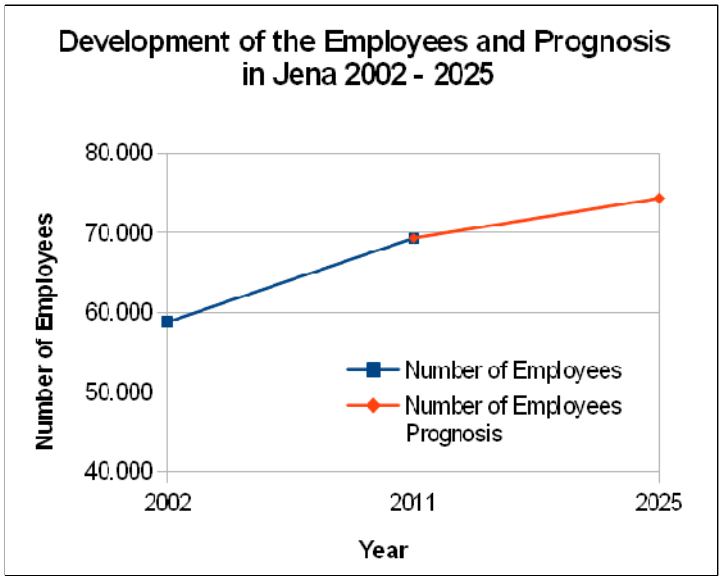


Diagram at the top: Development of the Population of Jena
Diagram on the top right: Demand for Industrial Areas in Jena
Diagram at the bottom right: Development of Employees in Jena

Source: Statistical Office of the City Jena; Prognos AG

Current Urban Development Projects

Picture on the top: Industrial area „Jena21“

Picture on the top left: Residential building „Sonnenhof“

Picture left: University campus „Inselplatz“

Source: Wick + Partner; J. MAYER. H.; JenaWirtschaft

What is the climatic situation in Jena?

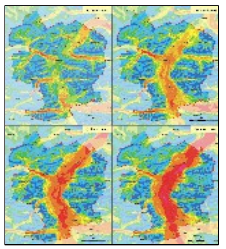
Climate Situation in Jena

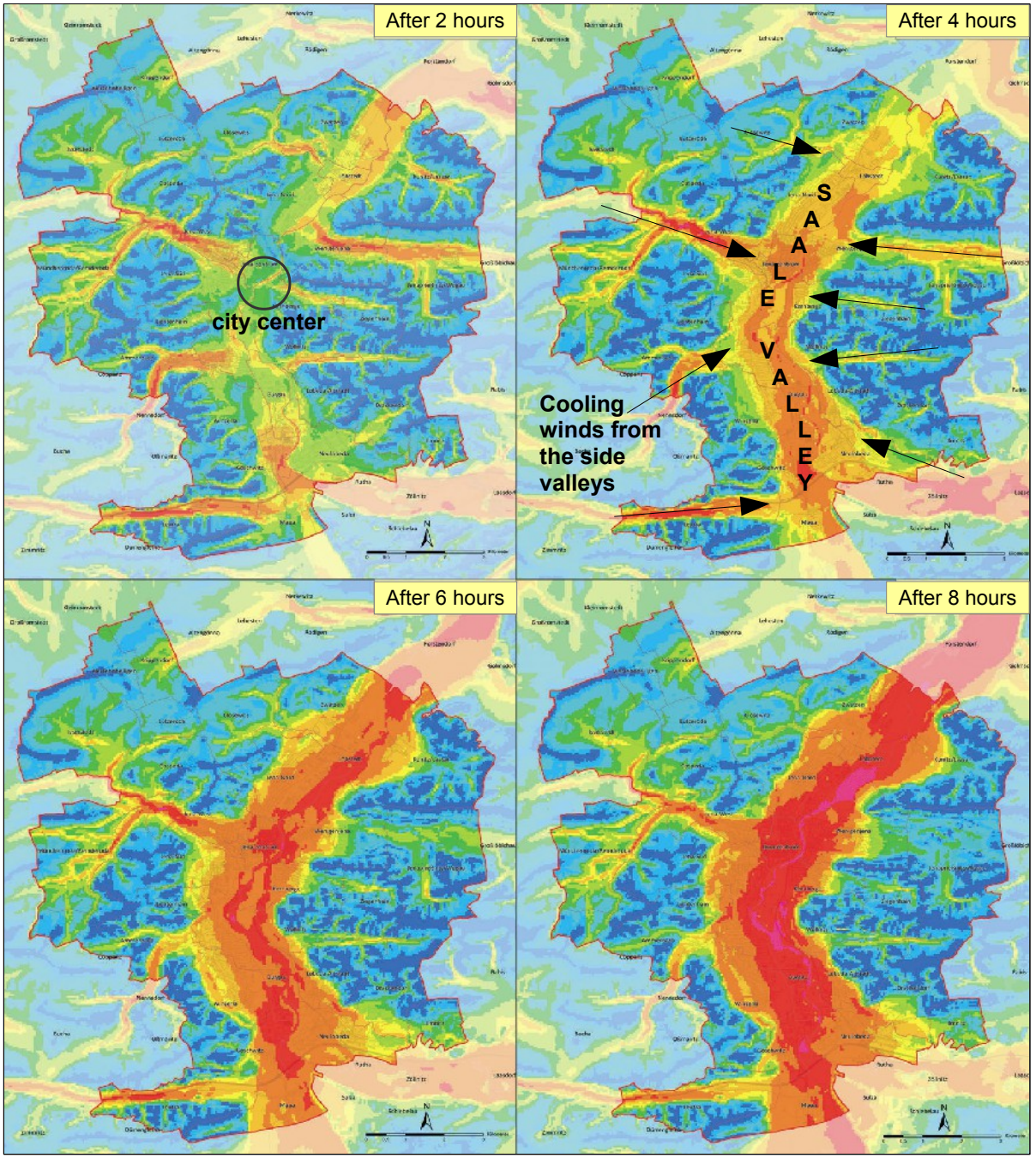
- Jena lies in a **hilly landscape** in the east of Thuringia, within the **wide valley of the river Saale**
- The city centre is situated at 160 m of elevation, whereas the mountains on both sides of valley „Saaletal“ rise up to 400 meters
- Characteristics of local climate situation / topography
  - **Low air exchange** (autochthonous weather every 5th day a year) → regular repeating smog-situations until 1990 due to energy use based on brown coal and low air exchange)
  - **Thermal overheating** (especially in densely built-up areas of the city) → Heat-Island-Effect
  - **Importance of cooling winds** from the side valleys

Autochthonous weather

- **Cloud- and windless** days with **intensive short-wave insolation**
  - Weather situation **without exchange** of warm and cold air masses
  - No cooling
  - In Jena **a 5th of all days** a year
- Side valleys of Jena play a central role in providing the exchange of air masses and cooling

Cooling winds in Jena: see visualization on next slide





Cold air volume flow
m³/(m*s)

