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D3.1 - Drivers of vulnerability and risk

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D3.1 – Drivers of vulnerability and risk

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Short summary	Identification of the main drivers of risk and vulnerability in the city of Monastir based on a review of literature and through stakeholder consultations	
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1 Introduction

Urban disaster risk is a growing problem driven by two megatrends of global change: urbanization and the increasing frequency and intensity of climate-related extreme events. Coastal cities are additionally confronted with sea level rise, land subsidence and coastal erosion. Combined with high levels of societal vulnerability, these trends increase disaster risk and associated loss of life and economic damage. Tunisia faces major risks among the EU neighbourhood countries, given its rapid population growth and almost 80% of its urban areas concentrated along the Mediterranean Sea.

Against this background, the Tunisian "Ministère de l'Equipement de l'Habitat et de l'Aménagement du Territoire" plans to develop a national urban Risk Information and Analysing System (RIAS) to assess the impact of these hazards and reduce their effects. Its implementation, however, faces several major challenges including the lack of relevant geospatial data for urban risk analyses as well as an insufficient understanding of the underlying drivers, current hotspots and possible future scenarios of urban disaster risk. To support this process, the UD-RASP project uses the city of Monastir as a pilot case, representative of Tunisian coastal urban areas faced with similar environmental hazards.

As a first step towards the assessment of multi-hazard risk for the city of Monastir, an analysis of the major drivers of urban disaster risk in Monastir (in all its components of hazard, exposure, and vulnerability) was conducted combining a systematic review of scientific and grey literature (e.g. reports, etc.) with stakeholder consultations in Monastir.

2 Conceptual framework

According to IPCC's Fifth Assessment Report (AR5), disaster risk is defined as the likelihood over a specified time period of severe alterations in the normal functioning of a community or a society leading to widespread adverse effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery (IPCC 2014).

As shown in Figure 1, it results from the interaction of one or multiple *hazards* (a natural or human-induced physical event), *exposure* (the physical overlap between the hazard extent and the elements that could be adversely affected by it), and *vulnerability* (the predisposition of an element to be adversely affected). Vulnerability is oftentimes further divided in three sub-components, namely *susceptibility*, short-term *coping capacity*, and long-term *adaptive capacity*.

Consequently, the identification of drivers of disaster risk requires an analysis of relevant hazards, exposed elements, and of factors contributing to societal vulnerability.

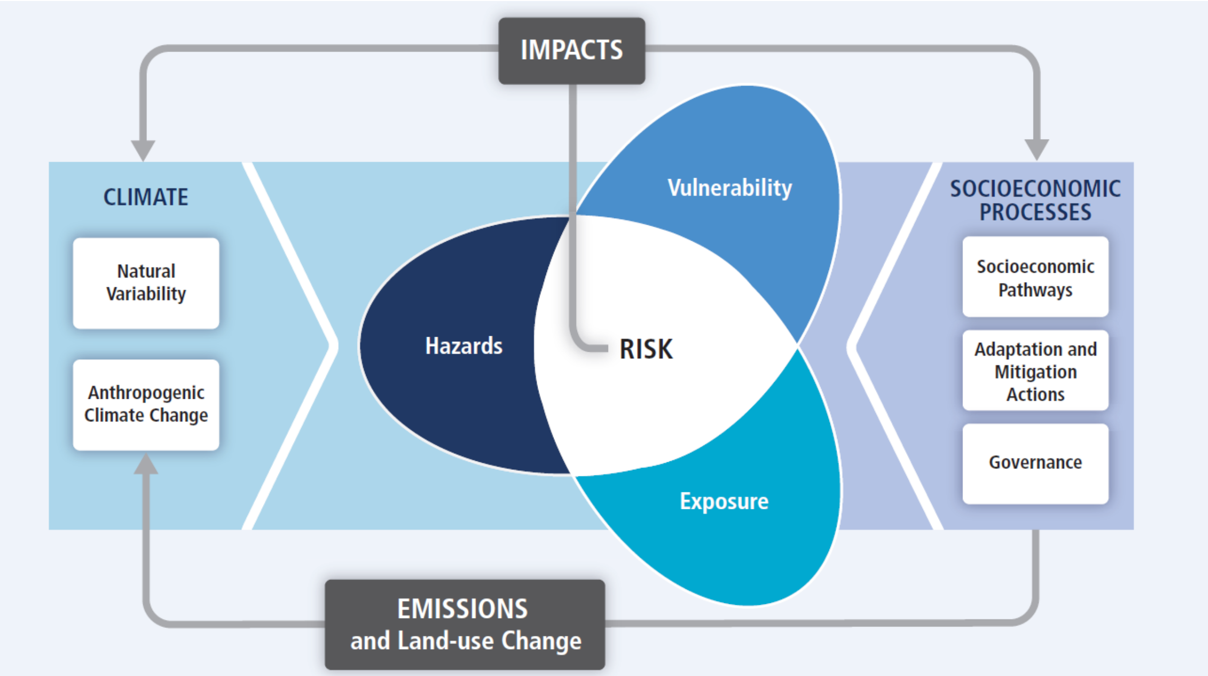

Figure 1: Conceptual framework (IPCC 2014)

