



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



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DIGITAL ASSURANCE



MOBILITY, ENERGY &  
ENVIRONMENT



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SPACE



DEFENCE & SECURITY

## 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,

2017Washington, DC





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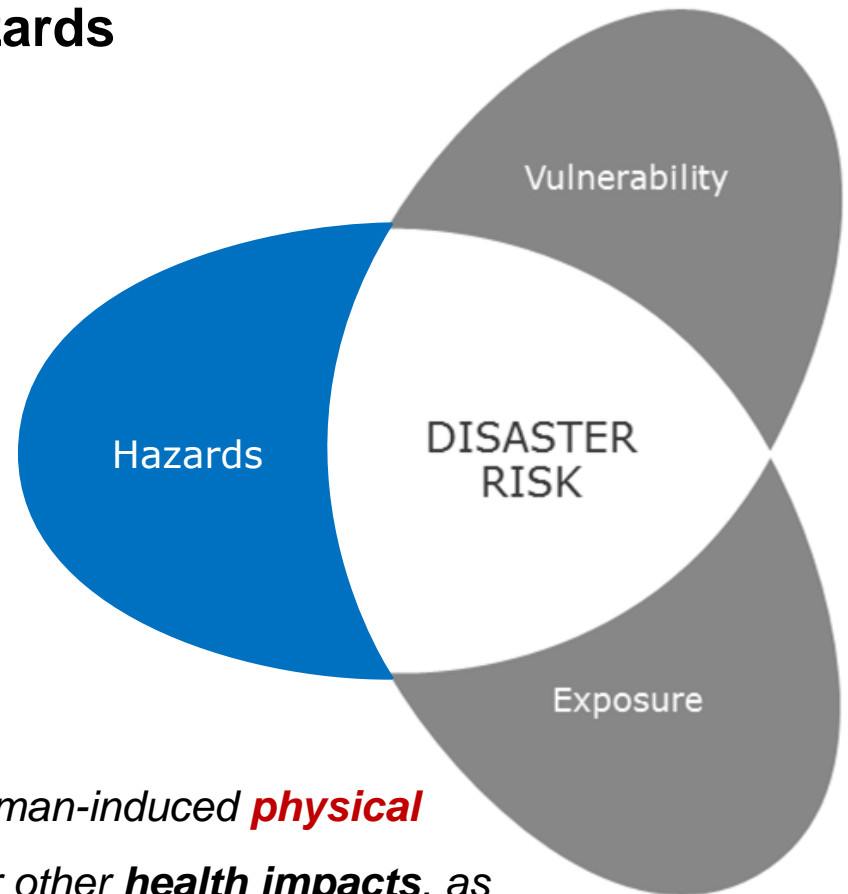


## Agenda

- 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



## Understanding disaster risk: Hazards



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.