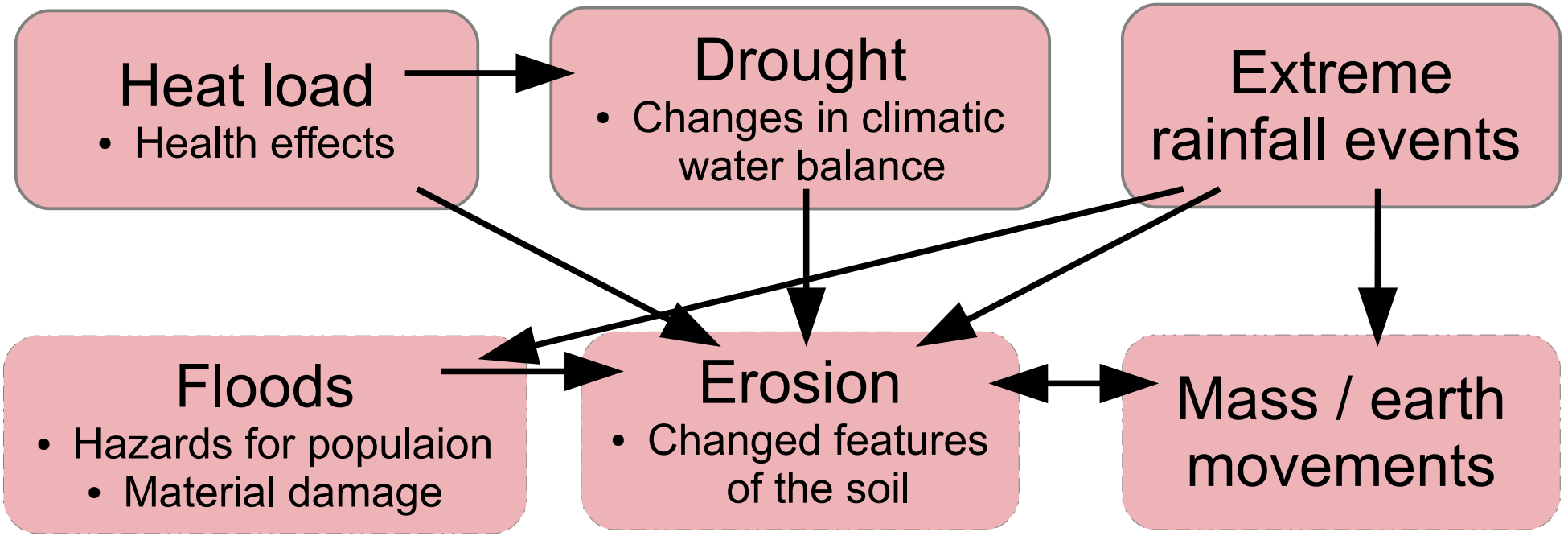
- 0-1
- >1-2
- >2-5
- >5-10
- >10-20
- >20-30
- >30-50
- >50-100
- >100-200
- >200

Picture: Cold air situation during autochthonous days in Jena
→ high importance of cooling winds from the side valleys; this happens overnight and leads to a cooling down of the Saale valley

Source: City of Jena

Climatic Change and impacts on Jena – biggest challenges in the future

- (1) Increase in temperature → thermal overheating
- (2) Increasing drought
- (3) Extreme events, especially heavy rainfall



(1) Heat load – Thermal overheating

- Jena is located in the warm temperate zone of Central Europe
  - The city has a relatively dry position in Thuringia and Germany
  - The average annual temperature in Jena is higher than in whole Thuringia (2001-2010: 10,1 Degree)
  - Jena as one of the warmest places in Central Germany → „Toscany of the East“
- Heat-Island-Effect
  - In the city center is a higher average air temperature than in surrounding areas → **possible threat for human health**

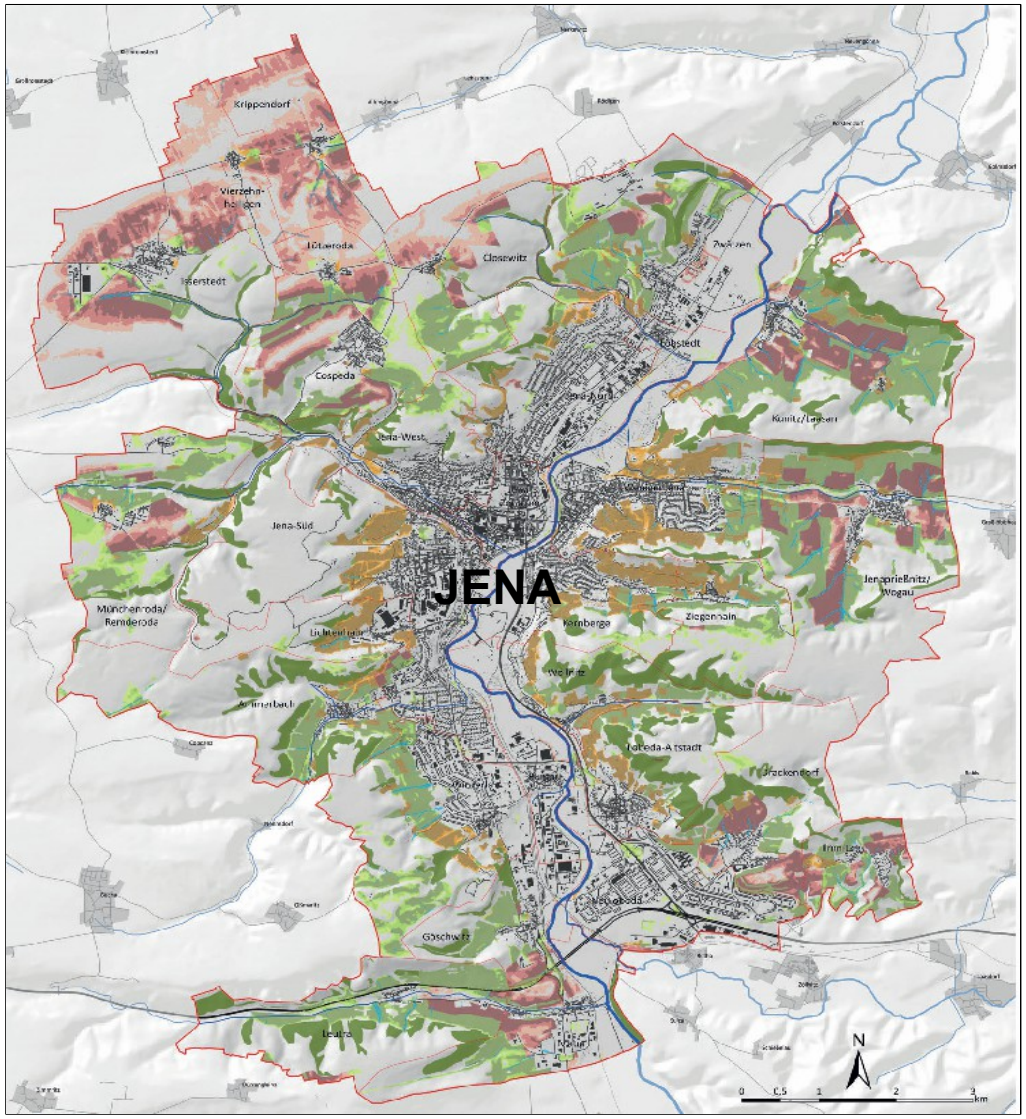
(2) Increasing drought

- Rising temperatures lead to a deterioration of the climatic water balance
- Loss of vegetation
- Hazard of soil erosion by wind and water (surface runoff during heavy rainfall events)