3 Methods to identify drivers of disaster risk

As indicated in the introduction the analysis of drivers of vulnerability and risk in Monastir was conducted combining (1) a systematic review of scientific and grey literature (e.g. reports, etc.) with stakeholder (2) consultations in Monastir. For the latter relevant stakeholders and stakeholders from several administrative, academic, private and civil organisations operating in the city or in the *gouvernorat* were identified by the Municipality of Monastir in close collaboration with the project team.

3.1 Stakeholder consultations

In order to identify drivers of disaster risk, the following activities were conducted: (a) stakeholder interviews, (b) a participatory stakeholder workshop, and (c) an online survey to follow-up on the interviews and the stakeholder workshop.

3.1.1 Stakeholder interviews

Individual interviews of approximately 90-120 minutes each were carried out with different stakeholders based on a semi-structured questionnaire, to elicit reflection and gathering information around Monastir's past disastrous events, main hazards, exposed elements, and drivers of vulnerability. 31 interviews were completed in Monastir between the 21st and the 24th of February 2017, involving a total of 27 different organisations (see Annex 1).

Figure 2: Stakeholder interviews conducted in Monastir (photo credit: authors)

3.1.2 Stakeholder workshop

In addition to the interviews, a dedicated one-day stakeholder workshop was organized by the UD-RASP consortium in Monastir the 23rd of February 2017. Following an introduction into the objectives of the project and key concepts and definitions of disaster risk, collective, participative activities aimed at the definition and the ranking of the most relevant drivers of disaster risk in the city (in terms of hazards, impacts and vulnerability). In total, 15 local and regional stakeholders and twelve project team members participated in the all-day workshop (Annex 1).

Figure 3: Stakeholder workshop conducted in Monastir (photo credit: authors)

3.1.3 Online survey

Following the on-site activities, the original semi-structured questionnaire was amended and implemented as an online survey using QuestionPro software, in the hope of reaching a wider selection of stakeholders. The link to the survey was shared with the project team in Monastir who was responsible for disseminating it further. Two separate surveys were prepared, one focussing specifically on urban disaster risk (past events, main hazards, drivers, etc.) and a second one focussing more specifically on the PAU (the city's urban plan) update and data availability (note: the latter will also serve as a basis for Deliverable 6.1 on existing capacities and needs). The survey on urban disaster risk was completed by seven respondents, three of which previously took part in the interviews (Annex 1).

3.2 Literature review

The literature review aimed at gathering a full understanding of the state-of-the-art coastal urban disaster risk research in the Maghreb region in order to complement the stakeholder-based identification of key drivers of disaster risk. A two-step approach comprising of both a systematic review of peer-reviewed scientific literature and a non-systematic review of additional grey literature (reports, conference proceedings, etc.) was pursued.

3.2.1 Systematic review of peer-reviewed literature

As a first step, a set of search terms and possible combinations was defined, comprising geographic terms (focusing on the Maghreb region), geomorphological terms related to coastal zones or urban areas, assessment terms related to vulnerability and risk assessments, as well as conceptual terms related to disaster risk (Table 1). The choice of search terms was motivated by the desire to explore and better understand drivers of urban disaster risk in coastal zones not just in Tunisia, but for the entire Maghreb region (i.e. Algeria, Lybia, Morocco, Tunisia) which, despite its diversity, features common elements in terms of urbanization, coastal development, and environmental, historical, social and cultural continuity. These searches were subsequently run on the two most commonly used academic search engines, Scopus (http://scopus.com/) and Web Of Knowledge (https://apps.webofknowledge.com/). The cut-off date was set to 05/07/2017.