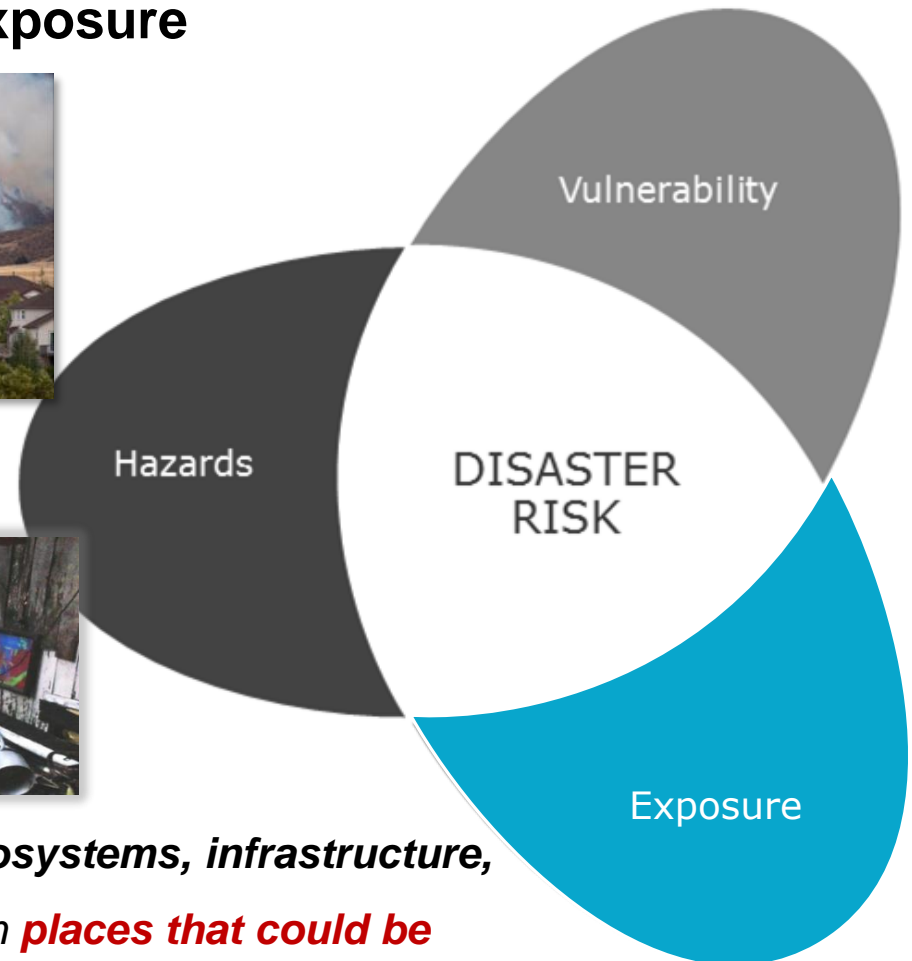


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## Understanding disaster risk: Exposure



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

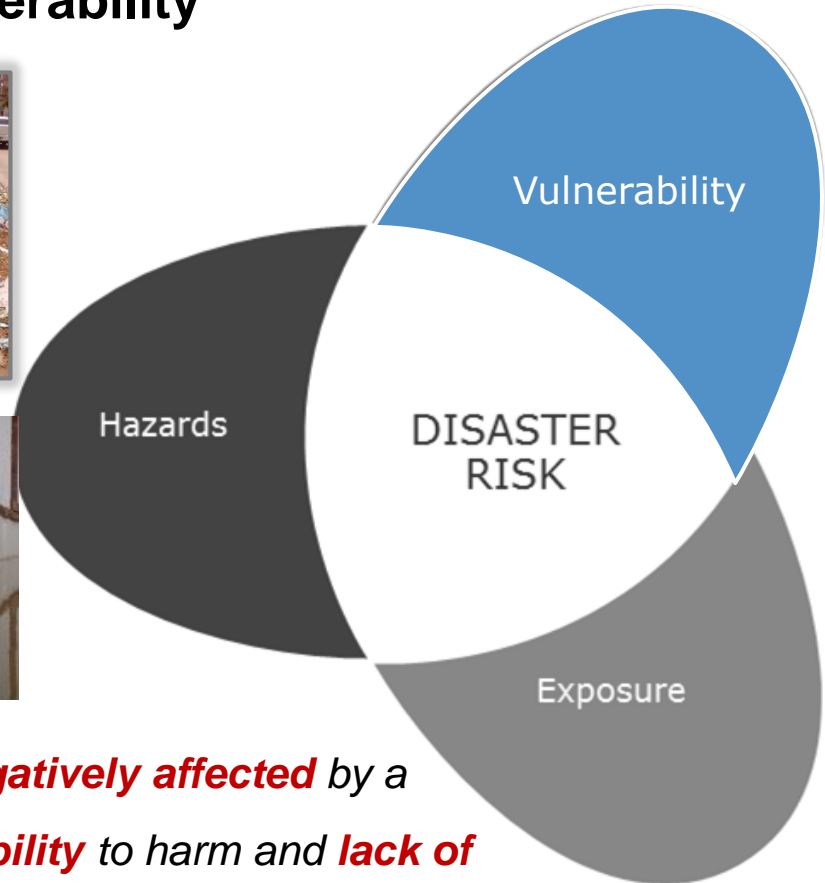


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## Understanding disaster risk: Vulnerability