Picture: Heavy rain events increase the soil erosion in agriculture: acre in the district of Kunitz / Laasan

Source: City of Jena (2012)

(2) Increasing drought



Potential hazard of erosion

Farmland
- High
- Very high
- Extremly high

Parkland
- High
- Very high
- Extremly high

Garden land
- High
- Very high
- Extremly high

- Forest with soil protection function

Source: City of Jena (2012)

(3) Extreme rainfall events

- severe **storm and heavy rainfalls** on May 30 & 31, 2013
- subsequent **flood** and **erosion** May 31 to June 7, 2013
- Considerable damage in residential and industrial areas

Source: Fire Department Jena (2013)

(3) Extreme rainfall events

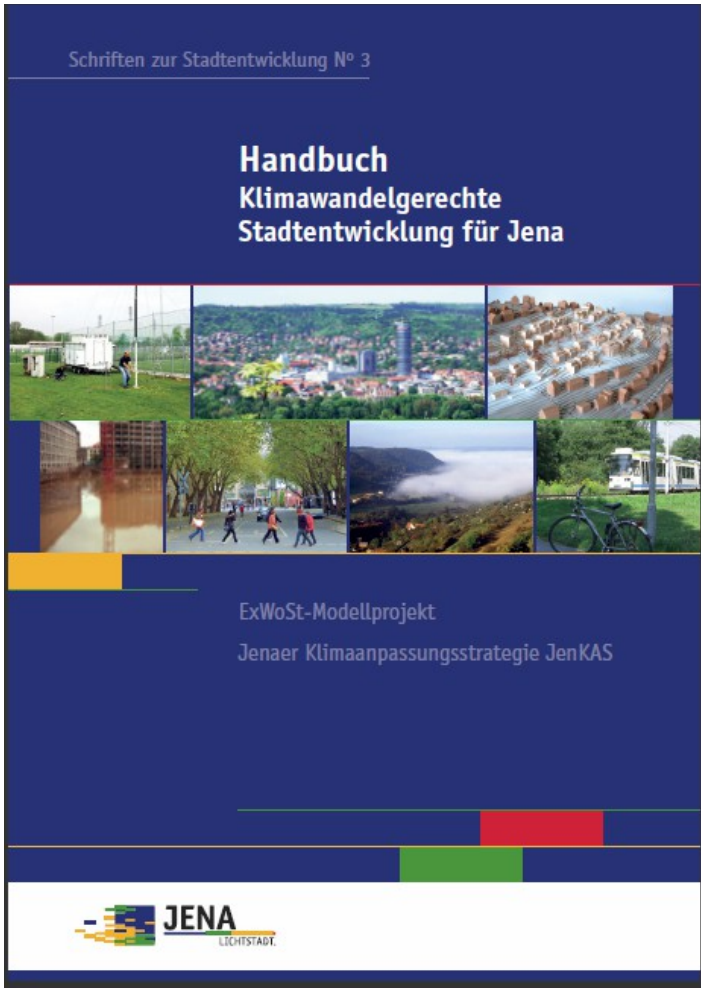
Pictures: Impressions of the Flood 2013

Source: Fire Department Jena (2013)

JenKAS – The Climate Change Adaptation Strategy of Jena

The Climate Change Adaptation Strategy of Jena

- **Starting point:** Report of the IPCC 2007 – Intergovernmental Panel on Climate Change
- **2009:** Preliminary study on an adaptation concept of the Institute of Geography of the University of Jena
- **2009-2012:** Federal promotion program
- **2013:** City Council Decision
- Consideration in urban development and planning



Source: City of Jena (2012)

Key Question:

How can municipalities integrate / improve climate adaptation measures in city development planning and daily processes?

Starting point of the JenKAS-Project

- Various observed trends, such as:
  - Increasing heat load / thermal heating in compact areas,
  - an increasing dryness (especially in the summer months) and
  - an inreasing risk of flooding of the river Saale and side channels (due to increasing extreme events).
- This led early on to the fact that the city dealt with issues of climate adaptation.

Partner of the JenKAS-Project

- City of Jena
- Thuringian Institute for Sustainability and Climate Protection (Think)
- Federal Institute for Building, Urban Affairs and Spatial Development at the Federal Office for Building and Regional Planning
- Thuringian State Office for Environment and Geology (TLUG)
- German Meteorilogical Service (DWD)
- Helmholtz Center for Environmental Research (UFZ)
- BPW baumgart + partner and plan + risk consult

Procedure

- During the Project we made an **integrated view of climate change impacts in the entire city** as well as the derivation of appropriate adaptation strategies.
- Colloborations, there was inter alia with the DWD or the UFZ Leipzig.

Source: Maercker (2011)

The Three-Perspective-Approach

- Consideration of **climate action sequences** in the entire city
- Analysis of the impact of climate change in five **action fields** which are then
- incorporated into an action or **recommendation catalog** of 118 recommendations for the city of Jena