Table 1: Search terms, combinations and resulting number of publications

Search terms and their combinations			Number of hits	
			Scopus	Web Of Science
Search Terms	#1	(maghreb OR tunisia* OR morocc* OR algeria* OR lybia*) AND (urban OR city OR coast*)	6,779	1,834
	#2	(maghreb OR tunisia* OR morocc* OR algeria* OR lybia*) AND (risk OR vulnerab* OR resil* OR susceptib* OR coping OR adapt*)	8,670	5,646

	#3	(maghreb OR tunisia* OR morocc* OR algeria* OR lybia*) AND (assess* OR index OR indic*)	15,880	6,589
	#4	(maghreb OR tunisia* OR morocc* OR algeria* OR lybia*) AND (hazard OR disaster OR "natural hazard" OR "climate change" OR "climate variability" OR "extreme event" OR "extreme weather")	1,497	377
Combinations	#1 AND #2		1,072	531
	#1 AND #4		345	62
	#1 AND #2 AND #3		565	291
	#1 AND #4 AND #3		191	36
	#1 AND #2 AND #3 AND #4		110	22

The respective publications were downloaded and their titles and the abstracts of the resulting hits screened to ensure that the focus of the papers matches with the focus of the review. Following this approach, a list of 91 possible relevant papers remained. After an in-depth review of their content, a final number of 42 relevant publications (Annex 2) was retained.

3.2.2 Non-systematic review of grey literature

The review of grey literature (reports, non-peer-reviewed papers, etc.) was conducted mainly through web engines (i.e. Google, Google Scholar, etc.) and via bibliographical cross references in the material already collected. Following this approach, a total of 12 publications relevant to the topic were retained (Annex 2). The review also revealed seven peer-reviewed publications which were not previously identified in the systematic review, but which were then included in the analysis.

4 Results

The combination of the stakeholder consultations and the literature reviews generated a list of factors describing the components of disaster risk (hazard, exposure, vulnerability) for the city of Monastir. The main findings are presented in the following sub-sections.

4.1 Hazards

Table 2 presents an overview of the main relevant hazards for Monastir (listed by source). It is important to note that the stakeholder interviews, the online survey, and the stakeholder workshop aimed at identifying the most relevant hazards in Monastir, while the literature review was conducted for comparable settings (urban coastal environments) in the Maghreb region.

Table 2: Hazards affecting Monastir

	Stakeholder consultation (Monastir)			Literature review (Maghreb)	
	Stakeholder interviews	Online survey	Stakeholder workshop	Systematic review	Grey literature
Flooding	x	x	x	x	
Coastal erosion	x	x	x	x	
Earthquakes / seismic act.	x	x	x	x	
Tsunami				x	
Landslide				x	
Sea level rise	x	x	x	x	
Drought	x	x	x	x	
Storms	x	x	x	x	
Heat waves	x	x		x	
Pollution			x		
Fires	x				
Subsidence	x				
Vector-borne diseases		x	x	x	

Figure 4 presents an overview of how often the different hazards were mentioned by the local stakeholders during the interviews, stakeholder workshop, and online survey.