*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).*

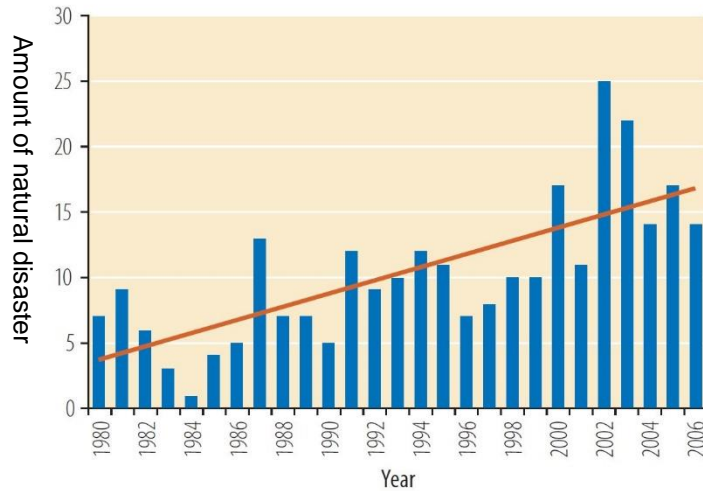


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## Climate change – Challenge for urban planning



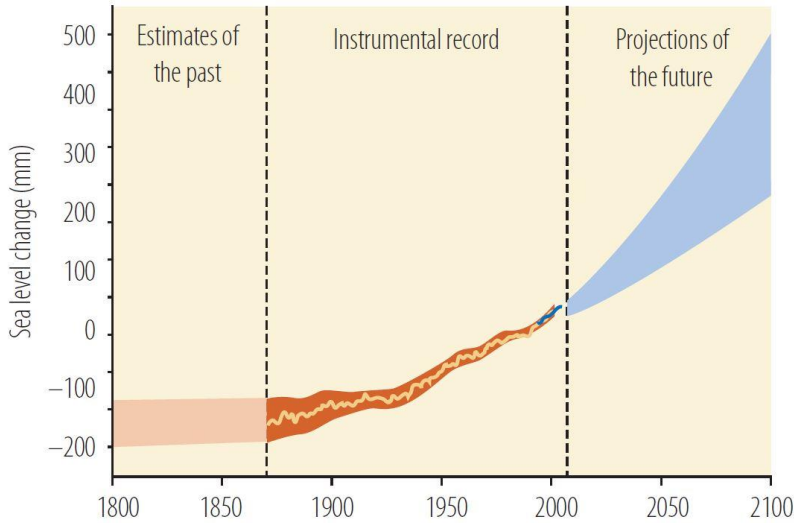
There is an increasing measurable trend of natural Disasters affecting North Africa & Middle East since 1980.

- 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

Urban Risks	Tunis	
	Current	2030
Seismicity/ground instability/	Medium	High
Tsunami/Marine submersion	Medium	High
Coastal Erosion	High	Very High
Flooding	High	Very High
Water Scarcity	Medium	Medium

■ Very High   
 ■ High   
 ■ Medium   
 ■ Low

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



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## 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)





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## 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)





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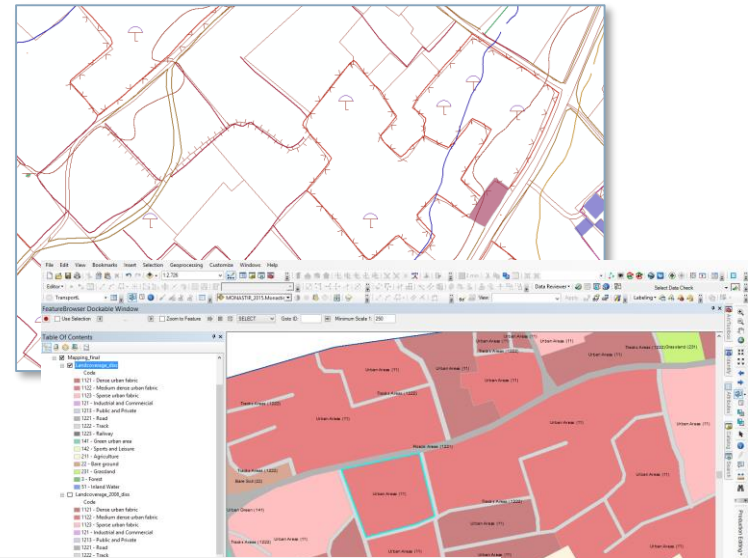
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## Urban Planning from paper maps to an intelligent Geodata Infrastructure