The Three-Perspective-Approach

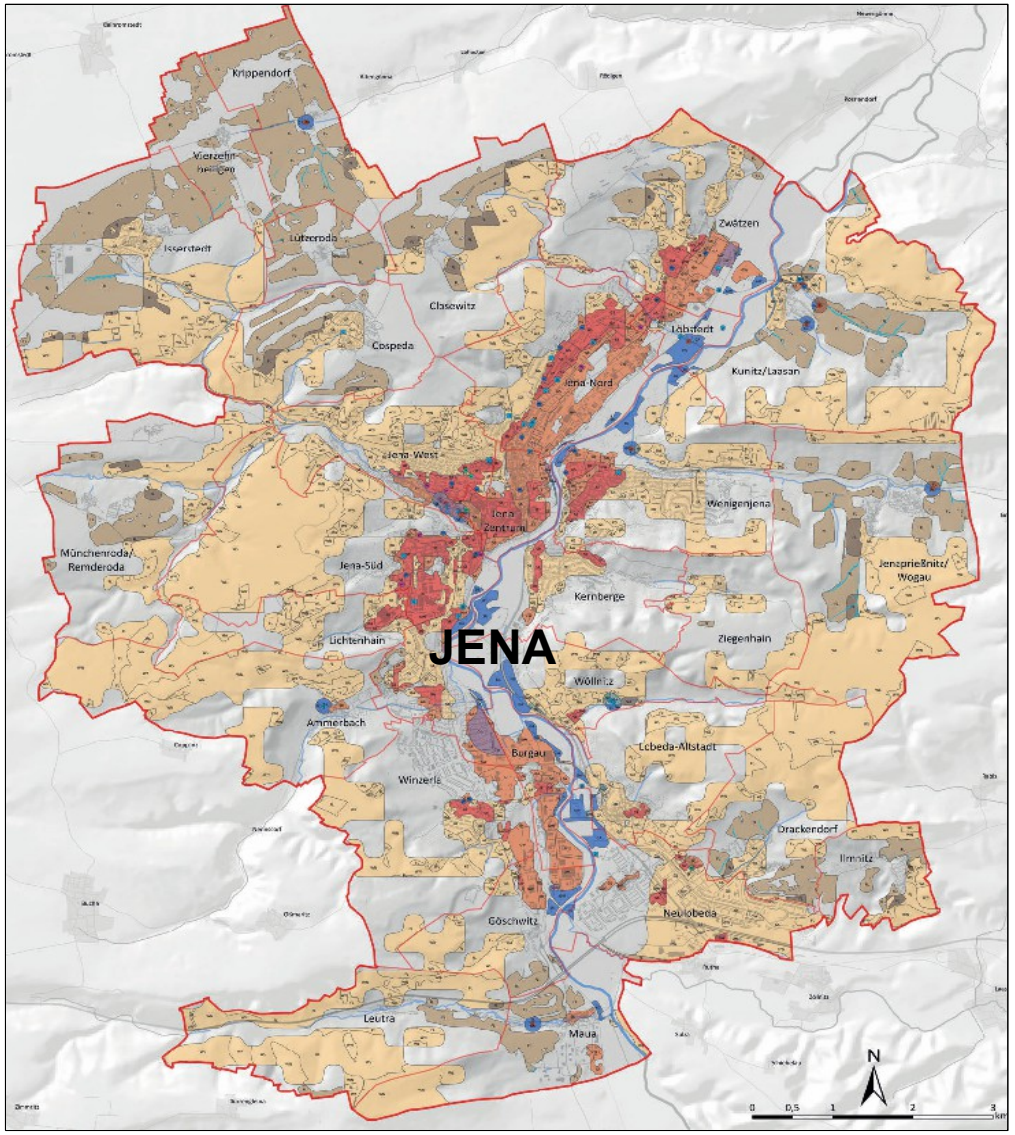
Climate impact	Field of action	Spatial unit
• Heat load • Summer drought • Flood • Erosion • Extreme events	• Settlement development • Nature & environmental protection • Water management • Agriculture & Forestry • Traffic & Infrastructure	• 30 Districts of Jena • Natural & Urban Space

118 recommendations for action

Results of the JenKAS-Project

- JenKAS – The Climate Change Adaption Strategy of Jena
- Map series / Atlas
- DWD-Expertise (German Meteorological Service)
- JELKA – A decision support system for local planners
- Recommendations for action
- Handbook & website

Results (1): Extract from the map series



Impacts of Climate Change

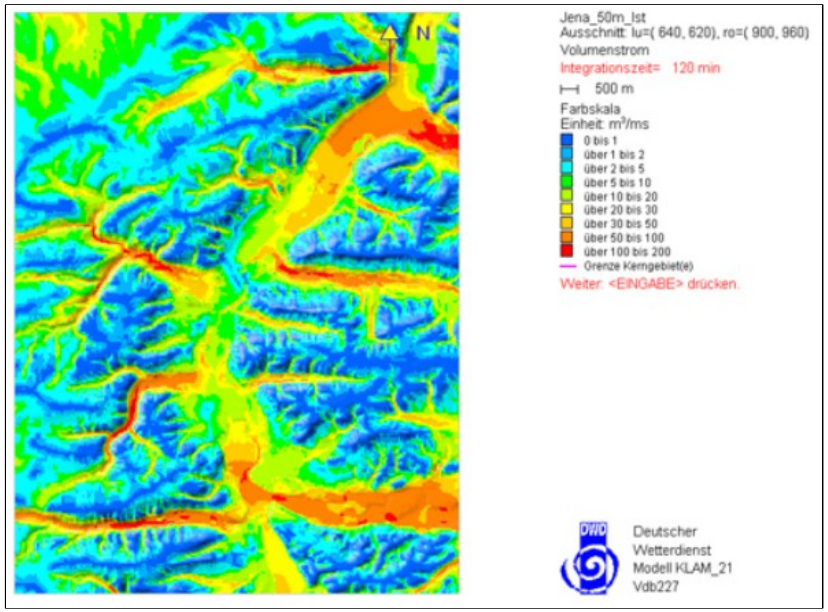
- Heat load
- Drought
- Flood
- Water erosion
- Heat load & drought
- Water erosion & drought
- Water erosion & flood
- Heat load & flood
- Drought & flood
- No significant effects

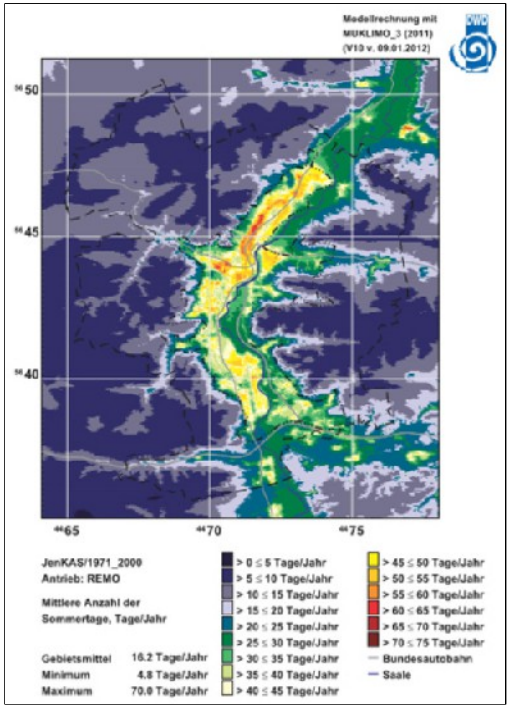
Picture: Risk-Conflict-Map of Jena

Source: City of Jena (2012)

Results (2): DWD-Expertise

- Final report of the German Meteorological Service (DWD)
- Results of local climate modeling with **cold air model** *(picture left)* and **urban climate model** *(picture right)*
- Statements on the local cold air dynamic and on the development of urban overheating tendency