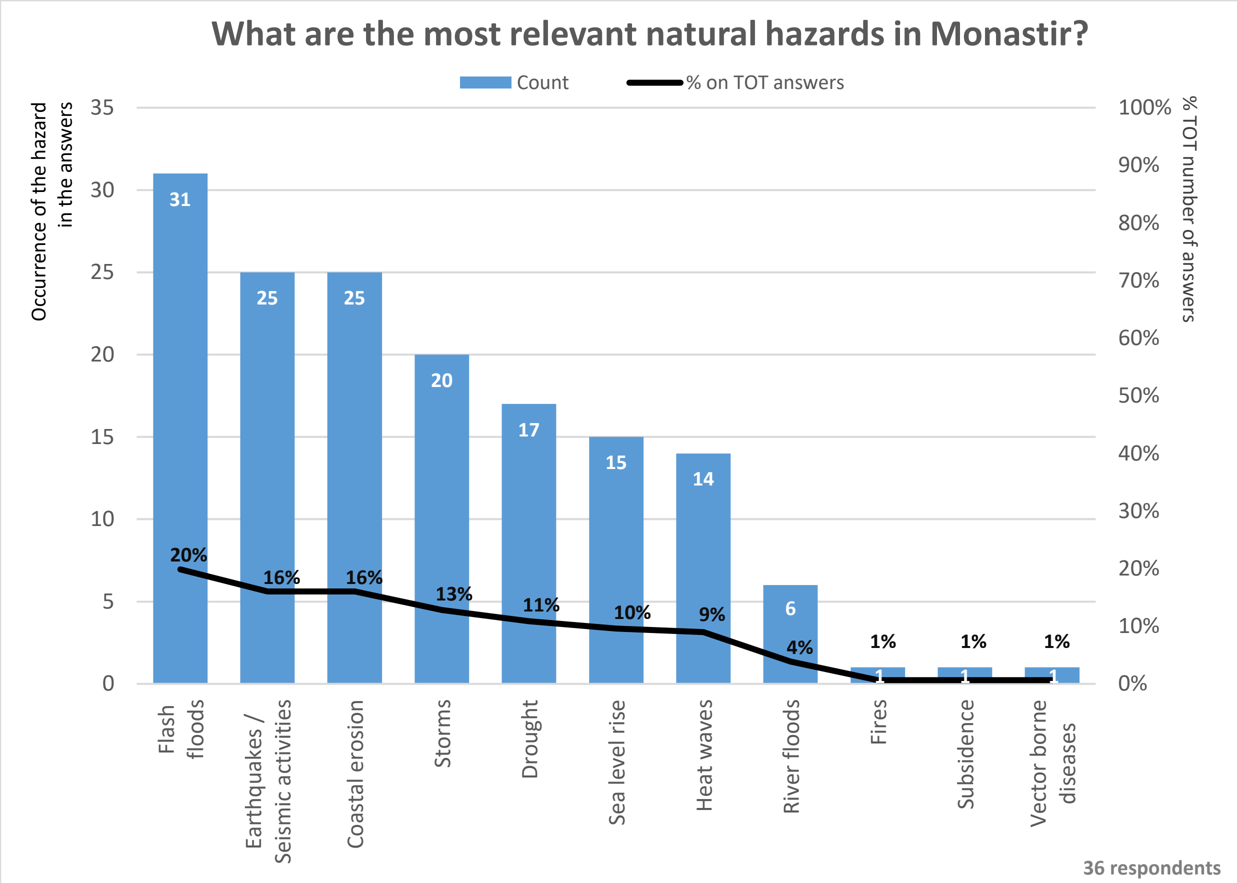

Figure 4: Most relevant hazards affecting Monastir according to local stakeholders

Figure 5 shows the response of the local stakeholders to the question "How will the frequency and/or magnitude of hazards in Monastir change in the future?". Although only based on their perception rather than on data and evidence, it gives a rough indication that most of the local stakeholders think that the intensity and/or magnitude of most of the hazards might increase in the future – with the exception of seismic hazards and storms where the feedback was balanced between "increase" and "no change". For two of the most relevant hazards, i.e. flash floods, coastal erosion, there was large agreement that these hazards would likely intensify in the future.