Documentation of Risk zones with text markers

Using Remote sensing and GIS for urban mapping



Table

landcoverage\_diss

OBJECTID*	SHAPE*	type	urban_type	Road_Surface_Type	Codett	SHAPE_Length	SHAPE_Area
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761	Point	Urban Areas (11)	dense	<Null>	1121	168.07562	1445.164504



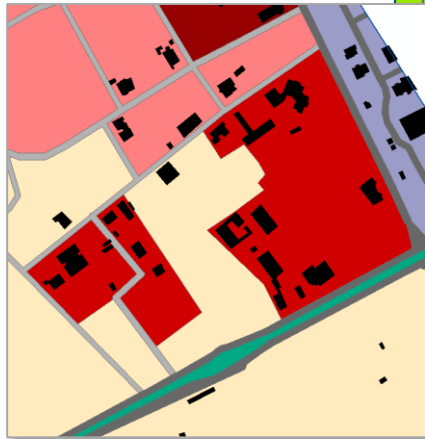
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## A Tunisian case study – Monastir - 1998

- Buildings
- 1121 - Dense urban fabric
- 1122 - Medium dense urban fabric
- 1123 - Sparse urban fabric
- 121 - Industrial and Commercial
- 1213 - Public and Private
- 1221 - Road
- 1222 - Track
- 1223 - Railway
- 141 - Green urban area
- 142 - Sports and Leisure
- 211 - Agriculture
- 22 - Bare ground
- 231 - Grassland
- 3 - Forest
- 51 - Inland Water



- Evaluation of the urban sprawl with a multi-temporal analysis 1998-2015
- 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



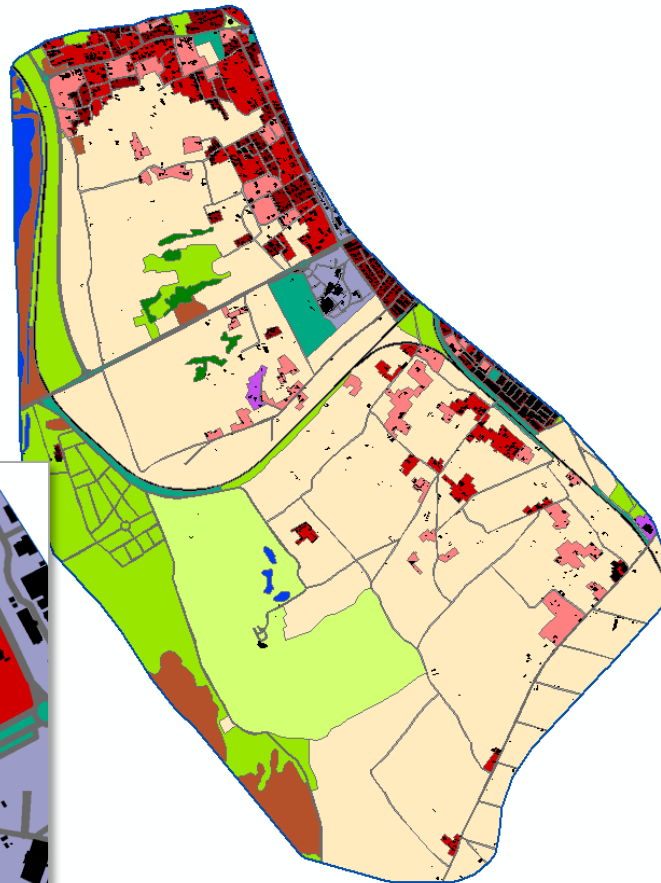
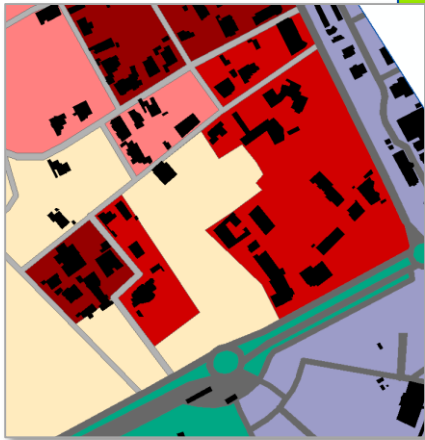
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## A Tunisian case study – Monastir - 2008