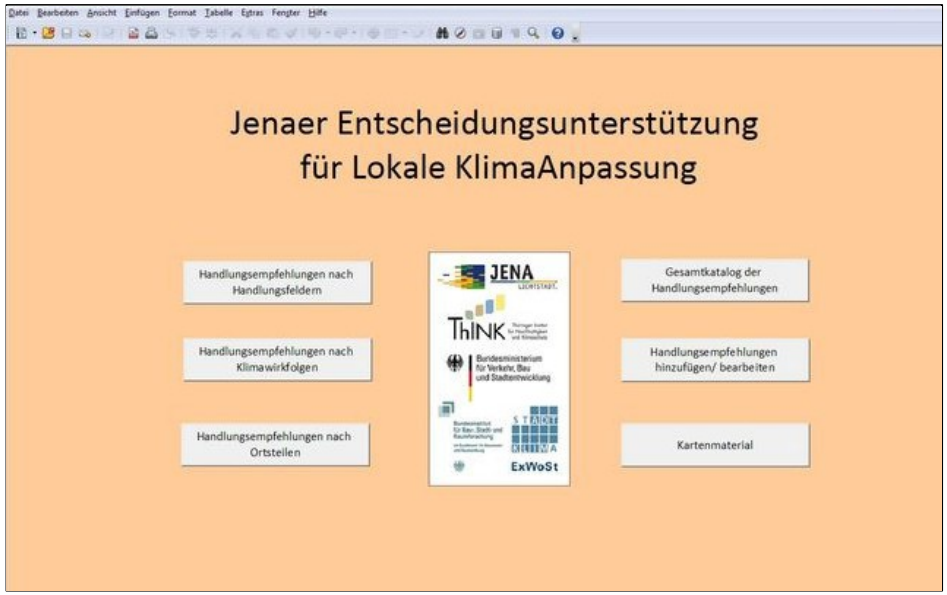


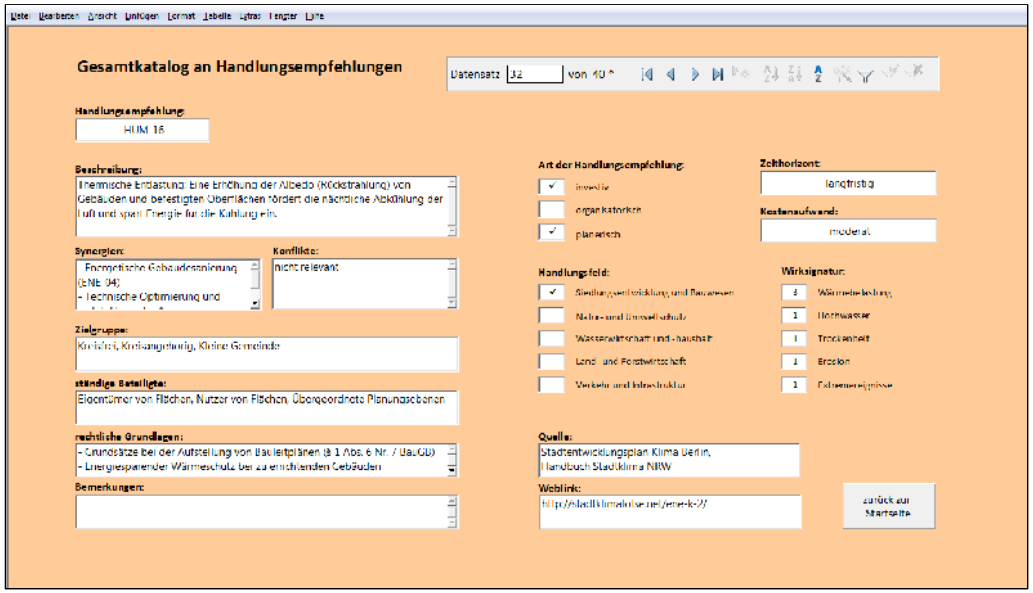


Source: DWD

Results (3): JELKA-Tool – A decision support system for urban planning

- Database with recommendations for action to adapt to climate change in Jena
- **Three-Perspective-Approach**
  - Selection of more than 100 recommendations for action according to **climate impact, field of action and district**





Source: Think

Results (4): Recommendations for Action

- For each of the 30 districts of Jena
- Traffic light labeling system (showing the degree of impact)
  - Important measure for raising awareness and information

District: Jena City Center

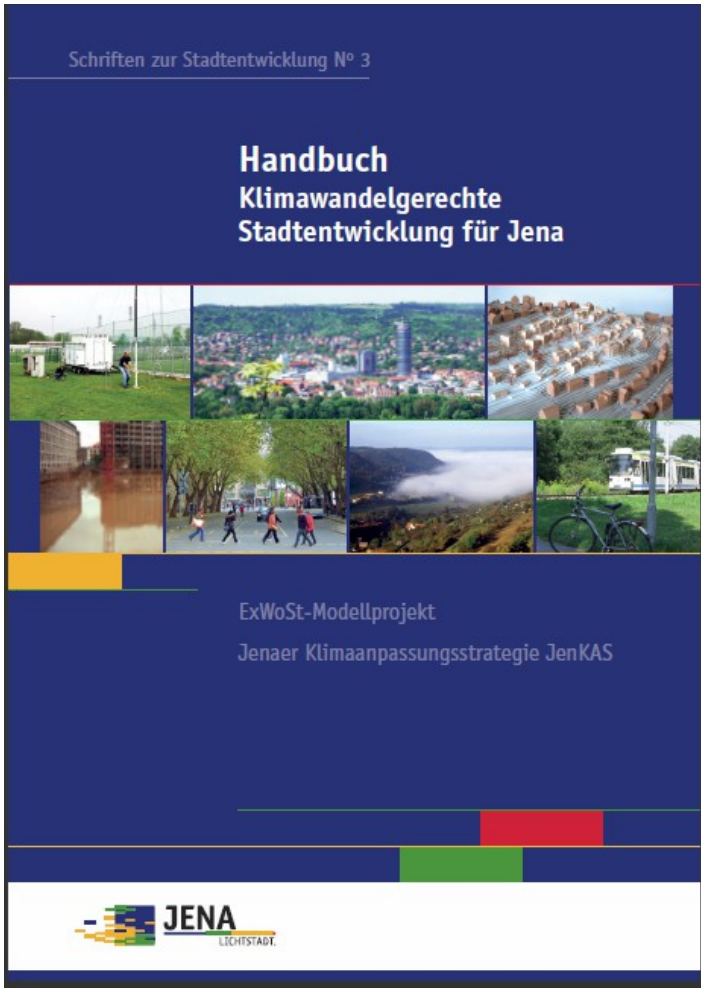
Concerns	Heat load	Flood	Drought	Erosion
	high	moderate	moderate	minor

District: Wöllnitz

Concerns	Heat load	Flood	Drought	Erosion
	moderate	high	high	minor

Source: City of Jena (2012)

Results (5): Handbook & Website



- Summary of all results in the **„Handbook of climate change-friendly urban development“**
  - Working base for the employees of the city council
- **Website** gives informations about the project, the scientific backround, documentation of the working steps and results

  → *www.jenkas.de*

Source: City of Jena (2012)

The JenKAS-Steadying Process

How can JenKAS become an inherent and permanent part in administrative action?