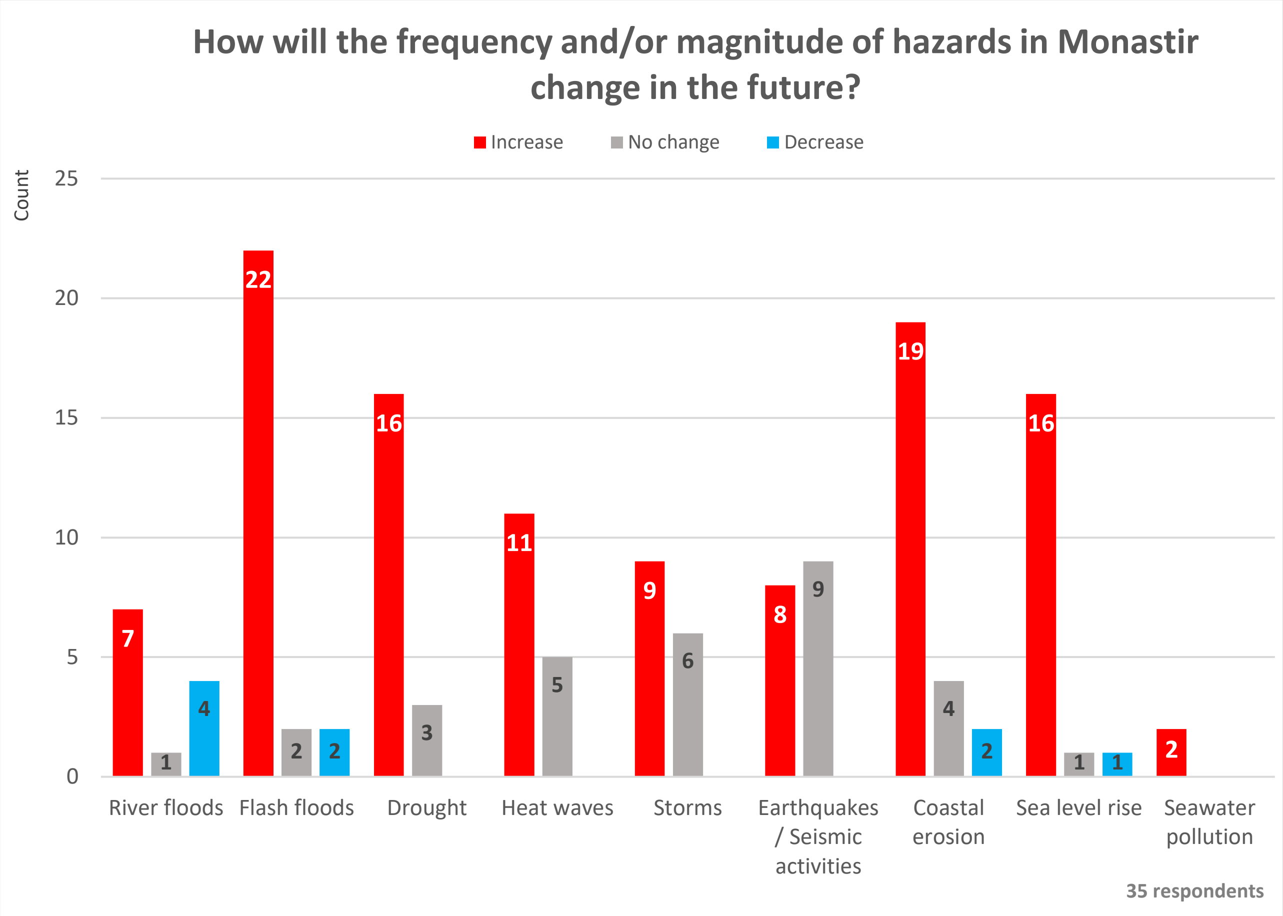

Figure 5: Perception of local stakeholders regarding changes in hazard intensity and/or magnitude

In addition to the "natural" hazards mentioned above, the following man-made hazards were mentioned by the participants during the stakeholder workshop:

- insect proliferation,
- smog,
- pollution (thermal, chemical, urban, medical waste, industrial waste, aquaculture residuals),
- offshore drilling platform,
- soil loss.

Since the project does not focus on risks associated with man-made hazards, these are only mentioned for the sake of completeness, but will not be discussed further in detail.

4.2 Exposure

Table 3 presents an overview of elements that were exposed to hazards in the past in Monastir (listed by source). It is important to note that the stakeholder interviews, the online survey, and the stakeholder workshop focussed on the situation in Monastir, while the literature review was conducted for comparable settings (urban coastal environments) in the Maghreb region.

Table 3: Exposed elements in Monastir

Category	Details	Stakeholder consultation (Monastir)		Literature review (Maghreb)	
		Stakeholder interviews	Online survey	Systematic review	Grey literature
People	Population (absolute, density, growth)	x	x	x	
Heritage	Major urban heritage / cultural heritage	x		x	
Infrastructures	General infrastructures (electricity, water, sewer system)	x		x	
	Protective infrastructures (dams)	x	x		
	Coastal Infrastructures	x			
	Roads	x	x	x	
	Railways			x	
	Airport	x			
	Public buildings (schools, hospitals)	x	x	x	
	Sport facilities	x			
	Costal desalinisation plants			x	
Urbanization & settlements	Rapid urban development / coastal urbanization / steep slope urbanisation / future urban expansion			x	
	Settlements	x	x	x	
Tourism	Tourist			x	
	Future touristic infrastructure			x	
	Hotels	x	x		
Other Economic sectors	Commerce	x	x		
	Industries		x		

Agriculture	Agriculture	x	x	x	
Ecosystems	Beaches		x	x	
	Wetlands			x	
	Terrestrial ecosystems			x	
	Freshwater ecosystems		x		
	Marine ecosystems		x		

4.3 Vulnerability indicators

Tables 4, 5 and 6 present an overview of key vulnerability indicators for Monastir, split by its key components: susceptibility (Table 4), lack of short-term coping capacity (Table 5), and lack of long-term adaptive capacity (Table 6) as derived from the stakeholder consultations and the literature review (see Annex 3 for more details).

Table 4: Susceptibility indicators

SUSCEPTIBILITY INDICATORS

Category		Indicator	Hazard Settings											Proxies
			Flooding	Coastal Erosion	Earthquakes	Sea Level Rise	Drought	Storms	Heat Waves	Pollution	Fires	Subsidence	VBD*	
Poverty & income	Poverty	Households below national poverty line (%)												Population below international poverty line (%); Asset-based poverty index
	Unemployment	Unemployment rate (%)												
	Tourism-dependent economy	Percentage of contribution of touristic sector to GDP (%)												Number of people working in tourism per 1,000
	Dependency ratio	Working age population (%)												Age groups (%)
Gender	Women condition	Female employment (%)												
Immigration	Immigration	In-migrants per 1,000 (%)												Number of new requests of residence at the civil registry
Health condition & disability	Health condition of the population	Incidence of health hazards (asthma, arthrosis, diabetes, low birth weight, depression, etc.) on population (%)												Number of hospitalization per 1000 habitants
	Disabilities	Disabled people (%)												
	Family violence	Reported cases of family violence per 1,000												
Informal settlements & building conditions	Anarchic urban development	Informal settlements (%)												
	Building conditions	Masonry buildings (%)												
		Houses with more than one floor (%)												
		Traditional buildings (%)												
Housing quality		Households with access to sanitation/sewage, electricity/gas (%)												
Urban design	Green spaces	Green spaces (ha)												
Infrastructure	Water supply	Availability of fresh water per capita (m3/person)												
	Management of solid waste	Households with waste collection (%)												
	Quality of infrastructure	Quality of infrastructure (categorical)												Number of employees in waste collection
Perception & behaviour	Risk perception	Risk perception of population (categorical)												
	Poor respect for existing laws	n/a												
	Negligence of information	n/a												
Degradation	Degradation	Vegetation loss (%)												Deforestation rate (%)
	Conservation Status	Protected areas (%)												
Insecurity	Lack of security /Criminality	Crime rate (%)												Homicide rate