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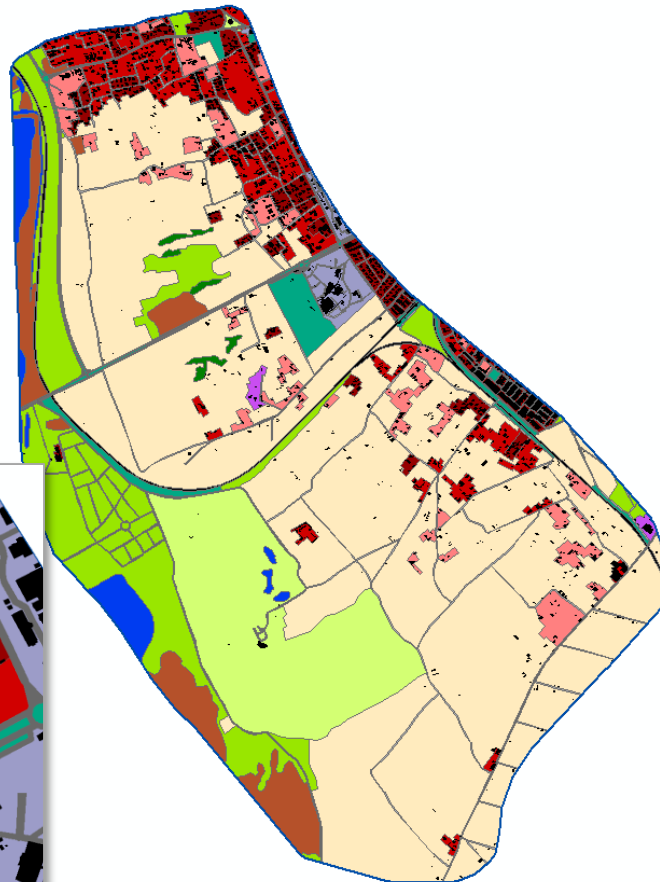
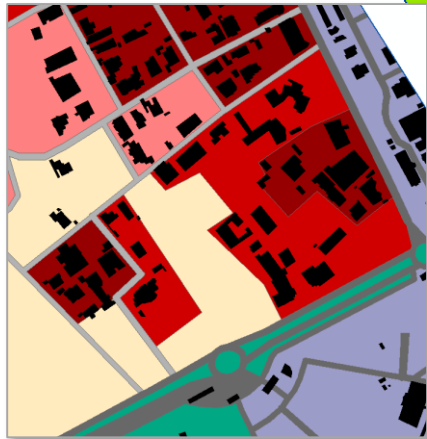
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## A Tunisian case study – Monastir - 2015

- Buildings
- 1121 - Dense urban fabric
- 1122 - Medium dense urban fabric
- 1123 - Sparse urban fabric
- 121 - Industrial and Commercial
- 1213 - Public and Private
- 1221 - Road
- 1222 - Track
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- Densification leads to increasing imperviousness
- Urbanisation through densification
- Loosing agriculture and natural land
- Sprawl into potential risk zones