The JenKAS-Steadying Process

… how the strategy is transformed into local action

- The „JenKAS Working Group“
  - Regular meetings (every 2-3 months)
  - Discussion of current projects, new project ideas, new insights
  - Members: Staff of the city council, Climate Agency (state institution), Thuringian Institute for Sustainability and Climate Protection (local research assistance), Centre for Environmental Research

  - **Objective:** Improving information and transfer of knowledge

The JenKAS-Steadying Process

… how the strategy is transformed into local action

Exemplary Activities:

- Temperature measurement on municipal buildings (2014)
- Project „City trees in climate change“ (2014)
- Training on JELKA-Tool (2013)
- Microclimatic analysis of several major building projects (since 2010)

Picture: Greening the marketplace for more climate comfort

Source: Dr. Lerm

Project: Analysis of the Impacts of Local Heat Hot Spots (2014)

- Analysis of the temperature-data of all municipal buildings
- Objective: Identifying **local heat hot spots** during selected periods of extreme heat
- Therefor: Analysis of outdoor-sensors of approx. 80 municipality buildings (schools, administration, kindergartens, sports facilities, etc.)
- Consideration: Analysis as basis for a **development of an emergency system** in periods of high temperatures for health prevention
- Protection of heat sensitive groups (children, senior citizens, construction workers, etc.)

Pictures: Buildings of the city administration; Owner: Kommunale Immobilien Jena, a municipal-owned enterprise for agement of municipal buildings

Source: Michael Miltzow

Project: City Trees in Climate Change (2014)

- Greening in the city improves the urban climate
  - Trees have the effect of an air conditioner, dust filter, water reservoir
  - Trees give shade and quality for urban life
- Project:
  - Inventury of all trees in the urban area of Jena
  - Focus: Concept for future plantings
    - Selection of suitable trees that are adapted to the conditions of climate change
    - Tree species that are tolerant to drought, summer heat and frost in the wintertime

Picture: Tree of Heaven *(„Götterbaum“)* as a promising future tree in climate change

Source: Dr. Lerm

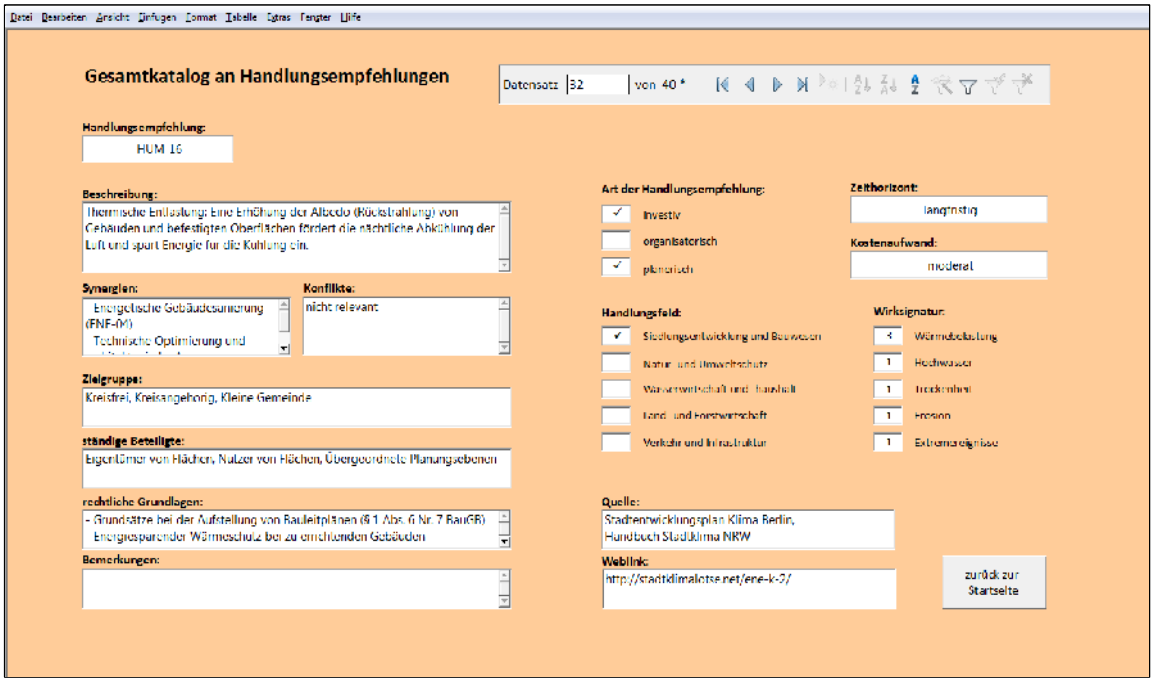
Project: City Trees in Climate Change (2014)

Pictures: Urban greening as climate comfort oases in the city of Jena

Source: Dr. Lerm

Training on JELKA-TOOL (2013)

- JELKA: Database and decision support system for local planners to adapt to climate change
- Select over 100 recommendations for action according to **climate impact, field of action and district**
- Training of the employees of the departments of the city administration
- **Objective:**
  Raising **awareness** for taking recommendations into account and using the tool