**Vector-borne diseases*

Table 5: Lack of coping capacity indicators

COPING CAPACITY INDICATORS

Category		Indicator	Hazard Settings											Proxies
			Flooding	Coastal Erosion	Earthquakes	Sea Level Rise	Drought	Storms	Heat Waves	Pollution	Fires	Subsidence	VBD*	
Protection measures	Coastal Protection Structures	Extent of coastal protection structures (hard or soft) (km2)												
	Quality of Sea Defence	Regular maintenance of protection structures (categorical)												
	Non-optimal conditions of hydraulic network	Quality of hydraulic network (categorical)												
Early warning	Lack of early warning	Existence of early warning systems (yes/no)												
		Households who have received early warning in the past (%)												
Access to information		Households with access to radio/TV/internet (%)												
Evacuation	Mobility	Households with a car/truck/motorcycle (%)												
	Road network	Density of transportation network (km per 10,000)												
Governance	Lack of law enforcement	Corruption perception (categorical)												
	Lack of transparency	n/a												
Coordination	Poor institutional coordination	Level of horizontal communication across relevant DRM actors (categorical)												
Emergency management	Response Plan	Availability of a plan (yes/no)												
		Number of people trained in crises management per 1,000												
	Delay in response	Average time between call and intervention (mins)												Travel time from EMS (mins)
	Decreasing number of emergency personnel	Number of emergency personnel per 1,000												Number of doctors per 1,000;
	Lack of equipment	Number of fire trucks, ambulances, etc. per 1,000												Number of fire brigades/police stations/hospitals per 1,000
	Insufficient hospital capacity	Number of hospital beds per 1,000												Number of hospitals per 1,000; Travel time to closest hospital
Savings	Financial resources	Households with savings (%)												
		Households with access to credits / loans (%)												
Recovery	Lack of reconstruction budget	Recovery budget per capita (USD)												

**Vector-borne diseases*

Table 6: Lack of adaptive capacity indicators

ADAPTIVE CAPACITY INDICATORS

Category		Indicator	Hazard Settings											Proxies
			Flooding	Coastal Erosion	Earthquakes	Sea Level Rise	Drought	Storms	Heat Waves	Pollution	Fires	Subsidence	VBD*	
Education	Education level	Population with post-secondary education (%)												
Strategies	Laws and regulation to address "disasters"	Availability of laws/regulations (yes/no)												
	Political strategic planning	Availability of laws/regulations/plans (yes/no)												
	Centralisation	Centralization (yes/no)												
	Regulations update	Last update of the PAU (years)												
	Lack of political will	n/a (categorical)												
	Lack of political accountability	n/a (categorical)												

**Vector-borne diseases*

5 Outlook

The here presented list of drivers and indicators of exposure, vulnerability and risk is used to inform the data collection process which is currently ongoing in Monastir. Once the data to spatially represent the indicators has been collected and pre-processed, it will be integrated into the spatial assessment of urban disaster risk in Monastir (deliverable 3.3).

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Annex

Annex 1: Stakeholders

Annex 1 provides an overview of the stakeholders who were interviewed, participated in the stakeholder workshop, and who responded to the online survey (Table A1).

Table A1: Stakeholders

Organisation	Stakeholder interviews	Stakeholder workshop	Online survey
Municipalité de Monastir	x	x	
Ministère de l'Equipement - Direction de l'Hydraulique Urbaine	x		
Ministère de l'Equipement - Direction Générale de l'Equipement	x		
Protection Civile de Monastir	x		
Office Topographique et du Cadastre	x		
Office de l'Aviation Civile et des Aéroports (O.A.C.A.)	x		
Institut National de la Météo - Météo régional Monastir (I.N.M.)	x		
Direction de Développement Régionale	x		
Commissariat Régional de Développement Agricole de Monastir (CRDA) - Reboisement et protection des sols (RPS)	x		
Commissariat Régional de Développement Agricole de Monastir (CRDA) - CES (Conservation des eaux et du sol)	x		x
Agence de Protection d'Aménagement du Littoral (APAL)	x		
Tunisie Telecom	x		x
Société Tunisienne de l'Electricité et du Gaz (STEG)	x		
Port de pêche de Monastir (APIP)	x		
Agence Technique des Transports Terrestres	x		
Direction Régionale Santé	x		
Hôpital Universitaire Fattouma Bourguiba	x		
Direction Régionale des Affaires Sociales	x		
Office National de l'Assainissement	x		
Société Nationale d’Exploitation et de Distribution des eaux (SONEDE)	x		
Direction Régionale du Transport	x		

