Urban Disaster Resilience through Risk Assessment and Sustainable Planning

Dr. Rainer Malmberg, Elke Krätzschmar  IABG mbH
Land and Poverty Conference 2017, World Bank
March 20-24, 2017
Washington, DC
Agenda

- Understanding Risk following the IPCC 5th Assessment Report
- Changing Environment – Climate change – Challenge for urban planning
- Stakeholder Engagement – Risks and driver if Vulnerability
- Geospatial Data Infrastructure – From data to information
- Urban Development in Monastir
- Remote sensing for monitoring processes – EU Satellite programs
- Conclusion
The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage & loss to property, infrastructure, livelihoods, ecosystems, etc.

Source: IPCC 5th Assessment Report Working Group II
Understanding disaster risk: Exposure

The presence of people, livelihoods, ecosystems, infrastructure, or economic, social, or cultural assets in places that could be affected by a hazard

Source: IPCC 5th Assessment Report Working Group II
Understanding disaster risk: Vulnerability

Vulnerability = the **predisposition to be negatively affected** by a hazard. Vulnerability is a result of **susceptibility to harm** and **lack of capacity to cope** (short-term) and **lack of capacity to adapt** (long-term).

Source: IPCC 5th Assessment Report Working Group II
Climate change – Challenge for urban planning

There is an increasing measurable trend of natural Disasters affecting North Africa & Middle East since 1980.

- There is a significant change in the magnitude of heavy rain due to climate change effects.
- It is verified, that there is an expected increasing frequency and magnitude of such natural hazard events.
- In 2003 Tunis took in about five times the volume of rain as typical fell in the entire month within 24-hours.
Climate change – Challenge for urban planning

Projections for the 21st century carry uncertainty, but even at the low end of range, sea level rise will compound current risks for North African coastal cities.

With climate change extreme episodes as occurred in 2003 are expected to become more frequent, requiring a fresh look at the city’s level of preparedness.

Record of Tunis source: regional study 2011 World Bank
Project Objectives

To **enhance urban multi-hazard disaster prevention and resilience** in Tunisia, using the city of Monastir as a pilot study

To **analyze & monitor urban development and disaster risk trends** & mainstream the derived information into urban planning / DRR strategies

- **Identify main drivers** of urban disaster risk (relevant hazards & vulnerability indicators)
- **Evaluate available and needed** (geospatial) **data**, fill gaps & develop a standardized GIS database
- Conduct a **multi-hazard risk assessment** and identify **risk hotspots** in the city (past trends, present conditions, future scenarios)
- Support **capacity building** activities
Stakeholder interviews – identification of Risks

Main Risks – Result of stakeholder Interviews

- Flash floods (20)
- Coastal erosion (17)
- Seismic activity / earthquakes (15)
- Storms (11)
- Drought (8)
- Heat waves (8)
- Sea level rise (7)
- River floods (6)
- Air pollution / smoke (5)
- Sea water pollution (3)
- Water stagnation (2)
- Fires (1)
- Subsidence (1)
Stakeholder interviews – Challenge for urban development

Factors increasing vulnerability

- Illegal settlements & poor housing (15)
- Poverty (9)
- Lack of governance / planning / transparency (9)
- Lack of information, maps, risk analyze (9)
- Lack of insurance (8)
- Lack of coordination (5)
- Lack of emergency response & equipment (5)
- Behavior of citizens (5)
- Waste & waste water disposal (5)
- Poor respect for legality (3)
- Immigration / rapid urbanization (3)
- Law enforcement (3)
- Lack of infrastructure maintenance (3)
- Lack of law enforcement (2)
- Lack of prevention (2)
- Lack of protection systems (2)
- Insufficient hospital capacity (1)
- Lack of training (1)
Urban Planning from paper maps to an intelligent Geodata Infrastructure

Documentation of Risk zones with text markers

Using Remote sensing and GIS for urban mapping
A Tunisian case study – Monastir - 1998

- Using Copernicus Urban Atlas standard nomenclature and classification for the urban mapping.
- Mapping of transport infrastructure and condition
- Creating a terrain model for flood simulation
A Tunisian case study – Monastir - 2008

- Using Copernicus Urban Atlas standard nomenclature and classification for the urban mapping.
- Creating a terrain model for flood simulation
A Tunisian case study – Monastir - 2015

- Densification leads to increasing imperviousness
- Urbanisation through densification
- Loosing agriculture and natural land
- Sprawl into potential risk zones
A Tunisian case study – Monastir - comparison

- 1998
- 2008
- 2015

Change 1998/2008

Change 2008/2015

Legend:
- no change
- urban densification
- urban sprawl from Agriculture
- urban sprawl from Grassland
- urban sprawl from Forest
- urban sprawl from Water
- urban sprawl from others
- sprawl of economic sites and infrast
- conversion from forest to agriculture
- conversion from forest to other nat.
- conversion from agriculture to nat...
- other changes

Responsible Land Governance: Towards an Evidence Based Approach
Annual World Bank Conference on Land and Poverty
Washington DC, March 20-24, 2017
A Tunisian case study – Monastir Analyse

Landcover Change 2008-2015

- urban densification
- urban sprawl from Agriculture
- other changes
- conversion from forest to other natural
- conversion from agriculture to natural
- urban sprawl from Grassland
- sprawl of economic sites and infrastructures
- conversion from forest to agriculture
A Tunisian case study – Monastir Analyse – housing development
Using free Sentinel1 for mapping flood areas
A Tunisian case study – Monastir Terrain Analyse Flood Risk Area

Terrain analysis
(flooding [m])

Sentinel-1A VV, 13/09/2016, Acquisition time: 17:12,
Recording before Flooding and at a flood event
Radar Interferometrie for monitoring of ground movements

Using coherence measurement of different Sentinel Radar scenes for larger areas and monitoring of buildings and critical infrastructure.
Summary

- There is an increasing risk for natural disaster caused by climate change effects that should be considered for a sustainable urban planning.

- To manage the urban area an intelligent consistent and up to date database is mandatory.

- Various satellites and remote sensing information give us important information of the exposure and vulnerability of an area.

- Free and open Sentinel Satellites open new opportunities for a long term monitoring of changes.

- Stakeholder engagement and capacity building is important for a successful implementation of new technology and processes.
Your contact:

Dr. Rainer Malmberg
Key Account Manager
Business Development
International cooperation
Geospatial data / Geoinformatics

Einsteinstraße 20
D-85503 Ottobrunn
Germany

Tel       +49 89 6088 2823
Fax       +49 89 6088 2355
E-Mail    malmberg@iabg.de
Web       www.iabg.de

Elke Krätzschmar
Remote Sensing Expert
Geospatial data / Geoinformatics

Hermann-Reichelt-Str. 3
01109 Dresden
Germany

Tel       +49 351 8923 145
Fax       +49 351 8923 133
E-Mail    krätzschmar@iabg.de
Web       www.iabg.de