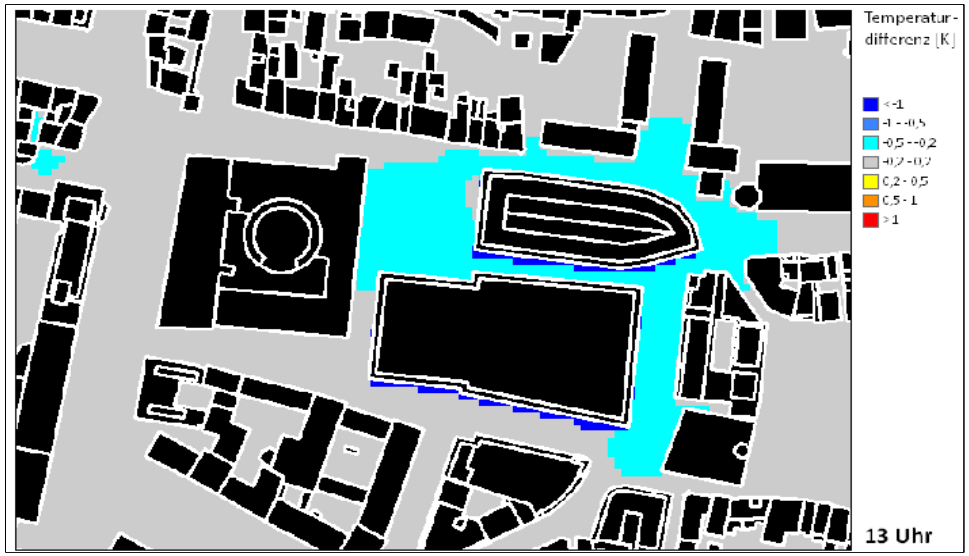


Picture: User surface of the JELKA-TOOL

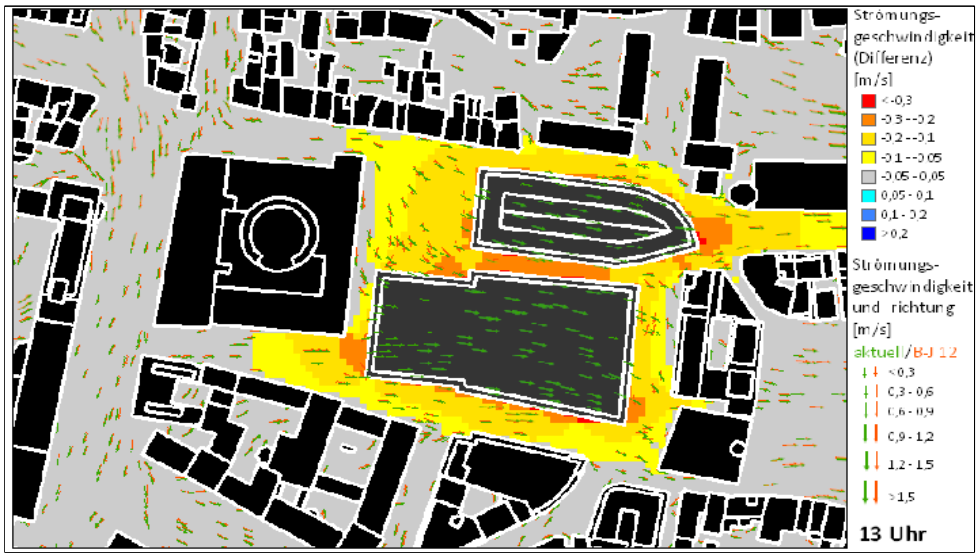
Source: Think

Micro-Climatic Analysis of Major Building Projects (2010)

1. Measurement of the microclimate and the air quality in areas of major development projects
2. Calculation of the climate in built-up space → show / unveil potential changes in temperature and air flow rate



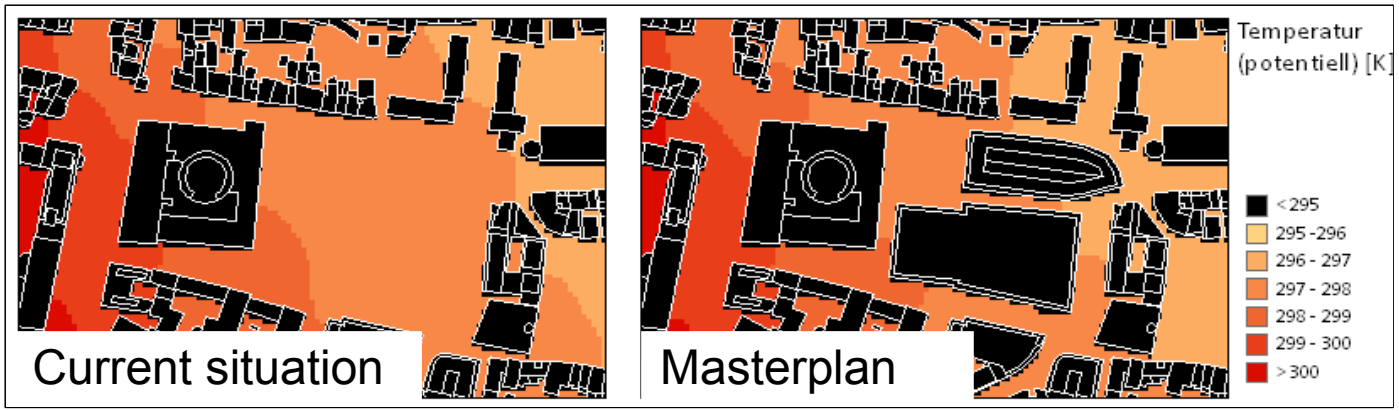
Picture: Calculation of the potential temperature in built-up space



Picture: Calculation of the air flow rate in built-up space

Source: Think

Micro-Climatic Analysis - Urban Development Project „Eichplatz“



Picture 1: Calculation of potential temperature

→ Minor changes of potential temperature

Picture 2: Calculation of the air flow rate

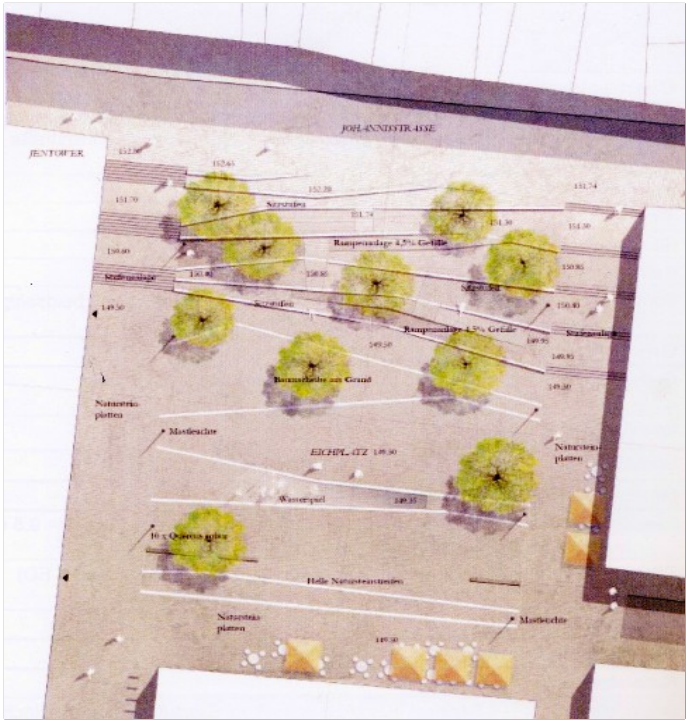
→ Reduction of the air flow rate

→ Changes in the flow direction

Source: Think (2011)

Micro-Climatic Analysis „Eichplatz“ – Results

- Consideration and integration of climate issues in building processes and masterplans



Picture right: Determining of green space in the Masterplan „Eichplatz“

Picture left: Square design with climate comfort oasis

Source: Stadt Jena

The JenKAS-Steading Process

Further activities…

- EU-Project BASE

  → Project in cooperation with the center of environ-mental research (UFZ) in Leipzig

- Workshops on climate change and effects on the health of citizens

  → Objective: Adaptation strategies on climate change to strenghten the health of citizens

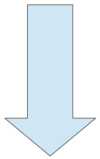
- Puplic relations (e.g. city-website, press, print, social media, events, flyers, information material)

The JenKAS-Steadying Process – „*Climate Proofing*“ in the City Council

- **Implementation of key research findings** as main challenge for the next years
- Considerations of aspects of climate change adaption in urban planning
- **Objective:** Resilience and adaptability of plannings and investments to current and future effects of climate change
- **First Milestones have been completed:**
  - City Council Decision in May 2013
  - Consideration of climate issues in building processes, urban plans and concepts