Institut National de Statistique	x	x	x
Office National du Tourisme à Monastir (ONTT)	x	x	x
Agence Foncière Touristique	x		
Agence Foncière d'Habitation (AFH)	x		
Commissariat régional de la jeunesse et des sports	x		x
Comité Régionale des Affaires de la Femme et de la Famille	x		
Association Respina de l'Environnement		x	
Université de Carthage		x	
A.R.A.A pour le civisme et la citoyenneté		x	
Observatoire Urbain Monastir (represented by members of I.N.M and O.A.C.A)		x	
Association pour la Culture numérique Libre (Clibre)		x	
Société civile (Architecte)		x	
Association Grand Bleu		x	
Association „I love Monastir“		x	
Association de Sauvegarde de la Ville de Monastir (A.S.G.M)		x	
Croissant-Rouge Tunisien – Gouvernorat Monastir			x

Annex 2: Literature

a) **This annex lists the 42 publications that were identified following the systematic review of peer-reviewed literature:**

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b) This annex lists the 7 peer-reviewed publications that were identified following the non-systematic literature search:

1. Chouari, W. and Belarem, M. (2017), "Enjeux de la Tunisie orientale. Un territoire développé et un environnement à protéger", *Confins*, No. 30.

2. Chouari, W., Suarez, R. and Raynal, J. (2016), "La gestion du risque d'inondation en Tunisie de la gouvernance de l'information géographique à la production et la diffusion des cartes", *Revue GéoDév.ma*, Vol. 4.

3. Daoud, A. (2013), "Retour d'expérience sur les inondations dans l'agglomération de Sfax (Tunisie méridionale) de 1982 à 2009 de la prévention à la territorialisation du risque", *Revue Géographique de l'Est*, Vol. 53 No. 1-2.

4. Dhaher, N. (2011), "Production du sol urbain et vulnérabilité aux inondations. L'exemple de la cité Sidi Hcine Essijoumi en Tunisie", *Confins*, No. 12.

5. Fehri, N. (2014), "L'aggravation du risque d'inondation en Tunisie: Éléments de réflexion", *Physio-Géo*, No. Volume 8, pp. 149–175.

6. Oueslati, A. (2010), "Plages et urbanisation en Tunisie. Des avatarsde l'expérience du XXe siècle aux incertitudesde l'avenir", *Méditerranée*, No. 115, pp. 103–116.
7. Sowers, J., Vengosh, A. and Weinthal, E. (2011), "Climate change, water resources, and the politics of adaptation in the Middle East and North Africa", *Climatic Change*, Vol. 104 No. 3-4, pp. 599–627

c) This annex lists the 12 grey publications that were identified following the systematic and non-systematic literature search:

1. Bendimerad, F. (2004), " The 21 may 2003 Boumerdes earthquake lessons learned and recommendations", 13th World Conference on Earthquake Engineering, Vancouver, B.C., Canada, August 1-6, 2004. Paper No. 9001

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3. Hinkel, J.; Vafeidis, A.T.; Lincke, D.; Wolff, C. (2015), "Assessment of Costs of Sea-Level Rise in the Republic of Tunisia Including Costs and Benefits of Adaptation", Technical Report, the Med Partnership. Available at: http://pap-thecoastcentre.org/pdfs/DIVA%20Tunisia.pdf

4. Kriaa, M.; Driss, S.; Karray. Z. (2011), "Inequality and spatial disparities in Tunisia", Working Paper 631, Economic Research Forum. Available at http://erf.org.eg/publications/inequality-spatial-disparities-tunisia/

5. Mallouk A., Lechgar H., Malaainine M.E., Rhinane H. (2016) A Multicriteria Approach with GIS for Assessing Vulnerability to Flood Risk in Urban Area (Case of Casablanca City, Morocco). In: El Oualkadi A., Choubani F., El Moussati A. (eds) Proceedings of the Mediterranean Conference on Information & Communication Technologies 2015. Lecture Notes in Electrical Engineering, vol 380. Springer, Cham

6. Ministère de l'Environnement de l'Aménagement du Territoire, Etude sur la délimitation du Domaine Public Maritime en prevision d'une élévation accélérée du niveau de la mer en Tunisie. Available at www.changementsclimatiques.tn/etude/Vul_DPM.doc

7. Ministère de l'Environnement et du Développement Durable, "Evaluation de la vulnérabilité, des impacts du changement climatique et des mesures d'adaptation en Tunisie". Available at http://www.environnement.gov.tn/index.php?id=88&L=0#.Wcjp6NFx2Uk

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9. Satta, A., Venturini, S., Puddu, M., Firth, J., Lafitte, A. (2015). Strengthening the Knowledge Base on Regional Climate Variability and Change: Application of a Multi-Scale Coastal Risk Index at Regional and Local Scale in the Mediterranean. Plan Bleu Report.