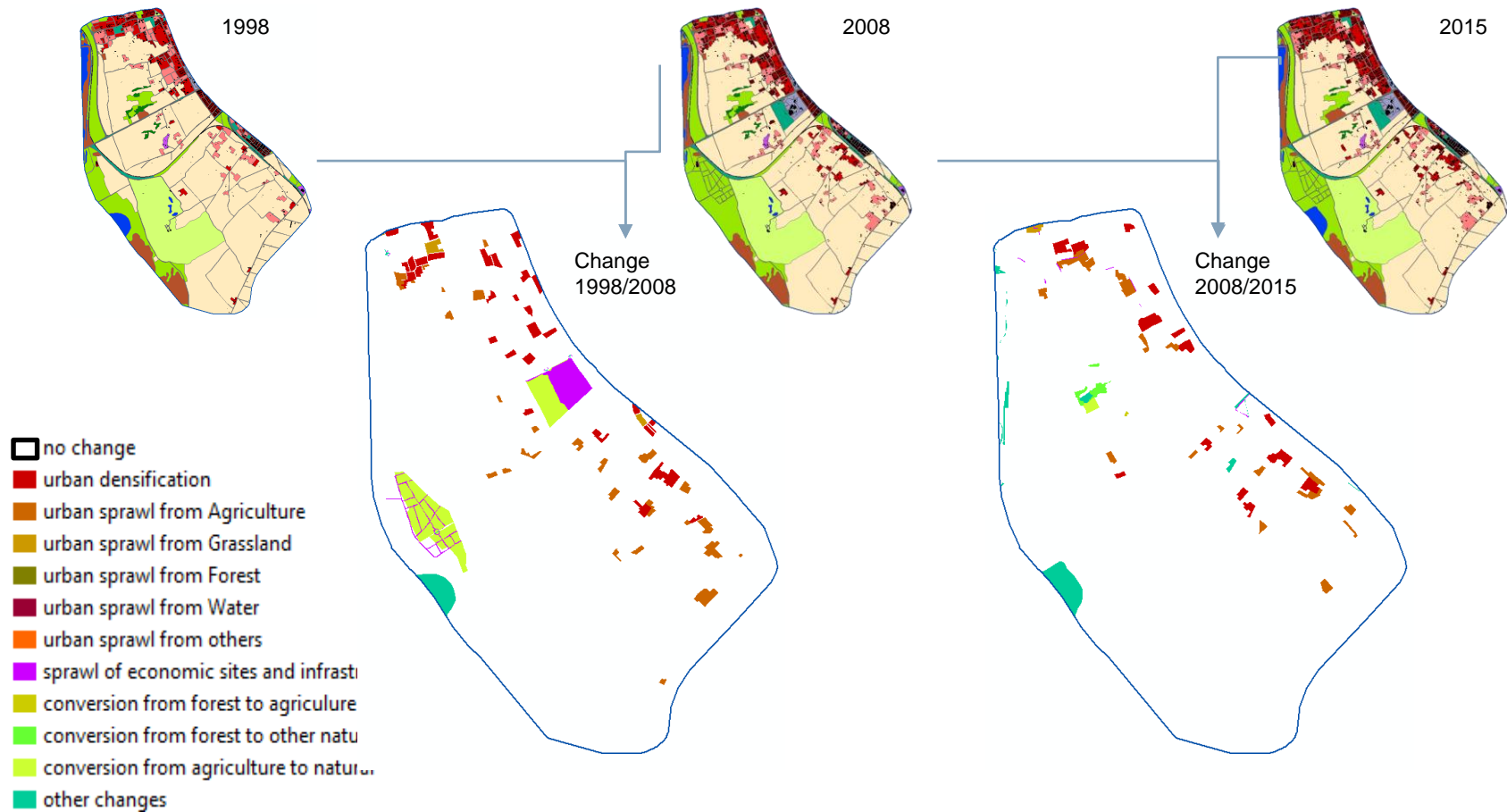


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## A Tunisian case study – Monastir - comparison