The JenKAS-Steadying Process

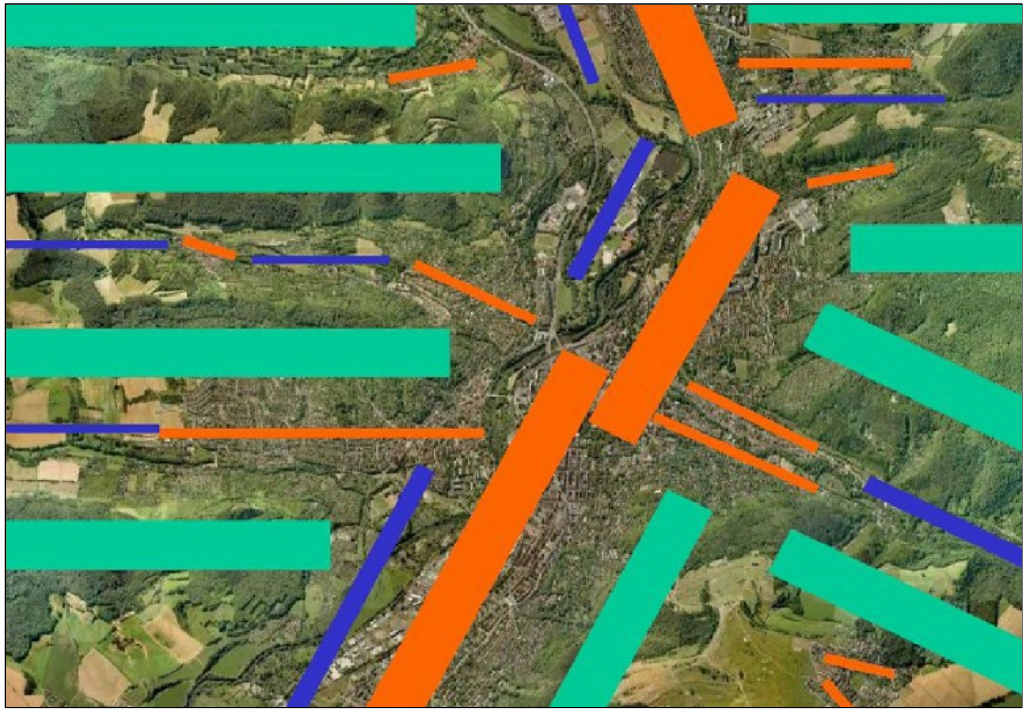
„*Climate Proofing*“ in the City Council



Next Step: JenKAS as an inherent and permanent part in administrative action and the preparation of urban plans

Climate-friendly urban development for Jena

- Tendencially linear urban compression
- Conservation of climate compensation areas
- Risk areas should be kept free



Picture: Map of Jena
- Orange – Linear urban compression
- Blue – Blue structures (water)
- Green – Green structures (green, forest, agriculture)

Source: Dr. Lerm

Sustainable Action Against Climate Risks

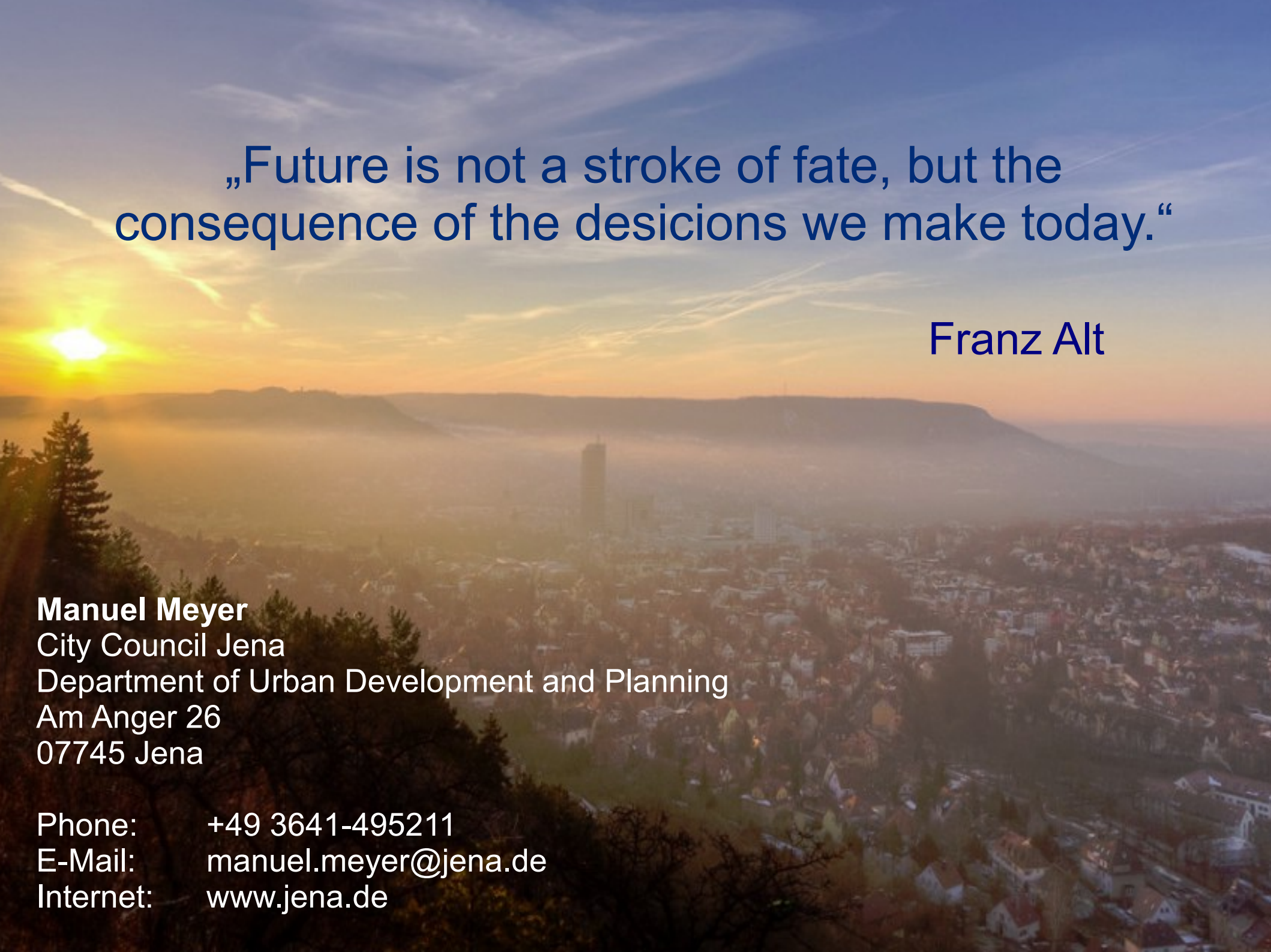
Avoiding Risks
(Climate Protection)

Reducing Risk Effects
(Providing, Adaptation)

Coping Compatible with Unavoidable Events
(Crisis Management)

Insuring unavoidable Risks
(Aftercare)

Source: Dr. Lerm



Manuel Meyer
City Council Jena
Department of Urban Development and Planning
Am Anger 26
07745 Jena

Phone: +49 3641-495211
E-Mail: manuel.meyer@jena.de
Internet: www.jena.de