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11. Ykhlef, B., Belouar, A., Boubidi, S., Diouri, A., Khachani, N. and Alami Talbi, M. (2014), "Plan for Prevention of Natural Hazards in Urban Areas. Case of the City of Constantine (Algeria)", MATEC Web of Conferences, Vol. 11, p. 3008

12. World Bank (2011), "Adaptation au changement climatique et aux désastres naturels des villes côtières d'Afrique du Nord - Phase 2 : Plan d'adaptation et de résilience – Tunis, Rapport final". Available at http://siteresources.worldbank.org/INTMENA/Resources/ReportPhase2_Tunis.pdf

Annex 3: Drivers of risk (by source)

Table A2: Susceptibility factors in Monastir

Category	Factors	Stakeholder consultation (Monastir)			Literature review (Maghreb)	
		Stakeholder interviews	Online survey	Stakeholder workshop	Systematic review	Grey literature
Poverty and Income	Poverty	x		x	x	
	Unemployment	x			x	
	Tourism-dependent economy	x				
	Age of population	x			x	
Gender	Women condition	x				
Immigration	Immigration	x				
Health conditions and Disability	Health conditions of the population	x				
	People with disabilities	x	x			
	Family violence	x				
Informal settlements & building conditions	Anarchic urban development	x		x	x	
	Old/marginal/informal urban buildings	x	x		x	
	Traditional buildings and urban layout (casbah)			x	x	
	Building Conditions	x			x	
Housing quality	Poor housing quality				x	
Urban design	Lack of modern urban features	x (lack of green spaces)			x	
	Weakness of existing regulations (urbanism)				x	
Infrastructure	Water Supply	x			x	
	Lacking management of solid waste	x	x (industrial waste)		x	
	Outdated /damaged infrastructures	x				
	Insufficient wastewater management	x		x	x	
	Lacking river flow regulation		x		x	
	Streets construction / Concretisation of streets / canal building/Ground and Soil sealing				x	

Perception & behaviour	Ignorance of the risk / false sense of security / risk perception / acceptance of the risk/behaviour of citizens	x	x (lack of awareness)	x (lack of awareness)	x	
	Poor respect for existing laws	x			x	
	Negligence of information	x				
Degradation	Ecosystem health / degradation of vegetation				x	
	Conservation status				x	
Insecurity	Lack of security /Criminality	x				

Table A3: Lack of coping capacity factors in Monastir

Category	Factors	Stakeholder consultation (Monastir)			Literature review (Maghreb)	
		Stakeholder interviews	Online survey	Stakeholder workshop	Systematic review	Grey literature
Protection Measures	Lack / quality of (coastal) protection structures	x			x	
	Non-optimal conditions of hydraulic network				x	
Early Warning	Lack of early warning system	x				
	Lack of Information	x		x		
	Lack of prevention	x				
Access to information	Lack of communication / circulation of information	x		x		
Evacuation	Traffic jam			x (transportation)	x	
Governance	Lack of governance	x	x	x		
	Lack of law enforcement	x				
	Lack of transparency	x				
	Authorisation to build in "restricted" areas	x				
Coordination	Poor institutional coordination	x				
	Redundancy of actors	x				
	Lack of organisation	x				
	Missing response plan			x		

Emergency management	Delay in response	x				
	Decreasing number of emergency personnel		x			
	Lack of equipment	x		x		
	Insufficient hospital capacity	x				
Savings	Lack of financial resources	x (insurance)				
Recovery	Lack of reconstruction budget			x		

Table A4: Lack of adaptive capacity factors in Monastir

Category	Factors	Stakeholder consultation (Monastir)			Literature review (Maghreb)	
		Stakeholder interviews	Online survey	Stakeholder workshop	Systematic review	Grey literature
Education	Illiteracy				x	
	Education level	x		x	x	
Strategies	Laws and regulation to address "natural disasters"	x			x	
	Political strategic planning			x		
	Coastal policy/legislation vacuum				x	
	Centralisation	x		x		
	Regulations update	x				
	Outdated Urban Plan			x		
	Political will	x	x			
	Lack of responsibility	x				