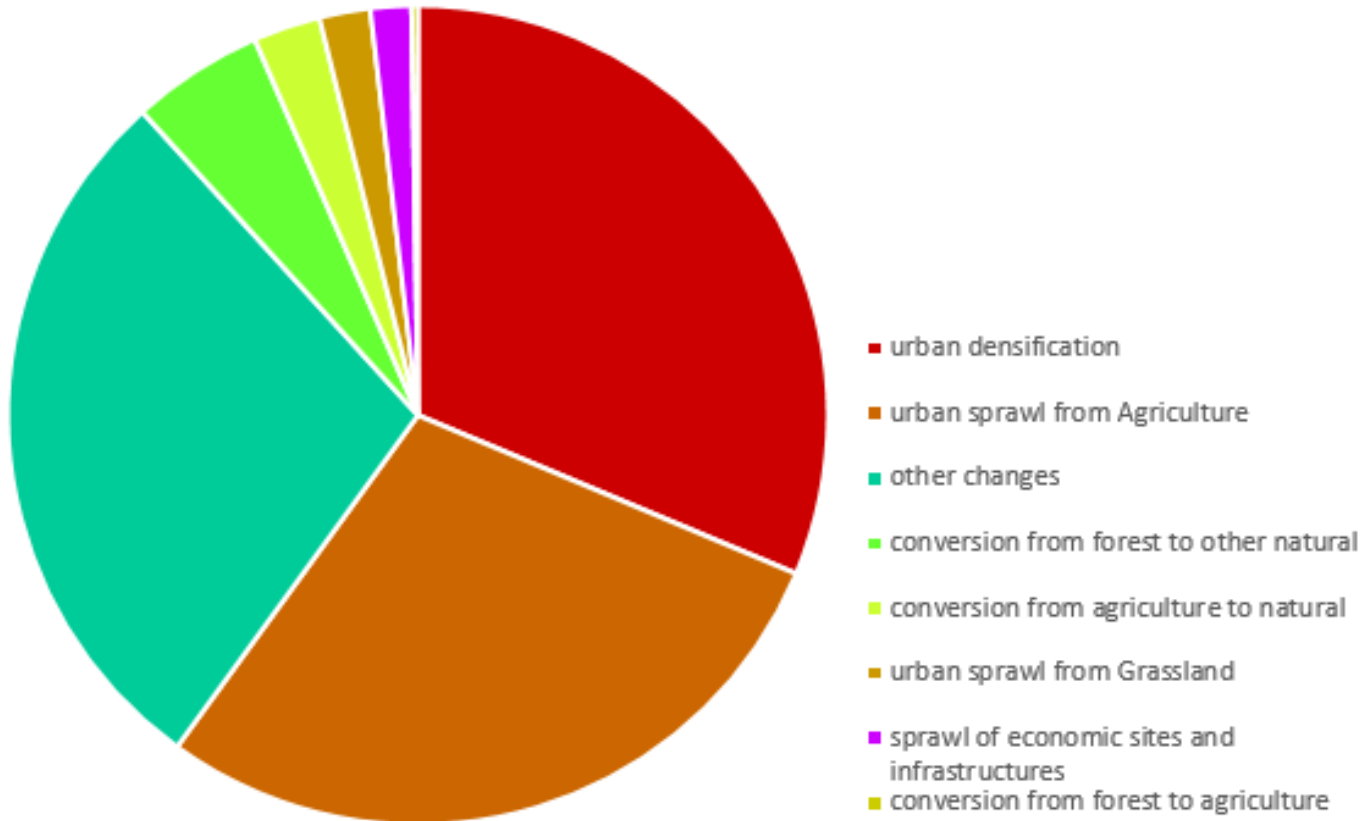
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## A Tunisian case study – Monastir Analyse

Landcover Change 2008-2015

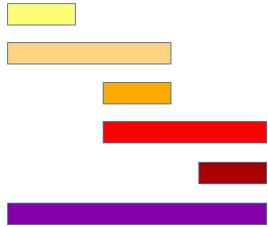






## A Tunisian case study – Monastir Analyse – housing development

1998      2008      2015





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## Using free Sentinel1 for mapping flood areas





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## A Tunisian case study – Monastir Terrain Analyse Flood Risk Area

Terrain analysis  
(flooding [m])

- -- 0
- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5



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



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